Ex-Post Project Evaluation 2011: Package II-1 (Vietnam, Laos, East Timor, Nepal, Ecuador, Egypt, Jordan, Serbia)

November 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

IC NET LIMITED

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Preface

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, third-party evaluations conducted by experts will be enhanced.

This volume shows the results of the ex-post evaluation of ODA Loan projects that were mainly completed in fiscal year 2009, and Technical Cooperation projects and Grant Aid projects, most of which project cost exceeds 1 billion JPY, that were mainly completed in fiscal year 2008. The ex-post evaluation was entrusted to external evaluators to ensure objective analysis of the projects' effects and to draw lessons and recommendations to be utilized in similar projects.

The lessons and recommendations drawn from these evaluations will be shared with JICA's stakeholders in order to improve the quality of ODA projects.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

November 2012
Masato Watanabe
Vice President
Japan International Cooperation Agency (JICA)

Disclaimer

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Minor amendments may be made when the contents of this volume is posted on JICA's website.

JICA's comments may be added at the end of each report when the views held by the operations departments do not match those of the external evaluator.

Vietnam

Ex-Post Evaluation of Japanese Technical Cooperation Project
The Project for Enhancing Capacity of Vietnamese Academy of Science and Technology in Water Environment Protection

External Evaluator: Tsuyoshi Ito, IC Net Limited

0. Summary

This project aimed at creating a research base in Vietnam through improvement of technical capacity of IET with relation to water environment protection administration, and expected to contribute to betterment of water environment protection in Vietnam including the establishment of a national water quality monitoring system. At the time of planning the project, IET was expected to be responsible for giving technical recommendations to the government authorities for establishment of the monitoring system water quality. However, after the commencement of the project, the project staff members found serious difficulties to realize the original target, and strategic direction of the project needed to be reconsidered to be more realistic. As a result, while maintaining the effort to contribute to the establishment of the water quality monitoring system as much as possible, more emphasis was put on human resource development for local government agencies and research and development of more advanced technical areas. Despite this redirection of the project, the important conditions including high priority of water environment management for the Vietnamese government, existence of high demand for improvement of water quality and water quality protection, and also the reasonable development approach that IET, a research institute with comprehensive capability for environment management technologies, takes a role to disseminate appropriate technologies for water quality monitoring and wastewater treatment to local organizations through its branch laboratories are still maintained, therefore, relevance of the project is high.

Although the first part of the original Project Objective of contribution to the establishment of the monitoring system was not achieved, dissemination of relevant technologies was achieved, and impact was also partly achieved, therefore, the effectiveness is fair.

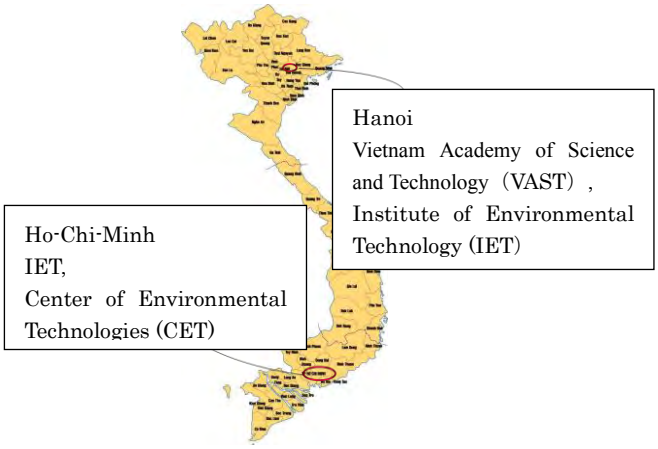
While the results of the experts dispatched and equipment provided exceeded the plan, this does not present a problem as there is a rational explanation for the additional input. Although the actual cost could not be compared with the budget plan, increase in the long-term experts and the equipment provision most likely made the total cost exceed the plan. Therefore the efficiency of the project is fair.

Financial and technical sustainability of the project effect was found good. After the revisions to the project design in respect to IET's position and roles for development of water environment management in Vietnam, there are sound environment surrounding the IET to continue its effort to develop and disseminate appropriate technologies for water environment management and to make contribution to policy formulations. Also, IET's organizational structure and its finances are stable enough. Therefore the sustainability of the project effect is high.

While this project displayed an insufficient effect for establishment of a national water quality monitoring system, which is a priority of the original plan, considered the real expectations to IET that it should provide necessary technical support to capacity of water environment management capacity of relevant organization in Vietnam, this project has accumulated effects.

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

1. Project Description



Project Locations

IET Headquarters

1.1 Background

In 1990s in Vietnam, the rapid industrialization led by the Doi Moi reform policy caused serious environmental pollution due to the waste products, exhaust gases, and waste water emitted by industrial plants. Concern over environmental problems was heightening not only within the government, but also among the general public. Among the various environmental problems, that of water contamination was becoming increasingly severe due to increased domestic wastewater with the rapid concentration of the urban population, groundwater contamination caused by elevated levels of untreated industrial wastewater, and poor sanitation as a result of the overflow of sewage from waterways during flooding. For example, the BOD[1] of waterways flowing through Hanoi was 25–45 mg/L, and in Ho Chi Minh was as much as 20–150 mg/L.

In such circumstances, the Government of Vietnam passed the Environmental Protection Law in 1993, and renewed the environmental standards in 1995. However, in terms of actual enforcement such as water-quality monitoring, the technology and facilities of the relevant agencies actually carrying out activities on the ground such as Department of Natural Resources and Environment (DONRE) of the provinces were inadequate, and the related laws and regulations did not produced a sufficient effect. Amidst this background, the Government of Vietnam requested Japan - with its rich experience in areas of environmental conservation such as water quality - to provide technical cooperation to improve skills in water quality analysis and the domain of wastewater treatment, and to improve the nation's capabilities in water environmental management.

The implementing agency of this project on the Vietnam side is the Institute of

[1] Biological Oxygen Demand. Total amount of dissolved oxygen in water used to oxidize or decompose organic matters in the water. The bigger the figure, the more the water is polluted. Usually used to measure extent of pollution of rivers. Generally, once the figure is 10mg/l or more, the water shows signs of pollution such as bad odor.

Environmental Technology (IET), which is in charge of research and development in the field of environmental technologies within the Vietnam Academy of Science and Technology (VAST). The VAST is an institution equivalent to a ministry within the administrative system of Vietnam, and has a status equal to that of the Ministry of Natural Resources and Environment (MONRE)[2]. In order to effectively reflect the outputs of this project on environmental administration, it was judged during the preliminary study of the project that the MONRE's participation in this project is required, so the MONRE was added to the members of the Joint Coordinating Committee of this project.

1.2 Project Outline

The outline of the project subject to evaluation is as follows:

Overall Goal	The capacity of Vietnamese authorities related to the water environment protection will be improved.
Project Objective	The capacity of VAST related to water environment protection is improved.
Outputs	Output 1: VAST researchers' abilities to conduct water quality monitoring and to develop analysis methods are improved. Output 2: VAST researchers' abilities to develop and apply suitable technologies on domestic and industrial wastewater treatment are improved. Output 3: VAST staff members' abilities to conduct training courses on water quality monitoring and wastewater treatment for central and local organizations are improved. Output 4: VAST researchers are to contribute MONRE's and related organizations' activities of water environment protection.
Inputs	Japanese Side: 1. 17 Experts (6 for long-term, 11 for short-term) 2. 28 Trainees received (including 4 trainees from the preparation period of the previous year, e.g., those in water quality control courses, wastewater treatment/water quality analysis courses) 3. 2 Trainees for Third-Country Training Programs (total) 4. Equipment: 367,647,000 yen 5. Local Cost: 53,807,000 yen (including 31,094,000 yen for the construction of a wastewater treatment experimentation facility) 6. Others (including dispatch of study team) Vietnam Side: 1. 114 Counterparts 2. Equipment Purchasing: wastewater treatment facilities (chemical processing), consumables such as pharmaceutical products, low-cost equipment 3. Land and Facilities: Project space, Expert's Offices 4. Local Cost: 6.222 billion VND

[2] A section which is responsible for the environmental administration in MONRE is Vietnam Environment Administration (VEA).

Total Cost	Approximately 855,100,000 yen
Period of Cooperation	November 2003–October 2006
Vietnamese Agencies Involved	Vietnam Academy of Science and Technology (VAST)
Cooperation Agency in Japan	Ministry of the Environment
Related Project	"Enhancing Capacity of Vietnamese Academy of Science and Technology in Water Environment Protection Phase 2 (January 2008–January 2012);" individual experts dispatched (environmental policy advisor)

1.3 Outline of the Terminal Evaluation

The results of the terminal evaluation conducted in June 2006 are as follows.

1.3.1 Achievement of Overall Goal

When the project was implemented, although national/regional water quality monitoring became increasingly active, the methods and procedures of monitoring were not standardized, and there were many problems with accuracy. Here the probability of contributing to the achievement of the Overall Goal was evaluated as high if the standardization of the analysis methods proposed by this project yields results, and the IET's skills were transferred to other relevant organizations.

1.3.2 Achievement of Project Objective

Although there was room for improvement in the quality of some of the outputs, the project Outputs were generally being achieved, and the Project Objective, namely, the capacity of VAST related to water environment protection is improved, was evaluated as more or less achieved.

On the other hand, in order to further increase the project's effectiveness, it was deemed that along with the strengthening of the government of Vietnam's measures on environmental improvement, stronger relations and a specific collaboration were necessary between IET and the relevant organizations such as the MONRE, and the MONRE's affiliated research institutes.

1.3.3 Recommendations

The following five recommendations were proposed in the terminal evaluation. The following table shows the measures taken vis-a-vis the recommendations at the time of this evaluation.

Recommendations at the time of completion	Measures taken by the time of follow-up
Aim to improve the quality of the products developed, and complete the remaining issues such as the development and submission of standard operating procedures for water quality monitoring and conducting wastewater treatment experiments (anaerobic digestion and compost processing). In addition, further absorb the knowledge, etc., of experts from the Japan International Cooperation Agency (JICA), and strive to further improve the quality of each output.	All scheduled wastewater treatment experiments were completed. The development of standard operating procedures (SOP) for water quality analysis continues, and efforts were being directed to improve on the quality of them.
Create a maintenance plan for project equipment, secure a budget, and consider a plan that takes into account the future renewal and upgrading/expansion of equipment. Furthermore, reliably secure and utilize the human resources. Additionally, with the completion of the new IET building, the Vietnam side should take responsibility for equipment relocation.	The equipment provided was appropriately maintained. While some equipment was unused as it was no longer required, the remainder was in routine usage at the time of this evaluation. The new IET building was completed in 2007, and all equipment was relocated appropriately.
In addition to the key administrative agencies MONRE and DONRE, positively approach various actors such as private sector corporations and universities, and in addition to cooperating on tackling actual issues related to the water environment, strengthen a productive collaboration in order to improve the capabilities of these various institutions. Improve practical technical capabilities through feedback from implementation of the project, and accumulate know-how.	Regular meetings with MONRE were held, and the IET was strengthening relations as much as possible. Neighboring DONRE and private sector corporations were being approached, and outsourced work was being received.
In future, DONRE offices throughout the country should directly oversee the management of Vietnam's water environment, and MONRE and other relevant agencies should contribute to reinforcing the technical capabilities of DONRE through collaboration.	Specific cases of contribution include convening regular meetings with MONRE, and the technical cooperation agreements concluded with Hanoi DONRE and Hung Yen province DONRE.

2. Outline of the Evaluation Study

2.1 External Evaluator

Tsuyoshi Ito, IC Net Limited

2.2 Duration of the Evaluation Study

Duration of the study: September, 2011 – November, 2012

Duration of the field study: December 11, 2011 – December 23, 2011; May 13, 2012 - May 20, 2012

2.3 Constraints during the Evaluation Study

None.

3. Results of the Evaluation (Rating: B[3])

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance with the Development Policy of Vietnam

3.1.1.1 Relevance to Development Policy

The "Seventh Five-Year Socioeconomic Development Plan (2001-2005)" mentions harmonizing development and environmental conservation, and makes particular note of the importance of monitoring and curbing environmental pollution in areas of high population density such as industrial districts and metropolitan areas.

The "Eighth Five-Year Socioeconomic Development Plan (2006-2010)" raises the "environment" as one of three axes that guarantees sustainable development.

The "National Environmental Protection Strategy 2001-2010" makes a declaration on strengthening efforts in the environmental field. Though the "Environmental Action Plan (2002-2007)" does not particularly locate the conservation of the water environment as a priority issue, it does include several related programs. Similarly, the "Five-Year Plan for Natural Resources and the Environment (2006-2010)" clearly specifies approaches to improve water quality.

In light of the above, this project was recognized to be consistent with the development policy of Vietnam.

3.1.1.2 Relevance of the Implementing Agencies within the Development Policy

The Vietnamese counterpart agency is the Institute of Environmental Technology (IET), which is a division of the Vietnam Academy of Science and Technology (VAST). The VAST is a research institution that possesses authority equal to the ministries, and has an equal relationship with the Ministry of Natural Resources and Environment (MONRE) which oversees environmental administration. When the project was planned, the VAST/IET was almost the only research institution handling environmental issues in Vietnam other than university-affiliated research institutions combining education and research. Hence it is fair to say that the IET was the only option in terms of selecting an institution to develop and spread research that contributes to the project's aim of improving environmental administration. Terminal evaluation of this project also concluded that despite the fact that role and responsibility demarcation among the government agencies relevant to environmental administration was not so well clarified during the planning of this project, it was a rational decision to select IET as the counterpart organization of this project.

This project was designed to make IET being able to formulate technical recommendations to MONRE for better water environmental management especially for establishment of a national water quality monitoring system and also to give technical support to develop human resources among DONRE and other local authorities in the field of water environment such as wastewater treatment (Project Objective). For this purpose, the project planned to enhance research and development capability of IET in the field of water environment management

[3] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

[4] ③: High; ②: Fair; ①: Low

especially for water quality monitoring and wastewater treatment (project Outputs). Through these efforts, the project was expected to contribute to the establishment of water monitoring system, strengthening of water environment management administration (mainly MONRE and DONRE), and dissemination of proper wastewater treatment technologies in Vietnam (Overall Goal of the project). As mentioned before, IET is independent from MONRE and the project was not requested by MONRE, however, in order to secure the pathway of technical recommendations by IET to legislative administrations, MONRE was included in the member of the Joint Coordinating Committee (JCC) of the project. The project continued its effort to maintain the communications and coordination with MONRE throughout the project period.

However, after commencing the project, following facts became clear: standardization of water quality monitoring method had been already in progress under MONRE; MONRE's technical level was not sufficient enough to handle IET's technical recommendations to utilize them for policy making[5]; and IET and MONRE are in different lines of government administration and MONRE does not have to fully accept IET's recommendations. On top of these, towards the end of the project period, the MONRE sat up two affiliated agencies to oversee the technical side of environmental conservation. One of the affiliates is the Center for Environmental Monitoring (CEM) and the other is the Center for Environmental Consultancy and Technology (CECT). The former is an agency that oversees the construction and supervision of a system of environmental monitoring focusing on water quality on a national level, and the later is one which provides technical guidance to related agencies on the research and development of environmental related technology including wastewater treatment. The agencies were established in 2006 and 2007 respectively (CECT existed beforehand as a division of the MONRE). The establishment plan was already more or less recognized at the final stages of the project.

After finding these circumstances, Japanese experts and members of Japanese advisory committee for this project recognized an urgent need to reconsider the direction of the project. As a result, adjustment of the focus point of the project Objective was made. Instead of the contribution to establishment of the national water quality monitoring system through standardization of water analysis procedure, the following two points were selected to be the new focuses: (1) research and development that emphasizes more advanced technology in the field of water management, and (2) the transfer of technology of water management technologies to local administrative agencies and the private sector. Also at the Overall Goal level, contribution to government agencies and private sector for their technical improvement with regard to water environment management through the above (1) and (2) was set as the priority rather than contribution to establishment of water quality monitoring system. However, these adjustments of the project strategy were not officially documented in any project reports, and the terminal evaluation of this project used the original performance indicator to measure the achievement of the project. This point is further discussed in the section of effectiveness of this evaluation report.

Given that the adjustment of the project direction was made, still, IET can be an appropriate implementing agency of this project. CEM and CECT created by MONRE are responsible for the similar activities to IET's, however, IET was already equipped with better facilities and equipment, IET had better accumulation of experience of research and development in the fired,

[5] According to Japanese exprets, there is an opinion that MONRE did not well establish its capability of policy formulation and legislative administration as well.

and IET's two branches in major cities gave a foundation for nationwide extension of its service[6]. IET was also recognized an institute which possess advanced and comprehensive capability in the field of environmental management more than the water environment. IET's functions of training and consulting service gives another advantage compared to other similar organizations that IET is a suitable organization which is responsible of technical transfer to local government agencies. These reasons were recognized as proper justification to continue the project for the phase 2.

Therefore, IET has been maintaining its justifiability as the implementing agency of this project from the planning stage to the time of this evaluation.

3.1.2 Relevance with the Development Needs of Vietnam

One side-effect of the rapid economic growth in 1990s after the Doi Moi reform policy was the serious environmental pollution due to the solid waste, exhaust gases, and waste water primarily emitted by industrial plants. Amidst this, in addition to pollution from industrial plants, as a result of increased wastewater due to population expansion, the contamination of water quality with the pollution of groundwater and waterways became a very severe problem. However, on the other hand, pressing issues that required resolution were the serious inadequacy of monitoring technology and facilities, and slow spreading of appropriate wastewater treatment technologies among the private industrial sector.

From 2005 to 2009, almost no decline was seen in the BOD level of primary waterways and lakes, or in the COD[7] and ammonia concentration of coastal waters. Economic development and population increase place a large burden on the water environment, and there are many remaining challenges to improving water quality in Vietnam.

IET was created in 2002 reorganizing departments of VAST to put all the sections relevant to environmental issues together and still needed improvement of technical level of the staff members and upgrading of laboratory facilities and equipment.

After the commencement of the project, there were some realities different from the original expectation during the planning stage revealed, and the situation was against the project's effort to give direct contribution to the establishment of water quality monitoring system. However, it does not mean the project lost its justification. This project has created a national research base for water environment protection in Vietnam established a foundation of technologies of water quality monitoring and wastewater treatment and provided equipment necessary for actualization of the researches. These contributions of the project are in accordance with the development needs of the country.

Under these circumstances, it can be assessed that the project is, still at the time of this evaluation, relevant with the needs of the country in terms of improvement of techniques of water purification and water quality monitoring.

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[6] According to Japanese experts, there is an opinion as follows. While MONRE, in reality, has difficulties to enforce its authority over DONREs, IET is under the Prime Ministers direction and it gives IET a better position to work with DONRE.

[7] Chemical Oxygen Demand. Total amount of dissolved oxygen in water used organic matters in the water is oxidized by potassium permanganate. The bigger the figure, the more the water is polluted. Usually, COD is used to measure extent of pollution of lakes and the sea. This is because that respiration of microorganism in lakes and salt in the sea water affect the measurement of BOD significantly.

3.1.3 Relevance with Japan's ODA Policy

Japan's Country Assistance Program for Vietnam of 2002 cites the environment as a key area, positing that assistance must be considered to counteract the increasingly severe situation of deforestation, and the pollution of the soil, water and atmosphere, and guidelines and environmental standards also need to be improved in order to make Vietnam's established environmental conservation law viable. Hence it is fair to say that this project is consistent with this assistance policy.

Likewise, this project was identified as a method to "improve the capabilities of study and research institutions," which is Output 2 of the currently underway "Vietnam National Urban Water Environment Program (2007-2015)." Here it was hoped that improvements in the technical capabilities of the IET would contribute to the program purpose in two main ways, namely by (1) providing a technical back-up to the actions of the central government in improving environmental administration, and (2) training personnel within the administrative institutions on the level of enforcement.

In light of the above, despite that there was an adjustment of the direction of the project, the adjustment was reasonable, and maintained the relevance. As a result, this project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

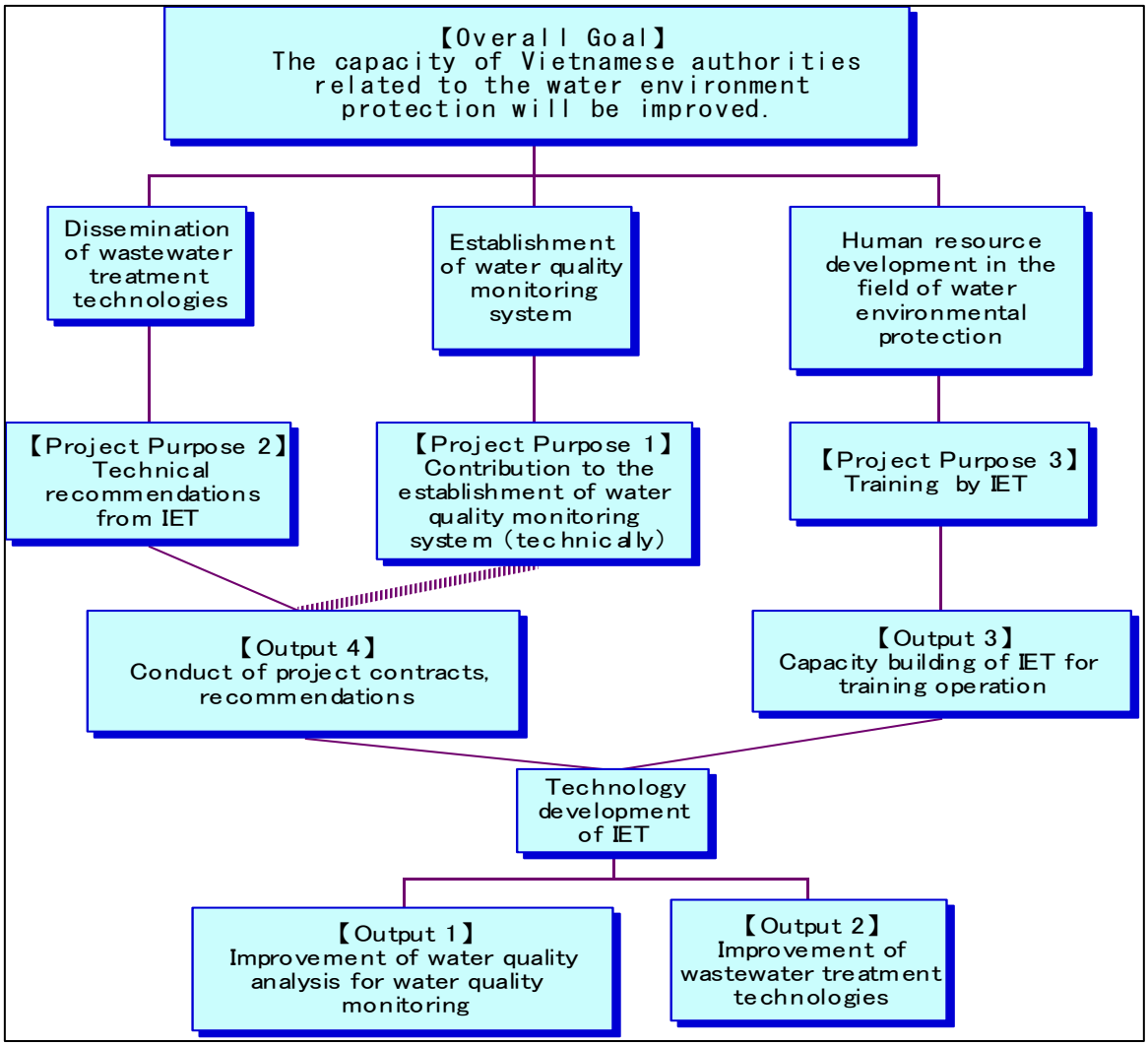
3.2 Effectiveness and Impact (Rating: ②)[8]

As mentioned above, after finding the real situation surrounding IET in the overall picture of water environment protection in Vietnam, adjustment of strategy of the project was necessary. The original structure of the objectives of the project can be depicted as Figure 1. In this structure, the linkage shown by a dotted line, which means a pathway between the IET's recommendations to the policy formulation, was lost unexpectedly. Due to this, priority setting of performance indicators of the Project Objective needed to be adjusted, however, the description of the Project Objective, namely "The capacity of VAST related to water environment protection is improved" and details of the project Outputs were not affected.

However, since the history of the adjustment of project strategy was not documented in the project reports, it is not easy when exactly the adjustment took place.

Based on these, this evaluation applied the original project plan and the performance indicators for judgment of effectiveness/impact with consideration of the influence of the strategy adjustment.

[8] Sub-rating for Effectiveness is to be put with consideratin of Impact.



Source: Evaluator created from collected material

Figure 1: Objective Structure of the Project

3.2.1 Project Outputs

3.2.1.1 Project Output

The four following Outputs were established as necessary to achieving the Project Objective.

1) Output 1

Outline	Indicator
VAST researchers' abilities to conduct water quality monitoring and to develop analysis methods are improved.	1. Number of analytical method mastered by VAST(IET) researchers through the technical transfer
	2. Number of reports on development of SOP on water quality analysis

In relation to indicator 1, through the project's activities, analysis skills for 12 types of water quality analysis instrument were acquired. For each instrument, research reports related to the instrument functions, analysis principle and operating methods were created,

and screening was completed by VAST's project evaluation committee.

In relation to indicator 2, of the 31 environmental standards in Vietnam, the creation of a standard operating procedure (SOP) was completed for 18 standards.

In the PDM, although no final target value was indicated such as the number of analysis methods to be acquired or the number of SOPs to be prepared, interviews with the IET showed that outputs during the project period were in keeping with the IET's expectations in terms of strengthening their performance at the time.

Given the above, it can be said that the initial objective was achieved for the Output 1.

2) Output 2

Outline	Indicator
VAST researchers' abilities to develop and apply suitable technologies on domestic and industrial wastewater treatment are improved.	1. Improvement of wastewater treatment system in VAST
	2. Number of case studies requested by MONRE and other organizations

In terms of the performance related to indicator 1, the IET staff themselves completed the VAST and IET's wastewater treatment facility for which they had created the basic design, and acquired treatment skills through operating nine pieces of wastewater treatment laboratory equipment belonging to the facility. However, it would be essentially preferable if laboratory wastewater and domestic wastewater were separated, and harmful effluent was collected separately[9], so a "Master Plan for Wastewater Management in VAST" was created and submitted to the VAST. Nevertheless, the volume of laboratory wastewater within the VAST overall was lower than that of domestic wastewater, and laboratory wastewater was diluted. Thus there is little need for separate treatment, and this was judged not to be a technical problem, and was not ultimately carried through.

In relation to indicator 2, five wastewater treatment studies were conducted.

From the above results, it can be said that the initial objective was achieved for the Output 2. The aim of the Output 2 was to establish the basic knowledge and skills of IET staff in wastewater treatment techniques. The knowledge and skills acquired through these activities enable the IET staff to provide a consulting service related to wastewater treatment to external clients, and the required level of achievement has been reached.

3) Output 3

Outline	Indicator
VAST staff members' abilities to conduct training courses on water quality monitoring and wastewater treatment for central and local organizations are improved.	1. More than six teaching materials are made by VAST (IET) staff members
	2. Curricula are properly developed for each training course

[9] Organic compounds and metals contained in laboratory wastewater should be isolated and treated properly. If domestic wastewater is not separated, total amount of water to be treated becomes large and capacity of a treatment facility should be set large. Because of these two reasons, separation of laboratory wastewater and domestic wastewater is preferable.

Related to indicator 1, a total of 31 types of training material were created. They include 10 types of training material for water quality monitoring and analysis, and 16 types of material for wastewater treatment technology training.

Related to indicator 2, an investigation was conducted into the needs of the 64 regional Departments of Natural Resources and Environment (DONRE) throughout the country, and a draft "Effective Training Curriculum" was created based on the results. However, this was not a detailed curriculum; rather a training plan. Although a proposal was submitted to the MONRE based on the curriculum, the course did not actually get underway.

From this it can be said that the Output 3 was more or less achieved.

4) Output 4

Outline	Indicator
VAST researchers are to contribute MONRE's and related organizations' activities of water environment protection.	1. Number of projects given by MONRE and related organizations to VAST (IET)
	2. Number of evaluation reports for relevant projects of other organizations

Related to indicator 1, there were three projects in 2002, two in 2003, three in 2004, four in 2005, and one until the completion of the project in 2006. The projects were implemented in response to requests from government organizations such as the MONRE and DONRE. Approaches related to technical support were also received from other donors such as Denmark and Switzerland that support the environmental domain.

Related to indicator 2, there were results from four cases in 2004 and three cases in 2005. Consulting and engineering services were also offered in relation to wastewater treatment in hospitals and private sector corporations. It follows that the IET was now able to follow through with consulting and studies commissioned by external organizations. Hence it is fair to say that this project succeeded in furnishing the IET with the basic capabilities to respond to society's needs.

The terminal evaluation of this project described that one of the important contribution of this Output 4 was to formulate recommendations on water quality monitoring, standard of procedure of water quality analysis and so on. An opinion brief on several of the adopted water quality standards that did not reflect the current situation in Vietnam was created and submitted to the MONRE and the Ministry of Science & Technology (MOST). Similarly, in September 2005, a recommendation on the standardization of water quality analysis was submitted to the Vietnam Standards and Quality Agency (a sub-division of the MOST). Under Vietnam's administrative procedures, the MONRE - which has jurisdiction over water quality management - is required to put forward its views on these and begin investigations into making them into new legislation. The MONRE, however, did not put forward any views, which leads us to the present[10]. One of the crucial aims of the Output 4 was to contribute to creating results from the technical level in the formulation of IET's policies. However, it can be said that an adequate output has not necessarily been achieved in line with the initial plan of the project.

Accordingly, some problems persist for the Output 4.

[10] This evaluation could not identify exact reason of this event. According to a Japanese expert, there is an opinion that this is another evidence showing MONRE's weak capability as an administrative organization.

3.2.1.2 Achievement of the Project Objectives

The Project Objective is determined as follows.

Outline	Indicator
The capacity of VAST related to water environment protection is improved.	1. Water quality monitoring reports are submitted to MONRE by VAST (IET)
	2. Number of organizations being advised by VAST (IET) will increase compared to the year 2002.
	3. Participants trained by VAST (IET) will reach 100 persons

1) Indicator 1: Water quality monitoring reports are submitted to MONRE by VAST (IET)

As discussed already, due to the unexpected situations found after the commencement of the project, at the time of the terminal evaluation for this project, the water quality monitoring report form had not been submitted. The national water quality monitoring system itself was still in its formative stage. However, a water quality monitoring manual was created in relation to work on the ground and IET's technical capacity of water quality analysis was improved.

When this project was completed, regarding the water quality monitoring system at the national level, the arrangement of the monitoring points and monitoring agent (both internally and externally manufactured) at each of the points had not been constructed, and as mentioned in 3.1.1 of this report, MONRE created CEM in 2006, close to the end of the project period, to commission the work to establish the water quality monitoring system.

2) Indicator 2: Number of organizations being advised by VAST (IET) will increase compared to the year 2002

There is no figure for the year 2002. However, the trend is one of increase with three cases in 2003, 25 cases in 2004, 32 cases in 2005 and 11 cases by the end of the project in 2006. They mainly include water quality analysis and technical consultations on wastewater treatment. Though the number of cases is not stable, the increasing trend is undeniable considering the basis of three cases in 2003. Similarly, as seen with the status of achievement of the Output 4, the ability to provide technical services externally was clearly heightened, and the Project Objective of "improved performance" can be said to have been achieved.

3) Indicator 3: Participants trained by VAST (IET)

Training was conducted mainly for staff members of DONRE and other government organizations, and for master degree students. In the two sessions of training (three courses) conducted in 2005, a total of 213 people participated, which greatly exceeded the target of 100 people, and achieved the objective.

Thus for the indicator 2 and 3, the project achieved the target more or less, however, for the indicator 1, the target was not achieved due to the unexpected changes in the situations with regard to the water quality monitoring. This project has somewhat achieved its objectives, therefore, its effectiveness is fair.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

The Overall Goal of this project is determined as follows.

Outline	Indicator
The capacity of Vietnamese authorities related to the water environment protection will be improved.	1. Number of monitoring points
	2. Number of transferred technologies being applied in actuality
	3. Number of technological issues recommended by VAST (IET) to related authorities

The lost linkage shown in the Figure 1, depicted by a dotted line, also affected the project's contribution at the impact level, and the contributions of IET to the establishment of water quality monitoring system and MONRE's policy formulation have been in indirect forms. After the adjustment of the project strategy, the project aimed to achieve the Overall Goalthrough strengthening IET's contribution to the research and development work on advanced technologies relevant to water environment protection and human resource development or the technical transfer to the local organizations.

1) Indicator 1: Number of monitoring points

In relation to the construction of water quality monitoring points throughout the country, even though monitoring centers ware set up to control the monitoring activities in 60 out of the total 64 ministries, the construction of an overall mechanism that includes the installation of individual monitoring points has not yet been established. On top of this, according to CEM, standard operating procedures for the water quality monitoring was already prepared by MONRE and its collaborating organizations, and any organizations which take part in the water quality monitoring is obliged to follow these standards. However, there still is room for improvement in the standards, and this project has made continuous effort to improve them by preparing and introducing water quality monitoring manuals, SOPs to relevant organizations. At the time of this evaluation, the construction of a water quality monitoring system had been delegated to the MONRE's subsidiary CEM. According to CEM, the construction of a national water quality monitoring system will take time until 2020.

Although, it was not possible to specifically confirm the general financial situations of the DONRE, which actually conducts the monitoring and the budget allocated for environmental management, according to CEM, the environment budget continues to decline due to the recent setback of the government finances. Also, competition with other environment-related work has meant that securing a budget for monitoring is not necessarily easy at present.

Amidst such circumstances, IET has participated in taskforces and study groups organized by MONRE and relevant workshops aiming to make contribution to the policy making of the government. It is reasonable to expect that if IET will continue to give technical inputs to these kinds of platforms based on its accumulated knowledge and experiences, it will be able to contribute to the formation of the water quality monitoring system at least indirectly.

2) Indicator 2: Number of transferred technologies being applied in actuality

As a result of the project, IET has enhanced its capacity of water analysis, water quality monitoring and wastewater treatment. Based on the established ability, IET has been expanding its services to other relevant organizations by giving technical consultations and training. At the time of this evaluation, these activities for technical transfer to other organizations have been conducted as normal operation of IET. In areas such as Hung Yen Province which adjoins Hanoi, technical support and training has been provided to the DONRE, and the IET routinely carries out technology transfer to related agencies and organizations.

This evaluation study confirmed two points in relation to the operations cooperation agreements that the IET has individually entered into. The first is that, the agreement with the Hanoi DONRE is not a general operations cooperation agreement, but a cooperation agreement specific to introduction of a system of pollution control managers. The other point is that the agreement with Hung Yen Province relates to technical support within more general operations.

Similarly, such services as consulting services are also being provided to private sector corporations. Through such activities, the wastewater treatment facilities planned by the IET are also being constructed. However, there are roughly ten cases of such activities annually, which cannot be viewed as a major contribution from the perspective of "improving capabilities related to protecting the water environment in Vietnam." In order to promote this service, strengthening of linkage between the headquarters in Hanoi and two branches, and further capacity building of the branches are necessary. This aspect was one of the main purposes of the Phase 2 of this project.

3) Indicator 3: Number of technological issues recommended by VAST (IET) to related authorities

This indicator is representing IET's ability of recommendation formulation which will result in variety of contributions to the water environment management administration of the government. According to the response to the questionnaire filled by IET during this evaluation, IET has been made 5 to 6 of concrete recommendations to the government authorities. They include proposals and consultations to MONRE, DONRE and other relevant organizations. On the other hand, the project documents do not show any particular target with regard to this indicator, and it is difficult to judge the extent of the achievement.

Meanwhile, it is not clear how many of the recommendations from IET would be actually used for policy formulation or environmental administration, therefore, it is fair to say that actual contribution of IET for improvement of water environment control is still uncertain. For example, the past proposals submitted to MONRE have not been fully adopted. MONRE recognizes IET as a partner organization with good technical expertise, however, the position of IET for MONRE is just one of the many other insitutions, and MONRE has to select an organization for contract work through an open bidding. Therefore, MONRE is not able to intentionally select IET for a main recipient of its outsourced work. IET has provided technical consulting services outside Hanoi, but limited to some provinces including Hung Yen, Hai Phong and Ho-Chi-Minh. It is still many areas to be covered if it aims to contribute at the national level.

From the above, although Overall Goal was somewhat achieved for its target indicator 2, but

the achievement indicator 1 was lower than the plan due to the changes in the situations, and the indicator 3 was not able to judge the magnitude of the achievement due to lack of information to specify the target figure for this indicator. Therefore, the Overall Goal was partially not achieved.

After these, the phase 2 of the project (2008-2012) reflected the strategic adjustment of this project and put more emphasis on further enhancement of technical capacity of IET and extension of technologies, with continuation of efforts to support the establishment of water quality monitoring system. The phase 2 project maintained a part of the Overall Goal of this project (phase 1), which was the technical transfer to DONRE and other relevant organizations (indicator 2). Phase 2 of the project also prioritized establishment and proper management of an integrated network between the headquarters and branches of IET, aiming for creation of regional centers for extension of technologies to related organizations and private sector nationwide. It is fair to expect that this network will gradually be effective.

3.2.2.2 Other Impacts

This project was expected to oversee the training of related personnel and provide a technical backup within the Japan International Cooperation Agency's "Vietnam Urban Water Environment Improvement Program." As the table below indicates, technical supports were provided directly and indirectly to the other projects, and programmatic collaboration was seen between the projects in this area.

Table1: Contributions of the project to the Vietnam Urban Water Environment Program

Project Name (Year implemented)	IET's Contribution
The Study for Water Environment Management on River Basins in Vietnam (May 2008–January 2010)	Providing technical advice and information
The Ha Long Bay Environmental Protection Project (March 2010–March 2013)	Providing consulting and analysis services
Project to Improve Water Environmental Management Capabilities in Vietnam (June 2010–June 2013)	Participation of IET staff members as resource personnel
Ho Chi Minh City Water Environment Improvement Project (2000–2007)	Direct participation in project activities, participation in evaluation activities

Source: Questionnair to IET, interviews of IET staff members

Viewing performance in relation to the Outputs and Project Objective mentioned earlier, it can be said that the IET has been equipped with capabilities of providing technical guidance and formulating proposals for the relevant organizations, and is actually commencing various approaches to apply these capabilities. In terms of individual guidance and training to private sector corporations and other relevant administrative agencies, though it must be conceded that the force of this impact on the national scale is yet limited, results are improving steadily. Phase 2 of this project assisted strengthening of the IET's branch network so that IET's service for

environmental protection can be nationwide, therefore, the service range of IET is expected to be expanded. On this point, it is fair to view the situation that the IET is using the basis constructed by this project in its ongoing effort to contribute to higher development targets. The response to a questionnaire from the IET was also that the remaining results of this project had satisfied its expectations.

As described above, in terms of the Project Objective, the indicator 1 (Submission of monitoring report to MONRE) could not be achieved due to the fact that the establishment of the monitoring system itself did not progress as expected, and the indicators 2 (Number of organizations advised) and 3 (number of trained people) were achieved. Regarding the level of achievement of the Overall Goal, the indicator 2 (technical transfer of water environment protection and their application) was achieved, but the indicator 1 (number of monitoring points) was not achieved due to the IET's position in the water environment management administration was not favorable for the project, and the indicator 3 (number of proposals to the authorities and other relevant organizations) could not be judged the achievement due to lack of target setting at the planning stage of the project. Although there is no official record, considered the adjustment of the project direction, there is a acceptable reason for insufficient achievement of the indicator 1 of the Project Objective and the indicator 1 of the Overall Goal.

Given these, this project has somewhat achieved its objectives, therefore, its effectiveness and impact is fair.

Phase 2 of the project prioritized research and development of advanced technologies and enhancement of function of the branches, with continuation of efforts to support the establishment of water quality monitoring system. It is fair to expect that further materialization of project effect will emerge.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

The following table summarizes the planned inputs and the performance at the time of completion.

Elements of Inputs	Plan	Performance (at completion)
(1) Experts	3 for Long-term: Environmental management, water analysis, water treatment Short-term (dispatched as necessary)	6 for Long-term (136 man-months: water environment management, water analysis, water treatment, operational coordination, monitoring) 11 for Short-term (24 man-months)
(2) Trainees Received	Approximately 5/annually (e.g., water treatment, water quality analysis)	28 trainees (including 4 trainees from the preparation period of the previous year. e.g., water quality control courses, wastewater treatment/water quality analysis courses)

(3) Equipment	Approximately 180 million yen	Total Cost: 367.647 million yen
Total Project Cost	No data available	855.1 million yen
Total Local Cost	No data available	53.80 million yen (including 31.094 million yen for the construction of a wastewater treatment experimentation facility)

3.3.1.1 Elements of Inputs

Of the inputs from the Japanese side, the actual inputs of the long-term experts and the equipment were over the plan. According to interviews to the JICA's Advisory Committee members of the project, at the time of planning, though the Japanese side had wished to start on a smaller scale, and had anticipated three long-term experts, project progress required that further experts were added as it was judged that the dispatch of a project coordinator was indispensable. Regarding the experts in charge of monitoring, at the time of planning it was expected for the experts overseeing water quality analysis to perform combined duties and oversee operations to improve water quality monitoring. However, it was explained that there was more technical transfer of analysis methods than anticipated, and the experts could not handle the water quality monitoring duties, so additional experts were dispatched.

To be exact, the three long-term experts in the plan refer to "three fields." There are 108 man-months over the three-year period of the project. The result of 136 man-months is 28 man-months longer than planned, which is an increase of approximately two man-years. This increase was appropriate considering the situations explained above.

Regarding the equipment, the equipment list was strictly scrutinized based on a similar policy at the planning stage of limiting the budget as much as possible. However, in order for the IET to become a state-certified reference laboratory during the project, it was required to be suitably outfitted and the purchase of additional analysis instruments proved necessary.

The number of trainees received also nearly doubled that of the plan, but this is not a problem since many participated in group training, which are funded by other budget than the project.

In terms of the Vietnam side's inputs, there were 27 counterparts on the plan, which rose to 144 in actual performance. While it is common for counterparts to increase as a ripple of the project's effects to more personnel is sought, this is not considered a problem. There was no evidence that the increase in counterparts led to any major increase in costs.

3.3.1.2 Project Cost

The total cost of the project was approximately 855 million yen. There can be no comparison with the plan as the plan mentioned no value. However, considering the fact that the equipment provision mentioned above added 200 million yen to the project cost, it is likely that the actual total project cost was higher than planned. Nevertheless, it is a problem that the budget plan was not properly filed and managed.

3.3.1.3 Period of Cooperation

The cooperation period was as planned with a performance of 36 months against the planned 36 months.

From the above, compared with the generated Outputs of the project, the period of cooperation was as planned. Although the actual cost could not be compared with the plan, increase in the long-term experts and the equipment provision most likely made the total cost exceed the plan. The inputs were appropriate for producing the Outputs and achieving the Project Objective, while the total cost exceeded the plan, therefore efficiency of the project is fair.

3.4 Sustainability (Rating: ③)

3.4.1 Related Policy towards the Project

Improving the abilities of managers within both the DONRE and the environment related departments of local authorities was deemed a major issue in the "Five-Year Plan for Natural Resources and the Environment (2006-2010)." Ever since, and at the time of this evaluation, it has been recognized that approaches to make the allocation of Pollution Control Managers obligatory, and the tightening of monitoring and regulation of industrial wastewater are crucial to environmental conservation and management. Coinciding with this, organizations with knowledge and skills related to water quality monitoring are being sought in order to effectively launch national policies and environmental policies. It can be said that a favorable environment now exists in terms of the legal and political perspective, as well as of the demand for the IET's training and consulting services in this sector.

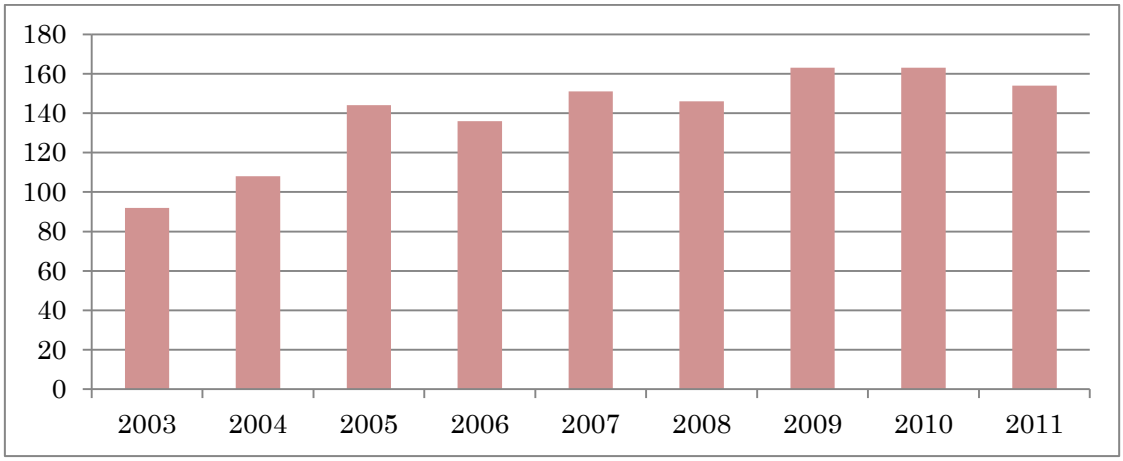
On the other hand, a sense of the expectation on the IET to become a receptacle for advanced technologies that exceed current analysis techniques and wastewater treatment technologies was revealed from interviews with the MONRE and others. Areas of the advanced technologies include the ones for monitoring and treatment of pollutants not yet detected in Vietnam, such as toxic organic compounds and endocrine disruptor (or environmental hormone). It is expected that IET would be able to predict and detect the pollutants using existing experiences from Japan and other countries and develop appropriate technology to control those substances, which is suitable for the Vietnamese conditions.

3.4.2 Institutional and Operational Aspects of the Implementing Agency

IET has five departments including Department of Environmental Engineering, Dept. of Environmental Quality Analysis, Dept. of Environmental Planning, Dept. of Environmental Electrochemistry and Dept. of Microbiology. Because of this comprehensive coverage of specialties, IET has ability to deal environmental issues with an integrated manner, not from the water aspect only. IET has two branches in Ho-Chi-Minh and these offices are the core stations for nationwide extension. Total numbers of IET staff members from 2003 to 2011 are shown in the figure 2.

There have been no major changes within the IET which is a stable organization. It is fair to say that from 2005 onwards, the number of IET staff members and distribution within the departments has gradually increased and remained relatively stable.

Of the 143 staff members registered during the project, 112 are still registered. Of those staff members leaving their jobs, eight retired, and 23 left their jobs in real terms - which accounts for 16% overall. Social need is high, and when bearing in mind those engineers in the field can hope to change jobs, it is thought that a staff turnover of 16% seven years after project completion is not particularly a high figure.



Source: IET

Figure 2: Number of staff members of IET

The IET has set up a unique salary system that utilizes independent finances acquired through such means as consulting services and projects received. In addition, the IET consciously motivates staff through such means as improving working conditions and providing training opportunities.

3.4.3 Technical Aspects of the Implementing Agency

Even after the completion of the project, standard operating procedures (SOP) were being continually created. This became possible not only at the Hanoi headquarters, but also at the Ho Chi Minh and Da Nang branch offices. At the time of this evaluation, there were 77 SOPs in total. Two branches in Ho-Chi-Minh and Da Nang have also been certified as reference laboratories. These can be seen as evidences of the IET's continual progress based on the achievements of this project.

There are around five external orders each year from the MONRE and around three or four continually contracted water treatment projects each year from other organizations and private sector corporations.

At the time of this evaluation, IET does not have regular training courses open for public, however, it regularly conducts a regular master degree program. IET also conduct on demand training courses, therefore, capacity of human resource development raised by this project has been maintained and used.

All the equipment provided by this project including the equipment at the Ho Chi Minh branch office, with the exception of some of equipment that had completed its role and was no longer in use, was in an appropriate state of management and operation. This was confirmed by the questionnaire given to the IET to check the usage status, and the direct observation done during this evaluation.

As described above, the technical foundations created by the project are firmly in place. On top of these is a need for skills and knowledge of a higher level or wider-range. At the time of this evaluation, the primary need voiced in the interviews of the IET was for environmental assessments, knowledge and skills related to the analysis of damages to health, techniques in the analysis of heavy metals, and for diverse techniques in wastewater treatment.

3.4.4 Financial Aspects of the Implementing Agency

The 2007–2011 income and expenditure data available at the time of this evaluation study is as follows.

Table 2: Balance of the IET's Income & Expenditure

	2007	2008	2009	2010	2011
1 Total Income	18,478,766,942	18,834,502,818	26,994,621,717	40,523,308,493	40,101,775,118
1.1 Government Financial Aid	11,050,588,090	10,279,172,639	13,422,242,496	17,632,949,135	17,072,853,154
1.2 External Income	7,428,178,852	8,555,330,179	13,572,379,221	22,890,359,358	23,028,921,964
2 Total Outgoings	18,427,456,091	18,824,264,657	26,972,381,732	40,498,180,049	40,080,885,618
2.1 Personnel	8,500,232,793	8,663,871,296	12,417,525,990	19,045,954,992	18,647,325,430
2.2 Materials & Equipment for Analysis	7,945,869,785	8,098,836,212	11,607,687,338	18,032,872,279	17,644,781,052
2.3 Operation/ maintenance of analysis instruments and facilities	923,938,347	941,725,141	1,349,731,086	1,418,315,797	1,604,071,005
2.4 Miscellaneous	1,057,415,166	1,119,832,008	1,597,437,318	2,001,036,981	2,184,708,131
3 Income & Expenditure (1-2)	51,310,851	10,238,161	22,239,985	25,128,444	20,889,500

Source: IET

Income continues to increase stably after the completion of the project. In particular, from 2009 onwards, external income exceeded government aid, and this increasing trend is favorable. The necessary expenditure of analysis operations is also stable, and it can be said that there are no problems in financial sustainability.

From the above, in relation to the IET's activities for research and development and human resource development in the field of water environment protection, no major problems have been observed in the policy background, the structural, technical, financial aspects of the executing agency, therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed at creating a research base in Vietnam through improvement of technical capacity of IET with relation to water environment protection administration, and expected to contribute to betterment of water environment protection in Vietnam including the establishment of a national water quality monitoring system. At the time of planning the project, IET was expected to be responsible for giving technical recommendations to the government authorities for establishment of the monitoring system water quality. However, after the commencement of the project, the project staff members found serious difficulties to realize the original target, and strategic direction of the project needed to be reconsidered to be more realistic. As a result, while maintaining the effort to contribute to the establishment of the water quality monitoring system as much as possible, more emphasis was put on human resource development for local government agencies and research and development of more advanced technical areas. Despite this redirection of the project, the important condtions including high priority of water environment management for the Vietnamese government, existence of high demand for improvement of water quality and water quality protection, and also the reasonable

development approach that IET, a research institute with comprehensive capability for environment management technologies, takes a role to disseminate appropriate technologies for water quality monitoring and wastewater treatment to local organizations through its branch laboratories are still maintained, therefore, relevance of the project is high.

Although the first part of the original Project Objective of contribution to the establishment of the monitoring system was not achieved, dissemination of relevant technologies was achieved, and impact was also partly achieved, therefore, the effectiveness is fair.

While the results of the experts dispatched and equipment provided exceeded the plan, this does not present a problem as there is a rational explanation for the additional input. Although the actual cost could not be compared with the budget plan, increase in the long-term experts and the equipment provision most likely made the total cost exceed the plan. Therefore the efficiency of the project is fair.

Financial and technical sustainability of the project effect was found good. After the revisions to the project design in respect to IET's position and roles for development of water environment management in Vietnam, there are sound environment surrounding the IET to continue its effort to develop and disseminate appropriate technologies for water environment management and to make contribution to policy formulations. Also, IET's organizational structure and its finances are stable enough. Therefore the sustainability of the project effect is high.

While this project displayed an insufficient effect for establishment of a national water quality monitoring system, which is a priority of the original plan, considered the real expectations to IET that it should provide necessary technical support to capacity of water environment management capacity of relevant organization in Vietnam, this project has accumulated effects.

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

4.2 Recommendations

4.2.1 Recommendations to Executing Agency

(1) Clarifying the Position and Roles of the IET

In terms of the IET's position and roles, the IET's annual report should specifically describes the IET as a neutral research institution responsible for the development and proliferation of primarily the latest technology within the field of the water environment; based on this, the IET is to formulate technical recommendations, and provide technical support to related parties directly responsible for activities related to water environment protection such as the DONRE and private sector corporations. Consensus on this IET's roles and position should be created among the related organizations including MONRE, and collaborations among them should be further promoted. CEM, CECT and research institutes of universities perform activities similar to a part of IET's activities, however, their activities are generally for standardization and/or dissemination of ordinal technologies. IET has been working for practical application and/or dissemination of a wider range of and more advanced technologies.

(2) Maximizing the Potential of the IET's Branch Offices

In order to expand the functions of the IET including formulation of proposals related to the latest technologies of water environment management, provision of technical consulting services and human resource development, it is necessary to further enhance technical capabilities and forge relations with all concerned parties in each region throughout the country

so that every branch office can provide them with a level of service equaling that of the Hanoi headquarters. In addition, it is necessary to enhance a technical backup system at the headquarters to handle situations which are over the current capacity of the branches, such as conduct of analysis using advanced technologies or require equipment only available at headquarters. Phase 2 of this project supported strengthening of the network of IET headquarters and the branches for the better technical services, and this effort should be further continued.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

The lessons learned from the project are as follows.

(1) Foresee of the Contribution of Research Projects to Development Administrations

When carrying out cooperation related to technical development and technical improvement, the counterpart implementing agency not infrequently becomes the highest repository of that technical field in the recipient nation. However, there are frequent problems in using the administrative system and policies to effectively utilize the technologies developed or transferred by the project. Therefore, if a project is aiming at actual use of the developed or transferred technologies for policy making and administration, clarification of the position of the target research institute in the policy making process, and incorporation of necessary activities into the project to secure a practical and firm linkage between the research institute and the administrative organization, is significantly important. Types of contribution by a research institute to the policy making and administration can vary: not only direct involvement to policy formulation, but also submission of proposal and recommendations, participation to relevant task forces, acceptance of contract work, support through human resource development, and so on. In any cases, taking a good consideration of the real roles and position of the research institute, project planner should formulate a realistic and not overambitious plan. Then, flexible management responding to the realities during implementation of the project is the key to a successful project and achievement at the level of the Overall Goal.

(2) Official Record of Adjustment of Development Scenario

In relation to the above, the direction of the IET's contribution was revised partway through the project. However, this point was not recorded in the official documents related to the project, and it took time to confirm the fact during this evaluation work. Phase 2 of this project reflected this revision of the project direction, but neither of terminal evaluation report of this project nor any project documents of the phase 2 explains how the project members considered the roles and position of IET among other relevant organizations and how they reached the revision of the project strategy.

While recognizing that planning always stands on hyphotheses, changes to the environment and planning alterations due to unexpected circumstances arising after starting the project have to be taken into consideration and thoroughly documented, and it would be easily recognized whether the project would have been managed properly. Especially when a project is designed to be three years period, JICA does not conduct an official mid-term review and importance of

intentional consensus formation on such strategic changes is very significant. Therefore, proper documentation and filing so that anybody who needs to understand the situation can see the information is important. This is also crucial to ensure transparency and establish accountability.

(3) Proper Management of Budget Based on Clear Cost Projection

No figures for cost estimates at the time of planning could be obtained. In case of this project, additional long-term experts and equipment were procured in the course of the project implementation based on identified needs found after the commencement of the project. According to the Japanese experts and JICA advisory committee members, there were very good reason for each additional input, and addition of inputs itself is not a matter if there is a reason. The issue here is that budget management should be done based on plan-actual comparison, and any additional input should be examined from their necessity and acceptable limit of deviation from the original budget plan. In this case, no document showing how the examinations were done was provided, and it caused the difficulty to analyze and make judgment of the efficiency.

It is very important to properly file a budget plan and manage the change records.

Laos

Ex-Post Evaluation of Japanese ODA Grant Aid Project
Project for Vientiane Water Supply Development

External Evaluator: Noriko Ishibashi, IC Net Limited

0. Summary

This project is aimed at expanding and rehabilitating two of the four existing water purification plants in Vientiane[1], the Kaolieo and Chinaimo Water Purification Plants, for securing a stable water supply and raising the water supply coverage in the service area there. It is relevant to the development plan and development needs of Laos, as well as Japan's ODA policy. Therefore the relevance of the project is high. After the expansion and rehabilitation of the two water purification plants, the amount of water supplied in the city grew as expected, leading to an increased population served and higher water service coverage. However, the actual project period was slightly longer than planned. Therefore the efficiency of the project was fair. In terms of the sustainability of the project, neither of the two water purification plants have any major problem in terms of their daily operation and maintenance, at least at present. However, there is some concern about their sustainability in the future. From the financial point of view, there are challenges to run on a financially self-supporting as an independent organization having self-supporting accounting system. Therefore, the sustainability of this project is fair.

In light of the above, this project is evaluated as (B) satisfactory.

1. Project Description

Project Location

Water receiving well at the Kaolieo Water Purification Plant

1.1 Background

In its fifth Five-Year National Socio-Economic Development Plan (2001 - 2005), Lao People's Democratic Republic placed great emphasis on the development of the social infrastructure, including water supply and sewerage. In the Development Plan for

[1] At the time of the planning for this Project, in 2003, Vientiane had four water purification plants, Kaolieo, Chinaimo, Thadua, Thagone within the city.

Communication, Transport, Post and Construction, announced earlier than the five-year plan, in 1997, the former Ministry of Communication, Transportation, Post and Construction[2] (currently Ministry of Public Works and Transport: MPWT) set a target of achieving 100 percent water service coverage in large cities as a development objective for the water services sector. Meanwhile, Japan started offering development aid for Vientiane Capital water services as early as 1963. Japan's support for the development of the urban water infrastructure there included the construction and repair of the Kaolieo Water Purification Plant (in 1964 and 1983, respectively) and the upscale and rehabilitation of the Chinaimo Water Purification Plant (between 1992 and 1996) and so forth. Before the implementation of this project, the Study on Vientiane Water Supply Development Project was carried out in 2003 to form a master plan for its water services sector. According to the study, before the implementation of this project, in 2003, Vientiane supplied about 78,000 cubic meters of water per day of its water supply capacity of about 100,000 cubic meters per day, lower than the maximum one-day demand that year of 122,000 cubic meters. Thus supply capacity was insufficient to satisfy the demand. It led to over capacity operation[3] of the existing water purification plants, in case the water demand would be high, whenever required. Expanding and developing its water purification plants to meet the demand for water was an urgent challenge for the city to address.

1.2 Project Outline

The objective of this project is to secure a stable water supply and raise the water supply coverage in the service area of Vientiane by upgrading water supply facilities and main water distribution pipeline there.

<table>
<tr><td colspan="2">Grant Limit/ Actual Grant Amount</td><td colspan="3">2,875 million yen / 2,171 million yen</td></tr>
<tr><td colspan="2">Exchange of Notes Date</td><td colspan="3">February 2006 (study for the Detailed Design)
June 2006 (Construction work)</td></tr>
<tr><td colspan="2">Executing Agency:</td><td>Ministry of Public Works and Transport, Laos / Vientiane Capital Water Supply Company (NPVC)</td><td>Project Completion</td><td>March 2009</td></tr>
<tr><td rowspan="3">Project contractor</td><td>Consultant</td><td colspan="3">Nihon Suido Consultants</td></tr>
<tr><td>Constructor</td><td colspan="3">Shimizu Corporation</td></tr>
<tr><td>Procurement</td><td colspan="3">Shimizu Corporation</td></tr>
<tr><td colspan="2" rowspan="2">Feasibility Studies, etc</td><td>Basic design study</td><td colspan="2">Detailed design study</td></tr>
<tr><td>The Basic Design Study on the project for the Vientiane Water Supply Development
1st: June - September 2004
2nd: April - September 2005</td><td colspan="2">February 2006 - February 2007 (as is in the Completion Report)</td></tr>
</table>

[2] The name of the ministry was changed in 2007 from Ministry of Communication, Transportation, Post and Construction to Ministry of Public Works and Transport (MPWT).

[3] Water supply capability of a facility is in principle determined by its design, however, slightly larger amount can be supplied.

Related Projects	Technical cooperation	Grant aid	Other international and aid agencies, etc.
	• Study on Vientiane Water Supply Development Project (March 2003 - February 2004) • Capacity Development of Urban Water Supply Authorities (September 2003 -) • Short-term expert: Water Supply Planning Sector (2000) • Long-term expert: Water Supply Facilities Operations and Maintenance of (2000 - 2002) • Japan Overseas Cooperation Volunteers: Water Purification Plant Water Quality Testing (1998 - 2000) • Senior Volunteers: Water Purification Plant Water Quality Testing (2001 - 2003) • Technical Cooperation Project: Capacity Development of Water Supply System (2002 - 2005) • Senior Volunteers: Non Revenue Water Management (April 2004 -) (NPVC headquarters) • Senior Volunteers: Water Purification Operation (2004 -) (Chinaimo Water Purification Plant) • Long-term expert: Capacity Development of the Water Supply System (2005 -)	• Kaolieo Water Purification Plant Development Plan (1963) • Vientiane Water Supply Facilities Repair and Expansion Plan (1983) • Vientiane Water Supply Facilities Expansion and Development Plan (1996) • Vientiane National Road 1 Improvement Project	• French Development Agency (AFD) Study on Water Distribution Networks (2003 - 2004) 2nd Leakage Prevention Project (2004 - 2005) Training Center Construction Project (Chinaimo Water Purification Plant) • Government of Laos Dongmakhay Water Purification Plant Construction Project

2. Outline of the Evaluation Study

2.1 External evaluator

Noriko Ishibashi, IC Net Limited

2.2 Duration of Evaluation Study

The duration of this ex-post evaluation study, and that of the field study for it, are as follows:

Duration of the Study: September 2011 - November 2012;

Duration of the Field Study: December 4 - 16, 2011; May 27 - June 1, 2012

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

3.1 Relevance (Rating: [3][5])

3.1.1 Relevance with the Development Plan of Laos

In its fifth Five-Year National Socio-Economic Development Plan (2001 - 2005), Laos regarded the spread of waterworks and the expansion of water service coverage as a priority issue in its socio-economic development, placing great emphasis on water supply and sewerage, as well as other social infrastructure. In the seventh Five-Year National Socio-Economic Development Plan (2011 - 2015), announced in 2010, the country set a target of supplying clean water to 80 percent of its total population as one of its objectives in the economic sector. In 1997, the Ministry of Communication, Transport, Post and Construction produced its Development Plan, declaring a target of achieving a water service coverage of 90 percent on a national average basis by 2020, with 100 percent coverage in large cities and 80 percent coverage in small cities, as a development objective in the water services sector. The Ministry of Public Works and Transport, in its National Urban Development Strategy announced in 2010 and to be approved by the government, has set the target for water service coverage in urban areas in 2020 at 80 percent of the population in these areas, or the 1,950,000 people living in urban districts.

In light of the above, this project is evaluated to be highly relevant to the country's development plan and policy.

3.1.2 Relevance with the Development Needs of Laos

At the time of planning for this project, in 2003, it was estimated that the maximum one-day water demand in Vientiane in 2007 would be about 140,000 cubic meters per day. At that time, the two existing water purification plants in the city had a combined purification capacity[6] of 100,000 cubic meters per day[7], an estimated shortfall of about 40,000 cubic meters water per day. The city saw its demand for water increasing from 2005, with the growing permanent population there, as well as an increasing fluid population, such as workers for private-sector companies and tourists, and the visitors to national sporting events held there. In addition to the two water purification plants for which this project was carried out, the city, having formed a joint venture with a Vietnamese company, was constructing two more plants. It also had a plan to build another plant with capital invested by China.

At the time of planning for this project, the population receiving water supply in Vientiane accounted for only 40 percent of those living in the city, and the remainder depended mainly on wells for water. In such circumstances, this project was conducted as a solution to the forecasted shortfall in the water supply. As Vientiane expected a constantly high level of demand for water, offering the city aid for the development of water supply facilities was highly relevant.

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

[5] [3]: High, [2] Fair, [1] Low

[6] Purification capacity of a purification plant, that is designed taking into account the one-day maximum water demand. Therefore it is larger than the 'amount of water supply per day' that is one-day average water supply volume. The actual one-day average water supply volume in 2003 was 78,000 cubic meters.

[7] The existed purification plants were four namely Kaolieo, Chinaimo, Thadue and Thagone, among which NPVC excludes the capacity of Thadue and Thagone because the operation of these two had been for emergency cases etc.

Table 1: Water supply in Vientiane

	2005	2010	2015 Estimate
Population of Vientiane (persons)	698,318	776,261	902,716
Water supply population (persons)	286,935	404,350	466,981
Water supplied (m^3/day)	120,197	171,807	n.a.
Water service coverage (%)	41	52	52

Source: NPVC data

3.1.3 Relevance with Japan's ODA Policy

In its Programme Implementation Plan effective at the time of planning for this project, the Japan International Cooperation Agency (JICA) referred to the stable supply of safe water as one of its five priority "development issues in the infrastructure and energy sectors." Before the planning for this project, the French Development Agency [8] (L'Agence Française de Développement: AFD; hereinafter referred to as "AFD") and JICA had agreed to divide the roles between them in the provision of aid for the urban water services sector of Laos, with the former expanding water distribution networks in urban areas and the latter rehabilitating and constructing water purification plants.

In light of the above, this project has been highly relevant to the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness (Rating: [3])

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Enhancement of the water supply capacity and the facilities utility rate[9]

Table 2 below shows the water supply capacities of the Kaolieo and Chinaimo Water Purification Plants and their facility usage rates.

As of 2010, after their expansion and repair in this project, the Kaolieo and Chinaimo Water Purification Plants had a water supply capacity of 61,000 and 85,000 cubic meters per day, respectively, and their facility usage rate reached 102 and 106 percent, both going above 100 percent.

[8] As stated before, Japan started in 1963 to provide aid to Vientiane for its water services sector. The city was supported in, among others, the construction and repair of the Kaolieo Water Purification Plant, and the expansion and repair of the Chinaimo Water Purification Plant. When JICA conducted the Study on Vientiane Water Supply Development Project (2003 - 2004), the agency held discussions with AFD, agreeing to divide the roles between them; for the former to repair and construct water purification plants for urban districts and for the latter to help expand the water distribution pipe networks. Based on this agreement, this Project was carried out as a grant aid project for the repair and expansion of the water purification plants.

[9] This is calculated by comparing a facility's planned maximum capacity with the actual amount of water supplied, indicating how efficiently it operates compared to its designed capacity.

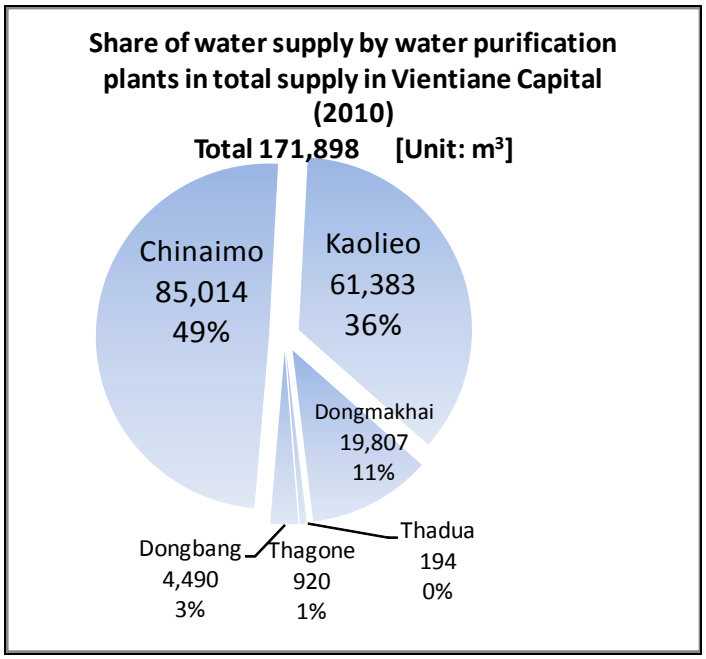
Table 2: Shares of the two water purification plants
in the total amount of water supplied in Vientiane

	2010	Design capacity 2009	Facility usage (%)
Water supplied by Kaolieo plant (m^3/day)	61,383	60,000	102
Water supplied by Chinaimo plant (m^3/day)	85,014	80,000	106
Total water supplied by the two plants (m^3/day)	146,397	140,000	105

Source: Basic Design Study Report and NPVC data

3.2.1.2 Water supply in Vientiane

The figure below shows the amount of water supplied by the two water purification plants and their proportional share of Vientiane's total water supply.



Source: NPVC data

Figure 1: Proportional share of the water purification plants
in Vientiane of the total water supply

In 2010, when this project had been completed, the city supplied 172,000 cubic meters of water per day on average, against the 2009 target of 105,000 cubic meters, achieving 164% of the plan (See Table 3). The background of this high level of the achievement is due to the contribution from the other new water purification plants shown above in Figure 1 (Dongmakhai and Dongbang Water Purification Plants[10]) had started supplying water. Simultaneously the two plants upgraded by this project are responsible for about 85% of the

[10] Dongmakhai was constructed by the Government of Laos, and Dongbang by a joint venture of a Vietnamese company and NPVC are subscribing.

total water supplied (146,000 cubic meters per day as in Figure 1)[11]. This project also raised the city's water service coverage[12] to 52 percent (114 percent of the plan as in Table 3), which is an excellent achievement compared to the plan (45.6% for 2009).

Table 3: Water supply of the entire Vientiane Water Supply Network[13], including the two plants for which this project was carried out

	Baseline 2003	**2010**	**Plan 2009**	Result/Plan (%)
Population of Vientiane (persons)	651,850	776,261	**767,949**	101
Water supply population (persons)	251,549	404,350	**351,329**	115
Water service coverage (%)	39	52	45.6	114
Water supply coverage (%)	47	59	**46**	128
Water supplied (m^3/day)	78,251	171,807	**105,001**	164
Water supplied per capita (liters/person/day)	n.a.	164	**n.a.**	n.a.
Water supply time (hours/person/day)	24	24	**n.a.**	n.a.

Source: Basic Design Study Report and NPVC data

3.2.1.3 Water supply time, pressure, and quality

According to Vientiane Capital Water Supply Company (commonly known as Nampapa Vientiane Capital hereinafter referred to as "NPVC"), the city's public water service corporation, it supplies water around the clock. At a beneficiary survey[14] conducted among users in the water supply areas of the two water purification plants for which this project was carried out (see also "3.2.2 Qualitative Effects"), the users answered that water was supplied around the clock. Therefore, it is considered that there is not any difficulty in supplying water around the clock. However, there seems to remain something to be improved as the water pressure falls to a low level or water is in short supply in the dry season and during peak times for water use, early in the morning and in the evening, for instance.

The two plants annually examine the quality of the water they supply with regard to the test items specified by the Laos national water quality standards[15], and these examinations have

[11] Precisely, the total of Dongmakhai and Dongbang supply 24,300 cubic meters per day (approx. 14%), and the existing Thadue and Thagone for 1,200 cubic meters (approx 2%).

[12] The water service coverage is the ratio of the population served in an administrative district to its total population. The water supply coverage is the ratio of the population served with water in a planned water service area to its total population. For this Project, the former is the ratio of the water supply population in Vientiane to its total population, and the latter is the ratio of population who are supplied with water in the Vientiane Water Supply Network (seven of the city's nine districts) to its population.

[13] The Vientiane Water Supply Network is composed of the seven counties of the city. The remaining two counties are part of the other two small-scale water supply networks, but they have been in service only for one year, and are not covered by the NPVC for its statistics.

[14] The survey was conducted in the water supply area for two of the water purification plants of the city. Business establishments were surveyed with person-to-person interviews, and villages were surveyed with group interviews of user representatives chosen by village chiefs. Samples were selected from among ordinary residents in six villages (n=65, 10 to 13 from each village), and among the managers of nine business establishments, whose businesses are hotels or factories (n=10) (75 samples in total).

[15] The standards include 34 test items which comprise: five physical items (color, turbidity, smell, taste, etc.), 20 chemical items (pH, hardness, calcium, etc.), three bacteria-related items (coliform bacilli, etc.), and six harmful substances (arsenic, mercury, lead, etc.).

proved that the standards are satisfied. Their test laboratories in those plants also examine turbidity, color, pH, and other major test items on a daily basis to confirm that the water satisfies the standards before it is distributed. However, a beneficiary survey (see "3.2.2 Qualitative Effects") revealed that the water became turbid[16] in some areas in the rainy season. As a result, it is understood that safe water is unavailable for some users in the rainy season.

According to the Technical Department of NPVC, the volume of water and/or water pressure fluctuates between time zones not so much because of the amount of water supplied than because in the water supply and distribution facilities, among other issues, some of the branches coming out of the main distribution pipes are too narrow to maintain the water pressure and the water feed pumps installed in some houses prevent the water from going and spreading to the areas around them.

3.2.2 Qualitative Effects

3.2.2.1 Amount of water, and water quality

To capture the effects that this project had produced in terms of its qualitative aspects, a beneficiary survey was conducted among the residents in the districts for which the project was carried out. Table 4 below outlines the findings of the survey. As stated above in Chapter 3.2.1.3, the water pressure falls to a low level or the water is in short supply in the dry season and during peak times for water use, early in the morning and in the evening. Nonetheless, all the respondents said that with the completion of the project, housekeeping, hand-washing, and other tasks in daily life had gotten easier.

Table 4: Findings of a beneficiary survey (summary)

Those surveyed	User awareness
Hotels and factories (Nine establishments)	• Eight of the nine establishments responded that the amount of water supplied and water pressure improved, so that these two factors can be said to be generally in good condition. • Two establishments answered that from 2007 water was supplied for a longer period in the day. • In terms of water quality, seven establishments said they saw no turbid running water, while two had recognized turbidity in the water. • All the nine establishments said the water charges were at an affordable level. Seven of them also answered that the water bill was at an appropriate level, while two responded that it was too high. • As one of the conditions they would consider in buying a site, five of the nine establishments pointed out access to water.

[16] In the beneficiary survey, some respondents from two of the nine business establishments surveyed and three of the six villages reported that the water supplied was sometimes turbid.

Village residents (Six villages)	• Residents in five villages said the amount of water supplied fluctuated according to the season and period of the day, with water short supply in the dry season and in the morning and evening. Those in only one village said there was no problem with the amount of water supplied. • Residents in two villages said the water pressure was sufficient, while those in four responded that the water did not run smoothly, especially in the morning. • In terms of water quality, respondents in three villages mentioned turbidity, mainly in the rainy season, as a problem. Those in five of the six villages pointed out the strong smell of chemicals that they sometimes recognized. • All the respondents in the six villages said that after their houses were connected to water pipes in 2006 and tap water was available, housekeeping and hand-washing became easier. Almost 30 percent of the 65 participants from the six villages said the water charges were too high, but other respondents from all the villages answered that it was affordable.

Source: Beneficiary Survey

3.3 Impact

3.3.1 Intended Impacts

This evaluation study has found no clear relationship between the project and improvements in public hygiene in Vientiane or the growth of its economy. In terms of the economy, despite an increased number of factories located in the city, concerned officers of the NPVC were of the opinion that there was no clear relationship between the economic development of Vientiane and this project. However, interviews with those working for hotels and factories in the city revealed almost 60 percent of the companies had produced a construction plan only after examining the availability of city water and the water supply conditions, a fact which suggests that improved water supply conditions have made an indirect contribution to Vientiane's economy.

3.3.2 Other Impacts

3.3.2.1 Impacts on the natural environment

An Environmental Impact Assessment and an Initial Environmental Examination were conducted as part of the Study on Vientiane Water Supply Development project (2003 - 2004), and it was concluded that the construction of the facilities for this project and operation of the facilities afterwards have no negative impact on the environment. The Ministry of Public Works and Transport says that with no major problem found in the project, no mitigation measure has been taken. Neither is any monitoring carried out. However no negative impact observed at the time of the evaluation.

3.3.2.2 Land Acquisition and Resettlement

The site of the Km6 Booster Pump Station was expanded to upgrade the station, and one household was asked to resettle to acquire its land. The land originally belonged to the NPVC,

but had been used by the family[17]. They, together with the village chief and some other third parties, talked, and agreed that NPVC would pay the necessary relocation cost as a solution. The land acquisition caused no problem as no complaint came from the original land user after they had moved.

Though water pressure falls low in some parts of Vientiane and/or in a specific season of the year, this project has produced greater achievements than planned in terms of amount of water supplied, the population served, and water supply coverage, for which it should be evaluated highly. In particular, the population served by water supply of Vientiane increased by 150,000 thanks largely to two water purification plants for which this project was carried out, and the increase led to a higher water supply coverage, another target of this project.

In light of the above, this project has produced the effects almost as planned, and therefore, its effectiveness is high.

3.4 Efficiency (Rating: [2])

3.4.1 project Outputs

As described later in more detail, the total length of water distribution pipes, one of the project outputs for which Japan was responsible in this project, was shortened by almost 30 percent as some sections of the construction work for the water pipes turned out to overlap with those of an aid project carried out by AFD. Meanwhile, the length of embankment work was extended at the implementation stage, though it had no impact on the effects of the project. In addition, some changes were made in the design as the need for correcting the tender documents arose to add items and specifications that had been omitted in them, among others (described later). Lao side was responsible for the leasing of land for storing machinery and equipment, the relocation of existing facilities, the acquisition of land, construction work for installing the power lines and putting up fences, which were completed as originally planned.

Despite some of the specifications that had been omitted at the tender, almost the same outputs as required in the Basic Design were delivered in the end with changes made in the design during the construction work and supplementary work carried out during the defects liability period. Those construction and supplementary work were done at the expense of the construction consultant. Regarding the main distribution pipe, sections of the pipe construction work that had been removed from this project scope were completed in an aid project carried out by AFD. As a result, it should be concluded that there was no change in the outputs that had an impact on the effects of this project.

[17] According to the NPVC, there are cases where the court recognizes the right of a third party to use land it has been using customary. In this case, the NPVC did not consider that the land had been illegally occupied.

Table 5: Comparison of the outputs (Plan/Results)

Output	Plan	Result
1. Expansion of Kaolieo Plant (Current capacity of 20,000 m^3/day is expanded to 60,000 m^3/day)		
1) Water intake and penstock facilities:	One set of water intake structures (44,000 m^3/day) Water intake pump, embankment construction (66 m)	As planned, except embankment construction (90 m, 24 m added)
2) Water purification facilities:	Facility capacity (40,000 m^3/day) ・Water receiving well; ・Mixing basin; ・Flocculation basin; ・Sedimentation basin and sludge removal equipment; ・Rapid filter, Total filtration flow basin and chloride mixing basin	As planned, except handrails and roofs added
3) Water distribution facilities:	Water distribution facilities (10,600 m^3) ・Distribution reservoir, pump well, distribution pump; ・Chemicals injection equipment	Almost as planned, except buoyancy prevention measures for distribution reservoir
4) Electrical and instrumentation facilities:	Electrical and instrumentation facilities	As planned
5) Development of the main administrative building and others in the premises:	Development of the main administrative building and others in the premises	As planned

2. Repair of Kaolieo plant (Existing capacity: 20,000 m^3/day)		
1) Water intake and penstock facilities:	Repair of the water intake tower, replacement of water intake pumps and the painting of penstocks	As planned
2) Water purification facilities:	・Improvement of the water receiving well (mixing basin); ・Flocculation basin; ・Improvement and repair of the sedimentation basin facilities; ・Change of the filtration method for the filtration basin; ・Improvement of the filtration rate ・Installation of new backwash flow meters;	As planned
3) Water distribution facilities:	・Embankment raising of the opening of the distribution reservoir, installation of additional distribution pipes, replacement of distribution pumps, and the installation of new submersible pumps; ・Chemicals injection equipment	As planned
4) Electrical and instrumentation facilities:	・Replacement and installation of power and control boards; ・Replacement and installation of raw water flow meters and other instrumentation equipment	As planned
5) Main administrative building, etc.	Main administrative building; ・Water quality test laboratory: Removal of existing facilities	As planned
6) Water distribution pipes:	Improvement (replacement) of distribution pipes	As planned

3. Improvement of Chinaimo Water Purification Plant (Existing capacity: 80,000 m^3/day)		
1) Water distribution facilities:	Distribution reservoir and distribution pumps	As planned, except embankment thickness of distribution resrvoirs added
2) Electrical and instrumentation facilities:	・Replacement of power receiving and transformation equipment; ・Instrumentation equipment	As planned, except oil-filled circuit breaker As planned for instrumentation equipment
3) Development of premises	Development of the premises	As planned
4) Supply and distribution pipes:	Separation of the water supplied and distributed, replacement of the supply and distribution pipes, and facilities to cope with water hammer	As planned

Output	Plan	Result
4. Repair of the Km6 Booster Pump Station		
1) Distribution facilities:	Replacement of water distribution pumps and improvement of distribution pipes	As planned
2) Electrical and instrumentation equipment:	Construction of power receiving and transformation equipment, and improvement of instrumentation equipment and the premises	As planned

5. Extension of the water supply and distribution pipes		
Supply and distribution pipes	・Supply pipes: 720 m	As planned
	・Distribution pipes: about 11,915 m	8,615 m (3,300 m reduction)

6. Non-physical components		
Training and instruction	For: employees of the two plants 1) Operation and maintenance 2) Water supply and distribution operation and control	As planned
Deliverables	1) Non-physical component completion report and implementation report ・Non-physical component completion report ・Non-physical component implementation report 2) Manuals, handbooks, etc. ・Water purification plant operation manual ・Operation and control manual	Almost as planned

Source: Basic Design Study Report and JICA's data

Table 6: Major outputs removed or added

Items changed	Removed from the scope	Additions to the scope
1. Kaolieo Water Purification Plant		
Embankment work	–	• Extension of the embankment work (24 km)
Distribution reservoir	–	• Buoyancy prevention
Filter bed	–	• Replacement of the existing filter sand
Flocculation basin, sedimentation basin, and others	–	• Installation of handrails, roofs, etc.
2. Chinaimo Water Purification Plant		
Power facilities	–	• Replacement of parts of the power receiving and transformation equipment
Distribution reservoir	–	• Thicker embankment
3. Extension of the water supply and distribution main pipes		
Length of the water supply and distribution pipes to be extended	Parts that overlapped with an AFD aid project were removed (3,300 m).	–

Source: Project Completion Report, JICA's data

Changes in the plan stated above were made in two stages, at the time of detailed planning and during the construction work, for the reasons given below:

Changes made at the time of the detailed planning

- As stated before, sections of the construction work for laying water distribution pipes that would overlap with a project to be carried out with the aid of AFD, which had remained

unclear at the time of the Basic Design study[18], were canceled. Because AFD's plan was made clear at the time of the Detailed Designing of this project, based on this information the total length of the water distribution pipes was reduced.

- Some parts of the existing power receiving and transformation equipment that had been believed to work at the time of the Basic Design study turned out to have some trouble, and they were replaced.

Changes made during the construction work

- There are two reasons; firstly tender documents produced and approved for the detailed design had some items and specifications omitted from them (installation of handrails and replacement of the filter sand and so on) and some inconsistencies with the basic design. Secondly, as the estimated amount of rainfall and groundwater in the detailed design turned out to be different from the actual conditions at the implementation stage, an embankment had to be added for the Chinaimo distribution reservoir and additional work had to be done for the extension of the embankment of the Kaolieo Water Purification Plant to enable the project to produce the effects as originally planned. These changes were put on the table at a later half of the implementation stage, and as a result a part of the works on embankment of Chinaimo and other minor additions must have been carried out after the project period.

3.4.2 Project Inputs

3.4.2.1 Project Costs

The loan approved amount for this project was 2,875 million Japanese Yen, and Japanese side actually spent the project cost of 2,171 million yen as ODA funds (75 percent of the plan). However, some of the original construction work for this project was carried out by a construction consultant as additional work after the project period, and with the cost for the additional work, or about 21 million yen, included, the actual cost spent to carry out the original plan as was in the Basic Design was 2,192 million yen (76 percent of the plan). The final project cost was even lower than the cost in the revised plan, which was mainly because competitive bidding led to lower price proposals from tenderers.

Lao side was asked to bear 39 million yen of the project costs at the time of planning. The actual project cost that the country expensed was 15 million yen.

3.4.2.2 Project Period

The project period was set at 32 months in the Basic Design study. The actual project period was 34 months, from the conclusion of the Exchange of Notes to the completion of the construction work in March 2009 (two months longer than the plan, or about 105 percent of the planned period) so that it is slightly longer than planned. Some of the construction work sections with some changes made in the design after the work had gotten started went on into

[18] As described before, this Project was implemented with the roles divided between JICA and AFD for their aid projects. However, as of 2004, AFD was still conducting a study of the water distribution pipe network in Vientiane for its project, and planned to choose the target sections after completing the study. This Project was designed in a manner that the minimum necessary length of water distribution pipes would be laid to enable the Project to produce the effects without the AFD aid project. The overlapping sections were canceled at the time of Detailed Design study of the Project.

the defects liability period. The extra work was carried out by a construction consultant with its own expenses and was completed in May 2009.

The reasons why project period was longer than planned were; because delays arose in the construction work for National Road 1, another grant aid project, that overlapped with work for this project in some sections, which required adjustment of the work schedule; and because it took time to coordinate with Laos for the work required to make up for omissions found in the detailed design and for adjustments caused by differing conditions such as amount of rainfall and underground water and changes of the length of the embankment construction work and so on.

In light of the above, the project cost was lower than planned, while the project period was slightly longer than planned, and therefore the efficiency of this project was fair.

3.5 Sustainability (Rating: [2])

3.5.1 Structural Aspects of the Operation and Maintenance

The NPVC, the executing agency of this project, operated and maintained water purification plants and distribution facilities at the time of this ex-post evaluation study as before, and no change was found in its operation and maintenance structure. Neither was there any major organizational change from the time of planning in NPVC structure, including that of the targeted water purification plants, or in its implementation scheme, except that some departments were added and the workforce increased. It was pointed out that the Chinaimo Water Purification Plant needed one more person for operation and maintenance, but NPVC's Administration concluded that the plant could be operated with the current workforce. Actually no major problem in the operation of the plant had been reported. According to NPVC's Human Resource Department, after the Basic Design study had proposed that more meter readers be deployed, it increased the number of readers posted at each branch office from five to eight by the time of this evaluation study. No major problem had been reported in meter reading. The size of its staff is generally appropriate.

Table 8: Operation and maintenance scheme for the water purification plants

(Unit: in persons)

Department	Plan	Result (2011)
NPVC total	Some 320	467
NPVC headquarters total		211
(of which) Administrative (headquarters)		91
Technical (headquarters)		120
7 branch offices total	n.a.	148
Kaolieo Plant total	n.a.	37
(of which) Administrative		5
Technical		32
Chinaimo Plant total	n.a.	35
(of which) Administrative		6
Technical		29
Dongmakhai Plant	-	26
Km6 Booster Pump Station	n.a.	3
Others	n.a.	7

Source: NPVC's data and an interview survey

Note: The number of employees in the table above does not include those working on limited-term contracts.

3.5.2 Technical Aspects of the Operation and Maintenance

This project included non-physical components for training in two subjects: the operation and maintenance of the facilities, and the operation control for water supply and distribution. The field study conducted as part to this ex-post evaluation found that the basic operational data were recorded on a daily basis. Therefore their operation and maintenance was generally good.

Records kept by the plants and station were regularly sent to NPVC's headquarters to compile the necessary data. Records of the facilities operation, such as the amount of water, were kept in specific forms, demonstrating that a system had been established for recording. Their ability to keep records and perform the operation and maintenance were enhanced thanks not only to this project, but also to manuals produced by, and/or with the support of, JICA's senior volunteers and its experts in human resources development for water service corporations. However, though there had been no major trouble found in the operation and maintenance of the water purification plants, there were some problems in preventive maintenance as, for instance, the failure to carry out three-month, six-month, or other regular inspections and the lack of a plan produced for regular inspections in the first place. The fact that the two water purification plants saw their utilization rate staying above 100 percent also indicates that there is a great need for preventive maintenance.

They seem to have sufficient basic skills for the daily work, if not in the nighttime or in an emergency, at least at present, as there is a technical advisor available for repairing pumps who support all the water purification plants in Vientiane for the maintenance of their pumps, and the power company also comes to help them and repair electrical systems whenever necessary.

To help the water supply corporations maintain and enhance their technical expertise, lecturers were trained by AFD as part of its aid program and/or by JICA in its technical cooperation project, so that they would in turn give training to the plant workers. They provided two types of training courses, introductory and refresher classes. Classes to teach basic maintenance techniques are held regularly, which enables new technicians to be trained. Since the water purification plants each have different types of purification systems, thus, the training courses offered after the beginner-level course are aimed mainly at veteran workers so that techniques will be transferred to them through on-the-job based practical training. In general, however, the two plants have only weak schemes for updating manuals and helping their employees to further develop technical expertise in a systematic manner. For instance the aeration valve for water hammer effect in Chinaimo purification plant was unable to restart, and partly due to the transfer of the staff in charge, thus unoperational since a blackout in around 2010.

The NPVC's Technical Department is responsible for measures against non revenue water. With the support of AFD in its project, the department, together with the employees of NPVC's branch offices, work to prevent leakage, examine whether the meters work properly, and repair broken ones. The department has also installed pressure and flow meters at around 25 points on the water distribution pipe network in the city to monitor the flow rate and pressure for detecting any leakage. Despite such efforts, NPVC has not yet succeeded in reducing non revenue water.

3.5.3 Financial Aspects of the Operation and Maintenance

NPVC is operated on a self-supporting accounting system basis. The table below shows the NPVC's financial condition.

Table 9: NPVC's financial condition (last 3 years)

(in million kip; in million yen)

Item	2009	2010	2011	In yen
Revenues				
Water sales	74,701	55,134	61,516	
Other revenues	30,588	14,938	22,992	
Total revenues	105,289	70,072	84,508	857
Expenditures				
Personnel expenses	7,969	9,526	8,971	
Maintenance expenses	64,991	61,840	65,939	
Other expenses	25,832	12,292	19,023	
Total expenditures	98,792	△ 83,658	△ 93,934	△ 952
Balance	6,497	13,586	9,426	96

Source: Answers from NPVC's Financial Department to a questionnaire
Note: The exchange rate was 1 yen = 0.010138 kip (as of November 2011).

The NPVC operated at a deficit in the last two years. In 2011, it made a loss of 96 million yen [19, 20]. Deficits continued mainly because of low water tariff. (For more details, see the next heading.)

In interviews with us, members of the Financial Department said that revenues other than water sales were unlikely to grow fast in the future as they came mainly from connection fees[21], and that, in terms of expenditures, electricity accounted for a large portion of the maintenance costs, about 25 percent in 2011, leaving no prospect of the NPVC improving its financial position with its own revenue sources, at least in the short term.

The NPVC makes up its deficit every year with borrowings it obtains with government guarantees. As of the end of 2011, the NPVC had outstanding debt of 581 million yen on its balance sheet, while its assets were worth 3,815 million yen, enough to avoid its liabilities exceeding its assets. The Department of Improvement of State Enterprises, Ministry of Finance says the government intends to continue giving NPVC financial support as long as it works hard to improve its performance and efficiency. It is unlikely that NPVC will go bankrupt at least in the short or medium term.

3.5.3.1 Water rates

The NPVC is operated on a self-supporting accounting system. It is authorized by law to set a water rate at cost with a five percent markup on this. However, based on the public nature of water services, the Prime Minister's Decree 37 of 1999 requires that the water rate be set within a range that allows low-income families to pay not more than three percent[22] of their income for water and that the water rate be raised only after consultations with the government and obtaining the Parliament's approval. Any actual increase in the water rate is influenced by political factors, and it is difficult for the NPVC to set a water rate exactly in the manner it is authorized to do so by law. The present average water rate is 1,350 kip per cubic meters (2011), less than 70 percent of the actual cost of 1,999 kip, which is the cause of the NPVC's chronic deficit. According to the Financial Department of the NPVC, the water rate was raised in 2009 after two years of work negotiating with the Government and obtaining the Parliament's approval. During the process fuel prices and other production costs rose again, and the NPVC is faced with the need to raise the water rate once more.

Based on these water tariff setting criteria given by law, the water rate could only be raised by 80 kip per cubic meter to 1,470 kip, which is too low to cover the costs. There is no practical way to avoid setting a water rate that is too low, the cause of the deficit-ridden finances.

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[19] The exchange rate was 1 yen = 0.010138 kip (as of November 2011).

[20] Water sales increased in 2009 because water rates were raised only during six months of the year.

[21] After applying for the city water service, a household pays the construction work expenses for installing the water distribution pipes and a meter (about 400 yen, or 35,000 kip, as of 2011) and a connection fee of about 2,200 yen or 200,000 kip.

[22] In accordance with the Prime Minister's Decree 37 of 1999, issued in September that year, water rates in Vientiane were set in a manner that the water fees would amount to no more than three percent of the income of low-income families and no more than five percent of the income of medium to high-income families.

Table 10: Water rate per cubic meter from 2009 (householder and industrial use)

Volume of water used (m^3)	Rate (kip)
<6	500
6 to <21	1,000
21 to <51	1,350
≥51	2,700

Source: NPVC's data
Note: Charged by the cubic meter

3.5.3.2 Non revenue water

In interviews with members of the NPVC's Financial Department, they said non-revenue water also had a great impact on its financial condition. After this project was completed in 2009, the amount of water supplied increased, while the ratio of non revenue water also rose from about 30 percent, the estimate as of 2003, to 34 percent in 2010. Efforts to lower the high non revenue water rate from its level of above 30 percent have been made since the time of planning for this project. For instance, adjustments are made to prevent the water pressure from going too high. The high rate of non revenue water is due mainly to leakage from old water supply pipes. Although the NPVC recognizes that as a fundamental solution to leakage is replacing them, there is no financial resource available for this work.

3.5.3.3 Prospects for a water rate revision and financial support from the government

According to the Department of Improvement of State Enterprises of the Ministry of Finance, a member of the Water Services Regulatory Committee[23], the water rate was discussed at talks on an increase in the water charges[24]. However, the agreement was made that the NPVC is required to develop a long-term business plan and a system for internal business audits as a prerequisite for any water rate increase. The department also says the government will continue to make up the deficits of the NPVC only when it works hard to improve its own efficiency and business performance. The NPVC is required to improve its own management as the first step to making itself financially independent.

In this respect, JICA will start a "Capacity Development Project for Improvement of Management Ability of Water Supply Authorities,"[25] a technical support project, in August 2012 to help the NPVC to be capable of preparing a long-term business plan and strengthen its business audit system. These activities are expected to make NPVC's management more efficient, and help it satisfy the prerequisites for government financial support and a water rate increase in the medium and long-term.

As described above, the NPVC has been in a state of chronic deficit due mainly to a water rate that is set too low and to rising costs. Further pressure on its finances is expected with the

[23] An institution set up to help make public water service corporations and private-sector businesses more efficient through audits of their business.
[24] Discussions in Water Services Regulatory Committee meeting with the presence of NPVC Board of Directors and Water Services Regulatory Committee members
[25] Under one of the project objectives of helping the NPVC, as a pilot water service corporation for this Project, and for water corporations in two other provinces, systems will be developed to enhance their business administrative capacity from the medium to long-term viewpoint, thus the project is aimed at supporting them in preparing a business plan and improving their business indicators. The project period is for five years from August 2012 to July 2017.

investments it is intending to make to construct new water purification plants. Despite the financial support it is likely to receive from the Lao government for the time being, the NPVC has challenges to resolve in its financial sustainability.

3.5.4 Current Status of the Operation and Maintenance

The use and maintenance of the existing facilities and equipment is generally good. They have got through major problems using ad-hoc maintenance measures, for instance when a pump breaks down, they use an outdated spare pump. However without preventive maintenance plans, such as a maintenance plan prepared to cope with old and deteriorating machinery and equipment, and spare parts procured in advance according to a plan, there might be further problems in the medium and long term.

As described above, maintenance for this project has some problems in terms of its structural and technical aspects. In terms of its financial aspects, there is no major difficulty for the time being as its sustainability is guaranteed by the government. However, there is concern about its long-term financial independence. Therefore, the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is aimed at expanding and rehabilitating two of the four existing water purification plants in Vientiane, the Kaolieo and Chinaimo Water Purification Plants, for securing a stable water supply and raising the water supply coverage in the service area there. It is relevant to the development plan and development needs of Laos, as well as Japan's ODA policy. Therefore the relevance of the project is high. After the expansion and rehabilitation of the two water purification plants, the amount of water supplied in the city grew as expected, leading to an increased population served and higher water service coverage. However, the actual project period was slightly longer than planned. Therefore the efficiency of the project was fair. In terms of the sustainability of the project, neither of the two water purification plants have any major problem in terms of their daily operation and maintenance, at least at present. However, there is some concern about their sustainability in the future. From the financial point of view, there are challenges to run on a financially self-supporting as an independent organization having self-supporting accounting system. Therefore, the sustainability of this project is fair.

In light of the above, this project is evaluated to be (B) satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

4.2.1.1 Measures for improvement of the financial aspects

While the NPVC has no discretionary authority to set a water rate despite its status as a state enterprise run on a self-supporting accounting system, it needs to carry out all possible measures to improve its financial condition. As short or medium-term solutions, it is required that

government compensation for the NPVC's deficits due to a water rate that is set low for political reasons, and government financial support to the NPVC for capital investment.

4.2.1.2 Improvement of the water distribution pipe network infrastructure

While this project improved the amount of water supplied and the water supply coverage in Vientiane, it is observed that some branch pipes used to supply the water to households from a major distribution pipe, and some water supply pipe networks still have problems that make it difficult to keep water pressure at the appropriate level in some areas. Water distribution and supply pipes are being replaced with the support of AFD in its project only in places that have a greater need to stop water leaks. Additional work should be carried out so that narrow pipes will also be replaced in sections that are critical for maintaining the appropriate water pressure, as water pressure maintained at an appropriate level will make AFD's aid more effective.

4.2.1.3 Capacity enhancement of the plant employees

Employees working for the two water purification plants have sufficient expertise for daily operation and maintenance work. There were some cases where technical expertise was not handed over between employees, e.g. an air chamber in the Chinaimo Water Purification Plant, when they were transferred. To enable workers to deal with such new types of machinery, the executing agency should have a internal system within the plants in place to raise the level of the skills of the workers. Currently the plants do not carry out preventive maintenance or regular inspection of the equipment regardless of whether there is any trouble. A maintenance plan should be prepared in order to carry out such preventive kind of maintenance work.

4.2.2 Recommendations to JICA

4.2.2.1 Improvement of the NPVC's business

JICA plans to help the NPVC ensure that its management is more efficient through the technical cooperation project that it is providing called "The Project for Management Capacity Enhancement of Water Service Corporations," which is due to start in August 2012. To persuade the Lao government to grant the financial support that NPVC needs to restore its finances, it must develop an internal business audit system and prepare a long-term business plan. With the support of JICA in the program, the NPVC must develop a management system to enable it to set a water rate at the appropriate level, and prepare a business plan including a capital investment plan in order to establish the foundation of any sound business operation.

4.3 Lessons Learned

Regular maintenance is essential to ensure the continuity of any water service. It is crucial to assist the executing agencies to fully understand, using non-physical components, among others, how important preventive maintenance is even when there is no obvious problem.

Timor-Leste

Project for the Development of a Water Supply Service in Same and Ainaro

External Evaluator: Hisamitsu Shimoyama, IC Net Limited

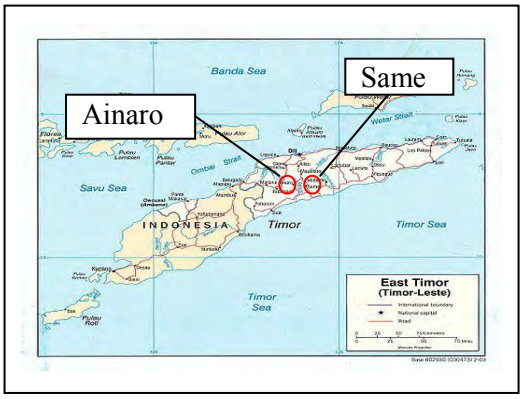
0. Summary

To provide a stable supply of safe water for the residents, this Project repaired, improved, and renewed water purification facilities and intakes in Same and Ainaro. The relevance of this project is high as it was highly consistent with the development plan of the government of Timor-Leste, the ODA policies of Japan, and the development needs at the time of planning. In the course of its implementation, the project was temporarily suspended due to conflicts that had been difficult to foresee, but it was completed as planned as far as the period of suspension is disregarded. The budget was not exceeded over the budget, either. Therefore, the efficiency is also high. However, after the project was completed, chlorination was discontinued in both areas and at the time of this evaluation. In Ainaro, the Nugupo Water Purification Plant supplies treated water only for a limited time of a day, and the river water without treatment is directly supplied as a tap water while the plant does not supply the water. In light of the above, the project has yet to achieve its target of a "stable supply of safe water," as it was planned. In Same, the 24 hour water supply is operated although the chlorination is not resumed. Also, provided 200 saddles were all installed. On the contrary, in Ainaro, water pipes laid in this project have been connected to only 33 households so far, and the utilization rate of the newly laid pipes remains low. As a result, the impact of this project cannot be clearly observed and its effectiveness is low. The sustainability of the project is low from the facts that, despite signs of some improvement in the financial conditions with the increase in the maintenance budget, the National Directorate of Water and Sanitation Services, DNSAS, cannot properly procure necessary materials. There are still many challenges to be solved in terms of the organization and maintenance, including the shortage of workers at the Ainaro Branch Office and the lack of a maintenance plan, which are necessary to sustainably show the functions of the facilities provided.

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

Timor-Leste is a young country, which only past ten years since its independence from Indonesia. In particular after the termination of the Indonesian governance, Timor-Leste has experienced the difficulties in developing the capacities of water works engineers and in acquiring sufficient budget to maintain its water facilities. However, in order to establish the sustainable water works, Department of Public Works prepared Action Plan (2013-2017) which includes rehabilitation of water works, and DNSAS prepared short and medium term action plans. DNSAS recognized the importance to acquire necessary budgets for sustainable supply of safe water, and thus its integrated continuous efforts are highly expected.

1. Project Description



Project Location

Nugupo Water Purification Plant, Ainaro

1.1 Background

The water service facilities in Same and Ainaro was not properly maintained after these facilities were constructed during the Portuguese rule between 1950 and 1974, or Indonesian rule between 1975 and 1995. Also, in 1999, these facilities were seriously damaged by people, and maintenance was no longer sustained due to evacuation of Indonesian water engineers from Timor-Leste. As a result, by the time of its independence in 2002, the existing water service facilities already caused serious troubles to residents, such as water cutoffs resulting from leakage and poor water purification. Also, people often stole water by illegal connections.

In1999 when United Nations Transitional Authority in Timor Leste started its governance after Indonesia left, Japan conducted a "Study for the Project for Urgent Development of Water Supply Systems" to examine water supply facilities in major 15 cities, including Same and Ainaro, as part of its work to support their restoration. Japan also conducted a study of "Support Program for the Reconstruction of Timor-Leste" which recommended the necessary assistances to rehabilitate water supply and sewage system in Timor Leste. Based on the findings of the study, Japan examined contents of assistances for the rehabilitation. In November 2002, the Government of Timor-Leste made a request to the Government of Japan regarding this project. Japan sent two basic design study teams to the country in March 2003 to conduct local field study and in August 2003 for dissemination of the result.

1.2 Project Outline

The objective of this project is to "provide a stable supply of safe water for the residents by improving water supply service in the districts through developing and repairing water service facilities (water intakes, aqueduct, and distribution facilities, etc.) in Same and Ainaro, districts of Timor-Leste"

Since the water quality in Same is relatively good, Same originally does not have a water purification plant. The water supply system in Same is to chlorinate the reserved water in reservoirs. Thus, the Project only develops and repairs water intakes, aqueduct, and reservoir.

Since Nugupo Water Purification Plant in Ainaro, the only one water plant in Ainaro, had a deteriorated function in terms of water treatment, this project renovated sedimentation tank and filter basin in addition to rehabilitation of water intakes and aqueduct.

Table 1: Project Outline

Grant Limit/Actual Grant Amount		1,064 million yen/1,062 million yen
Exchange of Notes Date (Grant Agreement Date)		May, 2005 March, 2007 (extended)
Implementing Agency		Ministry of Infrastructure/Directorate-General of Electricity, Water and Sanitation/National Directorate of Water and Sanitation Services
Project Completion Date		March, 2008
Project contractor	Main Contractor(s)	Dai Nippon Construction
	Consulting	Tokyo Engineering Consultants Co., Ltd.
Basic Design		March, 2003
Related Projects (if any)		[Technical support] Capacity Development Project for the Water Supply System in Dili and four Towns (Ainaro, Same, Liquica and Lospalos) (November, 2008 - March, 2011) [Grant aid] Study for the Project for the Urgent Development of Water Supply Systems (February, 2000 - February, 2001) Support Program for the Reconstruction of Timor-Leste Project for the Improvement of Water Service Facilities in Dili, implemented by UNOPS (June, 2000 - July, 2003; June, 2003 - March, 2004)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisamitsu Shimoyama, IC Net Limited

2.2 Duration of the Evaluation Study

A study was conducted for the evaluation of the project.

Duration of the Study: September 2011 – November 2012

Duration of the Field Study 1st: November 21 - December 22, 2011;
2nd: May 17 - June 1, 2012

2.3 Constraints during the Evaluation Study (if any)

As almost all of the flow meters of the water purification plant, intakes, and reservoirs concerned were decrepit[1]. Thus, information about the amount of water taken in, produced and supplied by the plant was unavailable. The lack of this data, which had been designated as

[1] The flow meter in Hoarula is the only one, which confirmed its operation at the time of the evaluation.

indicators to measure the effectiveness of this project, made it difficult to conduct some quantitative analyses, especially in evaluating its effectiveness.

3. Results of the Evaluation (Overall Rating: D[2])

3.1 Relevance (Rating: [3][3])

3.1.1 Relevance to the Development Plan of Timor-Leste

Timor-Leste's National Development Plan (2002/2003-2006/2007), mentioned the sustainable supply of sufficient safe water in urban areas, including Same and Ainaro, as one of its objectives. The development plan set two targets: (1) supply of safe water through pipe networks to 80 percent of the urban population[4]; and (2) the installation of safe small-scaled water-supply systems for 80 percent of the community population[5]. This project was helpful mainly in achieving the Target (1). At the time of planning of this project, the water supply rate was merely 27 and 66 percent at Same and Ainaro, respectively, which was far below the Target (1). The Secretary of State of Timor-Leste emphasized that the country would focus on development of water services in 2012 according to the interview with DNSAS at the time of the evaluation. As a result, the development of water service remains a priority policy for the country through the period from the planning to this evaluation.

3.1.2 Relevance to the Development Needs of Timor-Leste

At the time of the planning process in 2004, Same and Ainaro faced a wide variety of challenges to be resolved in providing water services, such as the underdeveloped organization and legislation that are related to water supply in DNSAS, poor equipment and the logging of its use, the aging of the facilities, and deteriorated distribution pipes caused by inadequate maintenance arrangements, and a lack of log books. In Same, the insufficient capacity for water taken in and the large amount of water leaking or being stolen from the distribution pipes arose, which resulted in a failure to supply sufficient water. In Ainaro, the aging Nugupo Water Purification Plant, its only purification plant, and aged distribution networks failed to work properly. Furthermore, the evacuation of Indonesian water engineers at the end of Indonesian governance contributed to leaving the town short of safe water. Therefore, at the time of planning, development needs for improvement of water supply systems in Same and Ainaro were high.

3.1.3 Relevance to Japan's ODA Policy

In 1999, when Timor-Leste's independence from Indonesia was in view, a Donors' Meeting for East Timor was held in Tokyo and Japan initiated offering aid to the country followed by other foreign governments. In 2000, JICA conducted the "Study for the Project for the Urgent Development of Water Supply Systems", and surveyed rehabilitation assistances for water facilities in major cities including Same and Ainaro. Japan's Timor-Leste aid program for FY2002, when Timor-Leste became independent, mentioned that water service is one of the priority areas in its ODA for the country. Therefore, the project is highly relevant to Japan's ODA policy.

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[2] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory
[3] [3]: High; [2] Fair; [1] Low
[4] The urban population is the population in district capitals including Same, Ainaro and other specified towns.
[5] Community population is the population where is outside district capitals.

In light of the above, this project has been highly relevant to the country's development plan, development needs, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Effectiveness[6] (Rating: [1])

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Operation and Effect Indicators

(1) Same

Information on the operation and effect indicators could not be obtained because the Same Branch Office of the DNSAS, failed to record measurements, such as the amount of water taken in and distributed, and water quality. As part of this project, water intake stations and reservoirs were equipped with flow meters. However, the Same branch neglected to keep quantitative records due to poor supervision of the workers and the lack of the means of transport for the workers to go to read the meters. This made a quantitative assessment impossible. Qualitative indicators for assessing effectiveness of this project - the level of stability in water withdrawal, and the state of sterilization with chlorine for controlling water quality - will be described in 3.2.2.

(2) Ainaro

Just as in the case of Same, information on the operation and effect indicators was unavailable as the Ainaro Branch Office of DNSAS failed to record measurements, such as the amount of water taken in and distributed, and water quality. However, with regard to the Nugupo Purification Plant, the operating hours and the amount of water purified will be described below based on information obtained through interviews with employees at the branch office. Qualitative indicators for assessing the effectiveness of this project - the state of sterilization with chlorine for controlling water quality at the Nugupo Purification Plant and the effects of the repair of its aquaduct - will also be described in 3.2.2.

Before the project, Ainaro's Nugupo Purification Plant was left with aging equipment and facilities, and at the time of planning, its water purification system had ceased to work. It was expected that once the project was completed, the plant would operate 24 hours a day. However, according to interviews with members of the DNSAS, the plant lost the accesses to the external electric source due to the troubles that DNSAS did not pay connection fees and water charge. In addition, there emerged other problems, such as, delays in the delivery of generator fuel, and a lack of workers to operate the plant during the nighttime[7]. Thus, the plant supplied the water only for ten hours in the daytime even as of October 2011, when the evaluation started. Before October 2011, DNSAS mobilized neighboring residents and the staffs at the plant cleaned the sand in the slow filtering system with helps of these residents. However, due to delays in disbursement of the maintenance budget, the branch office had to stop mobilizing these neighbors. Specifically, staffs boycotted cleaning sands due to its heavy labors after the stoppage although the staffs are supposed to clean it only by themselves. Between November and December 2011, the plant stopped working due to this maintenance problem. Since it seems that the staffs in the Same office misunderstood cleaning procedures, the staffs experienced unnecessarily hard labors. As a result, these staffs disfavored cleaning duties.

[6] The sub-rating for Effectiveness is to be put with the consideration of Impact.

[7] The short and medium term action plans prepared by DNSAS indicate the increases of operational staffs in the water treatment plant.

With the increased maintenance budget, from 500 USD to 1,000 USD per month, from January 2012, it started mobilizing those residents in neighboring communities to resume cleaning the sand. Nevertheless, even after January the plant still needed to stop operating for one or two weeks a month to wash the sand, leaving only two or three weeks per month for the plant to work. Besides cleaning methods, there is the problem that the gate valves at the filtering ponds were clogged due to a coagulation of calcium. Thus the staffs experienced difficulty in opening and closing the valves. This clogging issue contributed to prolonging time for cleaning sands.

Table 2: Operating Hours and the Amount of Water Purified in Ainaro at the Time of the Ex-Post Evaluation

Name	Plan/Actual results	Nugupo Plant
Operating hours*	Plan	24 hours/day
	Operating period/month	2 - 3 weeks
	Actual operating hours/ day	10 hours/day
	% to plan/month	19 - 29%
Amount of water purified	Plan	36,000 m^3/month
	Operating period/ month	2 - 3 weeks
	Actual amount	6,840 - 10,440 m^3/month
	% to plan/month	19 - 29%

Source: Summary of findings from the field survey by the External Evaluator

* According to interviews at the Ainaro branch office, in the months with two or three weeks of operation, the plant was in operation for ten hours per day.

In Ainaro, river water is distributed to the users without purification while the plant does not distribute the purified water. The town is still unable to offer a 24-hour supply of safe water after all the project work done.

3.2.2 Qualitative Effects

3.2.2.1 Qualitative effects expected at the time of planning

(1) Same

Same has no water purification plant because the town can withdraw raw water that is of relatively good quality. Once withdrawn from two rivers, the water is stored in two reservoirs before being sterilized with chlorine and then distributed. This project improved the intakes of the town's water supply system through replacing pipes in intakes and deepening the pipes laid. At the time of planning, the performance of the intakes was so poor that the amount of water withdrawn from the rivers was greatly affected by changes in the flow between the dry and the rainy seasons. After the implementation of this project, improved intakes exhibited better performance in water withdrawal, and the newly constructed reservoirs hold water in the intakes for a longer time, which also helps improve the water distribution performance.

Though quantitative data was unavailable, none of the 20 respondents among the people living in communities in Same, which were selected for a the simplified beneficiary study conducted during this evaluation study, said that the water supply was limited. But, the exception is the period when the branch office temporarily closes the valve of the intakes and limits water supplied during times of high turbidity at the rainy season. In interviews with members of the Same branch office, they said the town became able to withdraw a sufficient amount of water and that no complaints had been made by the residents. Based on these findings, Same withdraws a sufficient amount of water and offers a 24-hour water supply.

As for water quality, Same, with no purification plant in the town, has equipment installed at its reservoirs to inject chlorine and sterilize the raw water. However, the equipment has been left unused since 2010 as the workers there neglected to operate it. Asked the reason for this in the interviews, the workers of the Same branch office pointed out the lack of supervision whether the workers sterilize the water and of a means of transport in resulting a limitation of move for the staffs as major factors.

Coliform and other bacteriological examinations were not practiced and no data was available. The branch office explained that these test items were not found in the form, it submits to the DNSAS to report the results of water quality inspections. The instruments they use to count the bacteria are powered by electricity. However, until 2011, electricity had been available only during the night time every other day. Thus, it was impossible to keep the instruments ready for use all through the business hours[8]. In conclusion, without sterilization with chemicals, there should be no differences in the number of general and coliform bacteria contained in the tap water from that counted in the raw water.

In light of the above, the amount of water withdrawn and supplied in Same is sufficient, while, in terms of water quality, sterilization yet to be performed as planned. Therefore, the "supply of safe water" is not achieved there.

(2) Ainaro

At the time of planning of this project, the Nugupo Water Purification Plant, with no sedimentation basin or filter bed, was poor in terms of performance and was unable to treat highly turbid raw water. With the implementation of this project, the purification plant has been equipped with a sedimentation basin and a slow filtration system, which enables the plant to deal with more turbid water than it could before the project. However, while the plant stops the distribution of treated water, river water is distributed without any treatment. According to the interview with the staffs at the plant, given that the plant operates for two or three weeks in a month as shown in the table 2, working for ten hours a day, its working ratio is between 19 to 29 percent in a month. It distributes unpurified water for some period of time between 71 and 81 percent of any month.

[8] In 2012, power conditions improved both in Same and Ainaro, and electricity is now available between 6:00 p.m. and 6:00 a.m. in urban districts. However, the power supply is still cut off during the daytime.

In terms of quality, the Nugupo Water Purification Plant treats water to reduce its turbidity but provides no sterilization. This is because the plant has no accesses to external power[9], and the delivery of fuel to run its generator is often delayed, with its machines to inject chlorine left idle. The similar problems as in the case of Same ― misunderstandings among the plant workers and a shortage of power, which prevents its equipment from counting coliform and other bacteria.

The Nugupo Water Purification Plant led water into it through the drains which laid in ground, coated in ground and sides by concretes, and used covers on top to prevent the water from being contaminated before the project was implemented. The drains constituted a channel to supply raw water from the intakes to the plant. However, some of the covers were left broken, and in the rainy season, extraneous materials, such as animal excrement and mud, went into the drains, which was a serious problem. With the implementation of this project, these drains have been replaced by conduits, which prevent such contaminants from getting into the water and helps improve the water quality.

(3) Technical components

1) Technical transfer for the planning of water supply pipeline construction (Common to Same and Ainaro)

This training aimed at improving the capacity of maintenance for existing water supply pipelines and targeted directors of the two branches. The original training plan set three goals: (1) plans for the water supply pipeline construction would be completed, and that construction would be ready to start; (2) the current state of water distribution and supply pipes would be checked to make their management easier; and (3) the capacity for planning water distribution and supply systems would be enhanced. At the time of this evaluation, however, no map of the existing pipelines were produced, with the overall picture left unknown. Interviews with several participants of the training revealed that none of what they had learned in the training being effectively used in their work. This is because, although these directors obtained relevant knowledge to some extent through the training, these directors did not have the staffs who can work under them to follow the instructions.

2) Technical transfer for preparing customer files (Common to Same and Ainaro)

As part of this project, a plan was formed to give guidance on how to produce customer files as preparation for collecting water charges in future. Expected training outcomes were: (1) the preparation of customer files as a way to monitor the state of the water supply and (2) the production of files useful for the effective implementation of the collection of water charges. However, interviews to the participants from the Same and Ainaro branch offices revealed that they produced no customer files based on the techniques they learned in the training. Due to the political situation in Timor-Leste, which will be described below in the sustainability section, the branch offices had failed to start collecting water charges up to this evaluation. As a result, it was not possible to confirm any impacts achieved by this training.

[9] The electrical company charge a connection fee when DNSAS connect its incoming panel to the lines, which are owned by the company. However, since DNSAS did not pay the connection fee resulting in the trouble, the external power remains unconnected.

3) Technical transfer for water quality analysis (Common to Same and Ainaro)

At the time of planning, no water quality tests were being conducted. Technical guidance was offered for the staffs in water quality control division and ones in the water purification plant to introduce the minimum level of measuring techniques they would need to examine the water quality. Objectives of the training were: (1) increasing the awareness for the necessity of water quality tests; (2) acquisition of the minimum level of techniques needed for testing the water quality; and (3) increasing a level of understanding for safe water and establishing of the minimum necessary monitoring scheme.

At the time of the evaluation, though not perfectly, the Nugupo Water Purification Plant in Ainaro conducted inspections of the items specified by the DNSAS regarding what purification plants should examine, such as turbidity, pH value, water temperature, and residual chlorine on a regular basis, using the tools they had been granted[10]. Therefore, that the techniques transferred through the training are used in an effective manner.

In Same, however, tests of water quality are rarely examined due to negligence by the workers and insufficient transportation modes from the branch office to water intakes and reservoirs, and thus very few records are kept. As a result, it is impossible to conclude that the transferred techniques through the training are properly used.

4) Lectures on the slow filtration system and maintenance (only for Ainaro)

The lectures were given to three workers at the Nugupo Water Purification Plant in Ainaro to allow them to carry out appropriate maintenance on a slow filtration system installed in the plant. The training was conducted for two days. Specifically, they learned maintenance planning and the methodologies they would need to take care of its filter beds. As mentioned above, the workers at the plant disfavored this cleaning process as they wrongly believed too much labor was needed for cleaning the sand in the slow filtration system to maintain it. The method of maintenance originally planned was that all they had to do is to remove the sediment on the surface of the sand for every 20 to 40 days. However, they wrongly believed they needed to take all the sand out of the filter beds to wash it, before bringing it back into the beds. Therefore, that the appropriate effects by the training are yet to be realized.[11]

3.3 Impact

3.3.1 Intended Impacts

This evaluation study conducted a simple beneficiary survey in order to verify reduction of time needed to get water, outbreak of water-borne diseases, and utilization of new pipes laid in this project. The number of samples was 57, including 20 in Same and 37 in Ainaro for the first

[10] As aforementioned, the branch office does not use equipment to count general and coliform bacteria due to a lack of electrical supply, and thus they are not counted.

[11] According to the interview to the workers of the plant in December 2011, the evaluator heard that they followed the procedure described, and determined that these staffs did not properly follow the instructions given by the training for at least four years after completion of this project. However, at the second visit in June 2012, the director of the branch in Ainaro answered that the proper procedures and methods to clean the sands in a filter although the evaluator could not observe if those staffs actually follow the instructions. Thus, it seems the branch office improved the cleaning procedures by June 2012.

visits. These beneficiaries live along with distribution pipes. In the second visit, 56 samples were randomly selected and interviewed with the questionnaire only in Ainaro.

(1) Reduction of time needed to get water

In Same, the study demonstrated that this project improved water distribution conditions in the town, which enabled families to spend less time in getting water than when they had to go to a river or a spring to fetch water. The study has also revealed that any member of a family can be a person to get water, and that it is wrong to consider that women and children are primarily responsible for this work. Therefore, the study confirmed that this benefit even reached to adult males.

(2) Outbreaks of water-borne diseases

In interviews with two directors of the largest hospitals in both districts respectively, they could not identify any causal relations between tap water and outbreaks of water-borne diseases. Moreover, the director in the branch office of Same also mentioned no such causal relations.

On the contrary, the Ainaro branch office concerned that tap water might cause some water-borne diseases, and asked the district's Health Bureau to examine whether there were such causal relations and any outbreaks of water-borne diseases. However no progress is observed in this examination, leaving unclear whether there is such relations.

(3) Utilization of the new pipes laid in this project

In Ainaro, the distribution pipes were also replaced. It is a fact that even those who still connect the water supply pipes laid in the period of Indonesian governance found the benefits of this project, because water supply was improved by the rehabilitation of the plant. However, only a small number of households have been connected to the new pipes. As of May 2012, when the beneficiary survey was conducted, the Ainaro branch office recognized only 33 households that were connected to the new pipes[12]. In the second beneficiary study conducted in May 2012 with 56 households living in its urban area, 68 percent of the respondents (38 families[13]) answered that they were not connected to the new pipes. Among the remaining 32 percent of the respondents (18 families), who answered they had not been connected to the new pipes, 67 percent (12 families) said their house was too far away from the new pipes to be connected to them, while 22 percent (four families) answered they hesitated to pay the connection charge of 55 USD.

In this project, the Timol side is responsible for connecting distribution pipes to users' houses. Technically, the DNSAS is responsible for plumbing maximum of six meters of a water distribution pipe to a house. On the contrary, plumbing work beyond this range, if necessary, must be carried out by the users in principle. Partly because few plumbing materials are locally available, the work to connect households to the new pipes is delayed.

[12] Action Plan (2013-2017) prepared by Department of Public Works includes the ideas, such as, to improve the situation of connecting newly laid pipes by this project.

[13] 38 households answered that they had been connected to the pipes laid by JICA, a larger number of families than the 33 households recognized by the Ainaro Branch Office, since for each household connected to a pipe there were several neighbors who had unlawfully laid a branch pipe between their house and the pipe in order to connect without registration.

In Same, as many as 200 households have been connected to the new pipes. In this project, 200 ferrules with a saddle[14] were distributed and nearly all of them are in use. In May 2012, when the evaluation was being conducted, about another 900 households requested to connect to the pipes. The Timol side is responsible for procuring the ferrules exceeding 200, which were originally provided by Japan in this project. However, this connection work does not catch up the growing needs of the local residents.

3.3.2 Other Impacts

(1) Impacts on the natural environment

As this project was designed to repair existing facilities, it was not expected to occur any negative impacts to natural environment. At the time of this evaluation, the no impacts on the natural environment were observed.

(2) Land Acquisition and Resettlement

Since this project mainly repaired existing facilities, and laid new water supply pipes along the public roads, the project required no land acquisition or resettlement of residents without their agreements.

This project achieved its objectives at a limited level. Therefore its effectiveness and impact is low.

3.4 Efficiency (Rating: [3])

3.4.1 Project Outputs

The project was completed with the outputs mostly as planned.

Hoalula Reservoir, Same

Nugupo Water Purification Plant, Ainaro

[14] A type of joint used to connect a distribution pipe laid in an urban district with a service pipe leading to an end user.

Table 3: Comparison between the Planned and the Actual Outputs

Plan	Actual results
(1) Outputs 1) Same [1] Merupachi (Amount of water taken: 560 m^3/day) Intake station: Infiltration gallery (new): 1 Distribution station: Reservoir (addition): 1 (with partitions); Flow meter (new): 1; Sterilizer (new): 1 unit [2] Darelau (Amount of water taken: 864 m^3/day) Intake station: Intake crib (repair): 1; Penstock: Penstock (new): 1; Distribution station: Reservoir (addition): 1 (with partitions); Flow meter (new): 1; Sterilizer (new): 1 unit [3] Kotalala (Amount of water taken: 130 m^3/day) Intake station: Sterilizer (new): 1 unit; Penstock: (new): 1; Distribution station: Flow meter (new): 2 [4] Same Water Distribution District Distribution pipe extension: 15.5 km	(1) Outputs 1) Same [1] Merupachi (As planned) Intake station: As planned; Distribution station: As planned (However, the sterilizer has been out of use since the evaluation.) [2] Darelau (As planned) Intake station: As planned; Penstock: As planned; Distribution station: As planned (However, the sterilizer has been out of use since the evaluation.) [3] Kotalala (As planned) Intake station: As planned (However, the sterilizer has been out of use since the evaluation.) Penstock: As planned; Distribution station: Flow meter (new): 1 [4] Same Water Distribution District Distribution pipe extension: As planned; • Water pipe bridge: 2; • Shared faucet: 32 • Shared faucet (repair): 15

2) Ainaro [1] Nugupo Water Purification Plant Intake station (Sarai: Amount of water taken: 1,200 m^3/day): Broken weir (repair): 1 unit; Intake (new): 1; Penstock: Penstock: 1; Purification station: Ordinary sedimentation basin (modified slow filtration bed): 2; Slow filtration bed (new): 4; Reservoir (addition): 1 (with partitions); Office building (new): 1; Manager's house (new): 1; Facilities: Sterilizer (new): 1 unit; Power incoming unit: 1 unit; Power distributor (new): 1 unit; Monitoring equipment (new): 1 unit; Power generator (new): 1 3) Ainaro Water Distribution District [1] Distribution pipe extension: 8.3 km 4) Provision of equipment [1] Same • Water quality analysis kits: 1; • Ferrules with a saddle: 190; • Mortising machines: 2 [2] Ainaro • Water quality analysis kits: 1; • Ferrules with a saddle: 190; • Mortising machines: 2 (Spare bit: 8)	2) Ainaro [1] Nugupo Water Purification Plant Intake station (Sarai: Amount of water taken: 1,200 m^3/day): As planned; Penstock: As planned; Ordinary sedimentation basin: As planned; Slow filtration bed: As planned (Out of operation at the time of the evaluation); Reservoir: As planned; Office building: As planned; Other facilities: As planned 3) Ainaro Water Distribution District [1] Distribution pipe extension: As planned (However, there are as few as 33 households connected.) • Water pipe bridge: 8; • Shared faucet: 2; • Shared faucet (repair): 18 4) Provision of equipment Common to [1] & [2] left • Water quality analysis kits: As planned; • Ferrules with a saddle: As planned; • Mortising machines: As planned

5) Non-physical components [1] Technical guidance for the planning of water supply pipeline construction/Technical guidance for preparing customer files; [2] Technical guidance for enhancing the skills for water quality analysis; [3] Lectures on the slow filtration system and its maintenance (The basic design study has no information on inputs, etc.)	5) Non-physical components All implemented as planned. [1] Technical guidance for the planning of water supply pipeline construction/Technical guidance for preparing customer files (1.3 months from November 2006; Given by three Japanese consultants); [2] Technical guidance for enhancing the skills for water quality analysis (1.0 month from January 2008; Given by one Japanese consultant); [3] Lectures on the slow filtration system and maintenance (0.5 months from November 2007; Given by one Japanese consultant)

3.4.2 Project Inputs

3.4.2.1 Project Cost

At the time of planning of this project, the grant limit was set at 1,064 million Japanese yen. After several alterations to the contracts, the project was completed with an actual project cost of 1,062 million Japanese yen, 99.8 percent of the plan. The project costs were thus within the planned.

A major change from the original plan was the temporary suspension of construction work amid a conflict in May 2006 with evacuation of the Japanese experts in compliance with an order from the Japanese embassy. Extraordinary expenses of 19 million yen during the suspension and for the resumption of the construction work were added to the project costs. Since the contract amount before evacuation was 1,043 million Japanese yen, this add made the contract amount to 1,062 million Japanese yen.

The Timor-Leste's side obtained the lands, and procured the gates and fences of rehabilitated water facilities as their outputs. On the contrary, at the time of the evaluation, Nugupo water purification plant was not connected to external electrical sources yet. The amount of expenses borne by Timor-Leste was not confirmed as the necessary data was not prepared.

3.4.2.2 Project Period

The project period was estimated to be 29 months, from May 2004, the month of the exchange of notes, to September 2007. Actually the project was started in May 2004 and finished in March 2008 after 35 months, 120.7 percent of the plan. The project period was prolonged because construction work was temporarily suspended amid a conflict in June 2006 with the evacuation of Japanese experts in compliance with an order from the Japanese embassy. This considerable delay in the work period is not considered as a factor that has decreased the efficiency of the project. This is because the suspension of the construction work caused by the conflict is regarded as an unforeseeable and unavoidable accident. In short, the suspended 12 months are not regarded as construction period, and thus actual period is 23 months, which is 79

percent of the plan. Extra efforts by the project stakeholders especially after the suspension contributed to shortening the period for 6 months. Therefore, the project period is considered to be within the planned.

As stated above, the project cost was lower than planned. The project period was longer than planned, but this alteration was reasonable because it was the result of an action in response to the conflict, an unforeseeable factor. Therefore, the efficiency of the project is high.

3.5 Sustainability (Rating: [1])

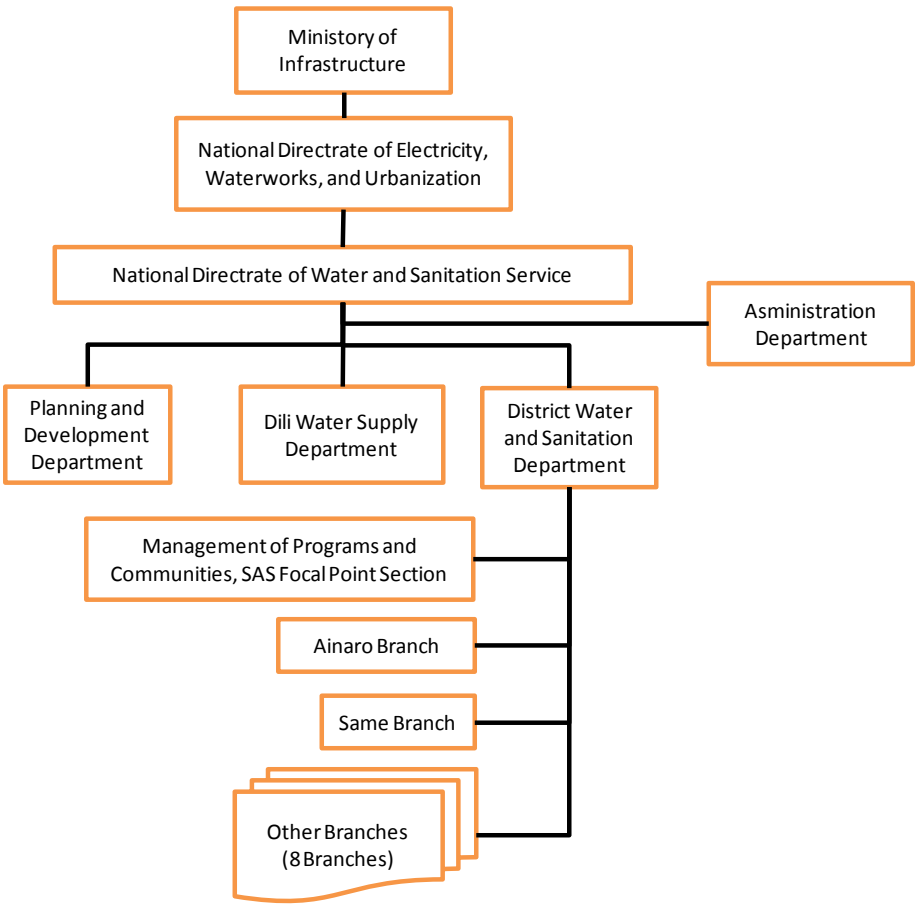

Figure 1 Institutional Chart of DNSAS （At the time of the ex-post evaluation）

3.5.1 Structural Aspects of Operation and Maintenance

(1) The Same and Ainaro branch offices both belong to the District Water Service Operation Management Department, DNSAS. DNSAS is composed by four departments: Planning and Development, Dili Water Supply, District Water and Sanitation, and Administration. The institutional chart is shown in Figure 1. At the time of planning, responsibility demarcation between DNSAS headquarters and the branches were unclear and partially neither was the division of responsibility assignments. JICA's technical cooperation project, which was conducted from 2008 to 2011, prepared the draft demarcation plan, which helped these issues reorganize.

According to the job description, DNSAS has many authorities of budget management of branches, payment of consumables for water treatment and materials to supply water, and salaries of staffs. On the contrary, the branches are responsible for operation and maintenance of water facilities in covered areas, customer services including connection of water supply pipes and any relevant trouble shooting. However, according to the interview with both branches, there are many problems. A budget for operation and maintenance, these consumables, and necessary materials are often delayed in delivering. Also, the engineers in DNSAS never visited at branches to instruct maintenance of water facilities.

(2) The Same branch office, operated with five employees at the time of planning, increased to 11 members, six more than before, when the evaluation was conducted. The materials from JICA suggested that the branch office should have three more employees, a total of eight. In the end, the branch office was staffed with three more workers than in the plan. A more than satisfactory number of employees is allocated.

On the contrary, the Ainaro branch office was operated with six employees at the time of planning. The materials from JICA suggested the branch office have nine more employees, a total of 15. By the time of the evaluation, however, it allowed only six additional employees, staffed with a total of 12 members.

The Same Branch Office was staffed with a sufficient number of employees. On the contrary, the Ainaro branch office is still understaffed to operate the Nugupo Water Purification Plant for 24 hours and to allot for rural water services in neighboring areas[15] that the Ainaro branch covers. However, local branches have only limited human resources, and adjust the distribution of duties between the workers in a flexible manner whenever necessary to carry out the work.

3.5.2 Technical Aspects of the Operation and Maintenance

(1) According to the final report of the "Capacity Development Project for Water Supply System in Dili and four Towns," produced in 2011, it seems unlikely that the necessary techniques had been properly transferred at the completion of this grant aid project. This conclusion comes mainly from the poor understanding of the workers at the water purification plant about its operation and the lack of opportunities for them to take part in training to enhance their abilities. The facilities granted in the grant aid project were not used as originally planned under its design, as seen in the fact that Same had long supplied unsterilized water. In Ainaro, the Nugupo Water Purification Plant failed to operate its facility in the correct way to wash the sand in its slow filtration system with the appropriate manner, which resulted in a shutdown of the plant. These cases demonstrate that the workers there lacked a proper understanding of the techniques they needed. In particular, about the washing methods, the proper understanding by the staffs in the plant will contribute to improving the current situation that the plant shuts down to wash the sands for one to two weeks every month[16].

[15] The Ainaro branch office plans to allot its engineers to Maubisse, Hato Buliko, and Hato Hudo. But, the branch has not sent them at the time of evaluation.

[16] In December 2011, the External Evaluator interviewed all the staff members of the Nugupo water treatment plant in the Ainaro branch about the sand washing methods in the slow filtering system. Although they had been instructed to clean only the top portion of the sand, i.e., from the surface to the depth of about 3 cm, they said that they scraped and washed all the sand in the filtering system. Therefore, the External Evaluator concluded that the staff members did not understand the washing methods correctly. However, the comments from DNSAS, the implementing agency,

(2) The manuals produced as part of this project were distributed, but also found that they were rarely referred to either in Same or Ainaro. In the interviews, the workers said the manuals were not used mainly because they did not understand English. As a part of the Capacity Development Project for the Water Supply System in Dili and four Towns, simplified manuals were produced in Indonesian for the workers at the plant. However, according to the interview with three workers in the Nugupo water plant, they said that these manuals were rarely referred in their daily works. This is because these workers hardly understand the contents of the manuals. Therefore, it was not observed that the manuals were used in an effective way.

(3) According to the interviews with JICA Timor office and DNSAS, the people who spent their youth under the rule of Indonesia were deprived of opportunities to have normal education amid the conflicts of those days. As a result, DNSAS sometimes faced difficulty in sustaining the trained skills among some of these workers. In addition, for most of the ten years since the country's independence in 2002, both the agency and the society have been in disorder and could not afford to make sufficient capacity development of the youth. It seems that these background factors prevented the agency from improving the operation and maintenance skills of its workers when it had hoped to.

3.5.3 Financial Aspects of Operation and Maintenance

(1) The Table 4 shows the cash income of both Same and Ainaro branch offices. They are fully financed by the DNSAS. Same and Ainaro have had the amount of their maintenance and personnel budgets raised to 336 and 270 percent of the level at the time of planning, respectively. In particular, in January 2012, their maintenance budget was raised from 500 USD per month to 1,000 USD per month. In interviews, members of the branch offices mentioned that they can clean the facilities more than before by mobilizing local residents. On the contrary, the branch offices still have many difficulties in their operation, such as the scarcity of financial resources to pay allowances to the workers when they have to work overtime[17], because they are not allowed to use the maintenance budget to pay for these expenses, which are budgetary issues to be addressed. In addition to the issues of maintenance budgets and salaries, there are still many problems in operation. Some materials are provided instead of paid by cash. The fuels for the motorcycles and generator, spare parts, chemicals for sterilization, and etc are scares in general due to logistic problems of the DNSAS.

state that the staff members understood the washing methods properly. This differs from what the External Evaluator learned in the interviews with the staff members.

[17] Although DNSAS could not allocate the sufficient budget for the consecutive two years from 2010, DNSAS plans reallocating the sufficient budget for maintenance in 2012.

Table 4: Budget of the Same and Ainaro Branch Offices

(USD per year)

Item	Region	At planning	At ex-post evaluation
Maintenance	Same	3,000	12,000
	Ainaro	3,000	12,000
Personnel	Same	5,916	18,000
	Ainaro	7,392	16,008
Total	Same	8,916	30,000
	Ainaro	10,392	28,008
% to plan	Same	336%	
	Ainaro	270%	

Source: Summary of the findings from interviews in the field study by the External Evaluator

The Director of the Administration answered that it would be quite difficult to improve these financial problems. It is likely that they will start collecting water charges in the medium- to long-term. However, these collected fees will go to the national treasury anyways. Even if they start the fee collection, it is unlikely that these fees become own financial resources.

3.5.4 Current Status of Operation and Maintenance

(1) Neither Same nor Ainaro conducts maintenance in an appropriate manner at the time of the evaluation. Neither of the offices has any maintenance plan for their equipment or facilities. Maintenance fully depends on the voluntary activities of the workers in charge. These branch offices neither have records of operations nor of water production. If the information is not properly gathered, it will become a serious hindrance to prepare maintenance plan in the future. To improve such a situation, in principle, the District Water and Sanitation Department in DNSAS should instruct preparing the maintenance and operation plans. Nevertheless, since it was not observed that these instructions were conducted in these branches, the solutions are not provided.

The Ainaro branch office asked the DNSAS, regarding the Nugupo Water Purification Plant observing some troubles with its equipment, to replace broken parts and fix the trouble in monthly reports. However, no repairers have come so far and the trouble has been left unresolved. DNSAS does not provide technical assistance properly clean the sand in its slow filtration bed. In interviews with members of the DNSAS in Dili, they explained that the directorate had difficulty in sending repairers to the plant because it had trouble in identifying the parts needed for the repair and securing the budget to send its employees to the plant.

The Nugupo Water Purification Plant in Ainaro needs electricity to inject chlorine into the water, but the plant has no external power supplied because of a trouble with the electric company as aforementioned. As a result, the plant cannot currently inject chlorine. The DNSAS explained that the power supply to the external source would be resumed soon, and thus the progress should be continuously monitored. Even the original plan was designed on the basis

that during the daytime an in-house power generator would be run to supply electricity since no electrical power is generated during daytime in Ainaro. However, due to little fuel allotted to its power generator, the plant is now unable to operate its chlorine injection equipment.

The Nugupo Water Purification Plant has solidified sand deposits blocking some of its conduits and water distribution pipes, and these have accumulated sufficiently to decrease sizes of spaces inside the pipes[18]. This problem was first pointed out in 2011 in an internal study by JICA. The water quality laboratory of the DNSAS confirmed that 200mg per liter of calcium contained in the water of the plant due to the geological feature in Ainaro. This calcium helps to accumulate sand layers. To tackle with this problem, an NGO working in the region helped the plant construct a new intake at another spring-fed pond and laid conduits made of a material that was effective in preventing the sand from accumulating. As the intake is in operation, the problem of calcium layers piling up inside the conduits is likely to be avoided for a while. The intakes and conduits constructed in this project have also been in use. However, they may be necessary to renew the conduits in the future with the further piling-up of sand layers.

In light of the above, major problems are observed in this project in terms of its maintenance scheme and technical aspects, despite some improvement in the financial conditions. Therefore the sustainability of the project effects is low. In order to realize the effectiveness of the project, which was implemented as the recovery assistant projects in newly established country, as planned, and make such effectiveness sustainable, further development is necessary through an appropriate structure for maintenance and operation, and applying proper technologies.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

To provide a stable supply of safe water for the residents, this Project repaired, improved, and renewed water purification facilities and intakes in Same and Ainaro. The relevance of this project is high as it was highly consistent with the development plan of the government of Timor-Leste, the ODA policies of Japan, and the development needs at the time of planning. In the course of its implementation, the project was temporarily suspended due to conflicts that had been difficult to foresee, but it was completed as planned as far as the period of suspension is disregarded. The budget was not exceeded over the budget, either. Therefore, the efficiency is also high. However, after the project was completed, chlorination was discontinued in both areas and at the time of this evaluation. In Ainaro, the Nugupo Water Purification Plant supply treated water only for a limited time of a day, and the river water without treatment is directly supplied as a tap water while the plant does not supply the water. In light of the above, the project has yet to achieve its target of a “stable supply of safe water,” as it was planned. In Same, the 24 hour water supply is operated although the chlorination is not resumed. Also, provided 200 saddles were all installed. On the contrary, in Ainaro, water pipes laid in this project have been connected to only 33 households so far, and the utilization rate of the newly laid pipes remains low. As a result, the impact of this project cannot be clearly observed and its effectiveness is low. The sustainability of the project is low from the facts that, despite signs of some improvement in the financial conditions with the increase in the maintenance budget, the

[18] At the time of planning, any counter actions against dealing with the raw water containing high levels of calcium were neither pointed out, nor considered. If conduits and distribution pipes accumulate the sand layers inside due to a function of calcium, the efficiency of water purification may be decreased.

National Directorate of Water and Sanitation Services, DNSAS, cannot properly procure necessary materials. There are still many challenges to be solved in terms of the organization and maintenance, including the shortage of workers at the Ainaro Branch Office and the lack of a maintenance plan, which are necessary to sustainably show the functions of the facilities provided.

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

Timor-Leste is a young country, which only past ten years since its independence from Indonesia. In particular after the termination of the Indonesian governance, Timor-Leste has experienced the difficulties in developing the capacities of water works engineers and in acquiring sufficient budget to maintain its water facilities. However, in order to establish the sustainable water works, Department of Public Works prepared Action Plan (2013-2017) which includes rehabilitation of water works, and DNSAS prepared short and medium term action plans. DNSAS recognized the importance to acquire necessary budgets for sustainable supply of safe water, and thus its integrated continuous efforts are highly expected.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Stable supply of safe water is the major policy concern with a given priority. However, the most serious problem is financial shortage that prevented the Nugupo Water Purification Plant, which is the target facility under the project, from supplying safe water for 24 hours. One of the problems causing the shortage of water supply hours is insufficient allotment of staffs in the plant. According to the branch office in Ainaro, the office needs two staffs for every eight hours. It means that the office needs to at least prepare three teams for 24 hour operation. The DNSAS should immediately allot necessary budget for the said sufficient numbers of staffs. Even if the directorate cannot allot the sufficient staffs, the directorate should consider increasing numbers of the staffs to extend operational hours within its capacity.

As a secondary issue, the plant is yet to be connected to the external electrical sources due to outstanding of both connection fee and electricity charge to the local electric company. By allotting sufficient budget, it should establish the operation system not to fully depend on a power source from a generator but to be supplied from an external power resource even only during the night.

(2) In Ainaro, the Nugupo Water Purification Plant is in operation for some period of time between 19 and 29 percent of each month. This is due to poor maintenance caused by a lack of access to external power supply and vague understanding of cleaning methods in the sand filtering system. Practically speaking, the DNSAS should immediately (1) conduct proper technical guidance to the staffs, (2) have the plant connected to the grid again, as well as review its plan for allocating fuel for the power generators, and (3) obtain some means of simple transport, such as bicycle, for its workers within a budget it can secure so that they can have uninterrupted access to the plant.

Although these practical ideas should be seriously considered, the directorate should immediately prepare the operation and maintenance plan. The directorate currently does not have the plan, and this is the most prominent problem. The DNSAS does not have to initially

prepare a very complicated plan, but it would be a very simple one, such as, a check list that instructs a periodical check to the staffs. The simple plan can be started whenever these staffs can do it. It is ideal that the plan can be gradually developed to the integrated one, which shows an appropriate structure of operation and maintenance.

(3) As for the Nugupo Water Purification Plant, even if the plant seeks the ways to solve the problem of its lack of access to external power source and the supply of a sufficient amount of fuel for its power generator to raise its utilization rate, there are no guarantees to obtain the 24 hour power supply. Therefore, the development of a solution for injecting chlorine into the water manually, not by using electricity, should be considered as the second best option. According to the JICA adviser, if the manually controlled chlorine injector, which is currently used in Same, can be installed in the said plant, it is highly feasible that chlorine sterilization is carried out without electricity. This option should be urgently considered.

(4) In Same, sterilization equipment granted as a part of this project are not in use, because of insufficient means of transportation for the workers and poor work supervision. Securing the means of transportation is as important as in Ainaro; bicycles, which are cheaper than motorbikes, should be considered as an alternative. The branch office should also give its workers thorough guidance to enable them to understand how important chlorine sterilization is in the water purification process. The guidance aims at improving the work supervision, which also contribute to reducing the negligence for sterilization by the branch staffs.

4.2.2 Recommendations to JICA

JICA has dispatched the adviser to the DNSAS as two years assignment since May 2012. This advisor has a plenty of the experience as a waterworks engineer. As mentioned in the section of sustainability, the adviser aims at improving skills of the engineers in the executing agency by continuous instruction since there are some engineers who face difficulty in improving their skills just by sporadic training. One of his assigned tasks is to assist improving operation and maintenance of waterworks facilities rehabilitated by Japan's grant aid or already existed in Dili. As mentioned in Recommendations to Executing Agency, it is recommended to establish a monitoring structure to maintain these facilities.

Furthermore, at the Nugupo Water Purification Plant, the workers quite likely lack a correct understanding of the sand cleaning process for its slow filtration bed. Workers there said they spent one or two weeks every month for cleaning the sand to maintain the filter. It is highly possible that transfer of the proper maintenance skills to these workers has failed. According to the manual prepared in this project, the workers should scrub a surface of sands for a few centimeters in the bed every 20 to 40 days. Thus, it should not be a duty to take such a plenty of time. It is desirable that the dispatched adviser should provide a technical advice to the workers in the branch office.

4.3 Lessons Learned

(1) Institutional structure for operation and maintenance

Just as was observed in this project, it is often predictable that the countries with only a short history since independence have a weak capacity to maintain any facilities. In terms of this project, the weakness of the DNSAS with regard to maintenance was pointed out as an issue at

the time of planning. Even though the project incorporated minor technical cooperation components, a grant aid program designed to only provide equipment and facilities is likely to face difficulty in ensuring a maintenance capacity. In a case of this project, with observing a status of provided facilities and equipments even after the completion, it was appropriate that JICA implemented technical cooperation project aiming to develop a whole maintenance capacity, and then dispatched an adviser for detailed cares. For the projects under the situation that the country only has a short history, the donor agency should confirm the path that surely establishes the system to maintain the provided facilities and equipments at the planning as long as possible. Then, it is significant that a donor agency provides an integrated assistance in corroboration with other assistant schemes rather than a grant aid if they are needed.

(2) The consistency between project contents and project objectives

Projects carried out in conflict-affected countries at the stage of reconstruction support have more difficulty in setting appropriate project objectives than those conducted in ordinary developing countries. This is mainly because it is more difficult in collecting data within a limited period of time. However, since these projects have bigger hurdles, they should set practically achievable objectives with a deep understanding of the conditions the countries are facing at the stage of reconstruction support and of the capacity of executing agencies. In terms of this project, for instance, the operating hours of the Nugupo Water Purification Plant at the time of planning were only in daytime, just as it is today, due to a short of staffs. Also, in Same, the branch office does not allot the staffs to inject chlorine during nighttime from the time of planning to the time of this evaluation[19]. The implementation of this project, mainly aimed at improving the existing facilities, was not sufficient by itself to achieve the objective of providing an 24 hour water supply service. To achieve the target with consistency, more was needed, such as a sufficient number of workers assigned to the plant. One of the lessons to be learned from this project is that the parties concerned should carefully examine the logic of a project design structure by comparing what effects a project is expected to produce and what targets it is likely to practically achieve. Then, appropriate project objective should be set.

(3) The necessary conditions to produce impacts

In Ainaro, there were not available that the materials needed to connect the households to distribution pipes. The branch office should provide steel pipes for any users when they request new connections, but the DNSAS in Dili cannot deliver the pipes to Ainaro. Also, users cannot procure the pipes due to unavailability even when they need it for extension. As a result, the distribution pipes constructed under this project and provided diversion saddles were not being used by residents in an effective way as originally planned, and these factors caused the circumstance that the final benefits of this project is not delivered. When the granted facilities can work effectively with the expenses paid by the beneficiaries, a careful examination should be conducted to find out whether the project will really be feasible. In particular, if any materials needed for a project is locally unavailable, this risk must be fully taken into consideration in preparing the project plan. If possible, it would be necessary for the

[19] As aforementioned in the section of sustainability, the Same branch satisfies the number of staffs as recommended at the time of planning. However, according to the interview at the time of this evaluation, the nightshift staffs for sterilization were not allotted, and thus the branch office was yet to establish the institutional structure for 24 hour water supply.

stakeholders to assess whether any locally available materials can be substituted with the maximum respect for the standards set by the authorities.

Timor-Leste

Project for the Development of a Water Supply Service in Dili

External Evaluator: Hisamitsu Shimoyama, IC Net Limited

0. Summary

The objective of this project is to supply safe water stably to the residents by restoring the function of the water purification plants and their intakes and distribution facilities in Bemos, Lahane, and Benamauk in Dili. This project is highly consistent with the Timor-Leste Government's development policy, the ODA policies of Japan at the time of planning, and development needs, and was highly relevant at the time of planning. Although the implementation of this project was temporarily suspended due to the occurrence of an unforeseeable conflict, the efficiency was judged to be high in view that the project was completed within the planned period, excluding the suspension period, and the budget was not exceeded. On the other hand, after the completion of the project, Benamauk plant has several obstacles for its smooth operations, and other two plants supply water during nighttime without purifying it. Therefore, it was judged that the goal of this cooperation project, "stable supply of safe water to residents" has not been achieved, and still has several obstacles to be overcome. With regard to the impact, as a result of a beneficiary study, some positive impacts were confirmed, such as improvement in the living environment in a wide area of Dili. However, it is judged that the effectiveness, including the impact, was low, considering the failure to achieve the project goal to be a serious problem. Although a slight improvement can be seen in the financial condition, sustainability was evaluated as low because there are many problems in both the organizational system and the level of maintenance skill in order to realize sufficient effects by the functions of provided facilities. Also, these factors are still under development.

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

Timor-Leste is a young country which only ten years past since its independence from Indonesia. In particular after the termination of the Indonesian governance, Timor-Leste has experienced the difficulties in developing the capacities of water works engineers and in acquiring sufficient budget to maintain its water facilities. However, in order to establish the sustainable water works, Department of Public Works prepared Action Plan (2013-2017) which includes rehabilitation of water works, and DNSAS prepared short and medium term action plans. DNSAS recognized the importance to acquire necessary budgets for sustainable supply of safe water, and thus its integrated continuous efforts are highly expected.

1. Project Description

Project Location

Overall view of Lahane Water Purification Plant

1.1 Background

In Dili, the capital of Timor-Leste, water supply networks were established during the era under Portuguese rule from 1950 to 1974 and during the era under Indonesian rule from 1975 to 1995. After that, however, no appropriate renewal or repair was carried out. During the period of pre-independent, which is before 1999, domestic conflicts damaged water facilities, and the evacuation of the Indonesian water engineers left the maintenance conditions behind. As a result, when the Timor-Leste Government was established in May 2002, inadequate purification and water leakage was worsened due to the decrepit waterworks, and also water theft was often occurred. Frequent water stoppage and poor water quality gave serious impact on the local people's lives.

When Indonesia gave up ruling Timor-Leste and the United Nations Transitional Administration in Timor-Leste was established in 1999, Japan began to carry out the Project for Urgent Development of Water Supply Systems, which covered 15 cities, and the Timor-Leste Reconstruction Support Project, which included a suggestion for the necessity of reconstruction of water supply and sewerage systems in main cities and considered details of support necessary for the reconstruction. Responding to this, the Project for the Improvement of Water Service Facilities in Dili was carried out and the Dili Central Water Purification Plant was established in 2004. In parallel with this grant aid project, in November 2002 the Government of Timor-Leste requested the Government of Japan to give additional support for the field of water supply. The basic design study and the basic design outline explanation study were carried out in March and August 2003, respectively.

1.2 Project Outline

The objective of this project is to supply safe water stably to the residents in the covered areas by restoring the function of the water supply through the repair, improvement, and renewal of the water purification plants, their intakes, and distribution facilities in Bemos, Lahane, and Benamauk in Dili.

Grant Limit/Actual Grant Amount	1,198 million yen/1,175 million yen
Exchange of Notes Date	May, 2004

Implementing Agencies		Ministry of Infrastructure/Directorate-General of Electricity, Water and Sanitation/National Directorate of Water and Sanitation Services[1]
Project Completion Date		May, 2007
Project Contractors	Main Contractor(s)	Dai Nippon Construction
	Main Consultant(s)	Tokyo Engineering Consultants Co., Ltd.
Basic Design Studies		March, 2003 (Research for Basic Design) August, 2003 (Explanation of Basic Design Outline)
Related Projects(if any)		[Technical cooperation] Project for Capacity Development for Water Supply System in Timor-Leste (November, 2008 – March, 2011) Study for the Project for the Urgent Development of Water Supply Systems (February, 2000 – February, 2001) Support Program for the Reconstruction of Timor-Leste [Grant Aid] Project for the Improvement of Water Service Facilities in Dili, implemented by UNOPS (June, 2000 – July, 2003; June, 2003 – March, 2004)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisamitsu Shimoyama, IC Net Limited

2.2 Duration of the Evaluation Study

For the purpose of this evaluation, the evaluation study was carried out as follows:

Duration of the Study: September 2011 – November 2012

Duration of the Field Study: (1st) November 21 – December 22, 2011

(2nd) May 17 – June 1, 2012

2.3 Constraints during the Evaluation Study

Information on indicators for measuring the direct impacts of this project could not be obtained, because almost all flow meters were out of order. Also, information on such matters as the quantity of water intakes, of water production, and of water supply could not be gained because the water purification plant managers failed to keep records. As a result, a hindrance occurred to the quantitative analysis particularly in the evaluation of the effectiveness.

A hindrance also occurred to the financial analysis in evaluation of the sustainability, because the executing agency did not disclose the detail information of expenditure on operation and maintenance.

[1] This is the Government-run organization that has jurisdiction over the water supply and sewerage systems. In this report, the DNSAS refers to an organization that belongs to the headquarters of the Central Government. However, the three water purification plants to be repaired in this project have been put under the jurisdiction of the Dili branch of the DNSAS, which is a subsidiary organization of the DNSAS. The organizational structure will be explained in detail in the section on sustainability.

3. Results of the Evaluation (Overall Rating: D[2])

3.1 Relevance (Rating: [3][3])

3.1.1 Relevance to the Development Plan

When this project was planned, stable supply of sufficient and safe water all over the country, including Dili was important political issue in the National Development Plan (2002/2003 to 2006/2007), and two goals were set as follows.: (1) supply of safe water through pipelines to 80% of the urban population[4]; and (2) provision of safe, simplified waterworks to 80% of the community population[5].

According to an interview with the National Directorate of Water and Sanitation Services, DNSAS, at the time of the evaluation study, the Secretary of State focused on the promotion of water supply service as a priority policy from 2012 onwards.

Therefore, the establishment of waterworks was an important issue for the national policies from the period of the planning to the evaluation.

3.1.2 Relevance to the Development Needs

In 2004, when this project was planned, the population of Dili was 153,300 and the quantity of water demanded per day was 29,800 m^3. According to a material provided by JICA, the water supply capacity of the water purification plants in Dili was only 1,995m^3 per day, which indicates that the water supply situation before the implementation of this project was very strained. In addition, the population was increasing and the urban area was expanding in Dili. Even in 2004, the central water purification plant, which has a capacity to supply water of 6,000 m^3 per day, was built by Japan's Project for the Improvement of Water Service Facilities in Dili. However, the plant was not sufficient to meet the increasing water demand in Dili, yet. To meet the increasing water demand, it was urgently necessary to improve the water supply capacity by repairing the water purification plants, whose functions partially or entirely stopped due to the absence of Indonesian engineers who returned to home country at the end of the Indonesian rule. Decrepit facilities were the other reason for the malfunction of these plants. Moreover, as predicted at the planning, the population of Dili continued to increase from 2004 and reached 205,400 in 2010 after the end of the project. This shows the population increased 34% up from 2004. Water demand is estimated to be 34,000 m^3 per day[6] and is continuously increasing in the city.

In light of the above, this project has been highly relevant to development needs.

3.1.3 Relevance to Japan's ODA Policy

In 1999, when Timor-Leste was planning its independence from Indonesia, a meeting was held in Tokyo by the countries that supported Timor-Leste. Discussions about measures for supporting Timor-Leste's reconstruction began on the initiative of Japan. JICA first conducted the "Study for the Project for the Urgent Development of Water Supply Systems" in 2000 and a study for support of the reconstruction of the water supply facilities in main cities, including Dili. Japan's White Paper on ODA in 2002, the year when Timor-Leste became independent, contained water supply administration as one of the priority support fields for Timor-Leste. This

[2] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory
[3] [3] High; [2] Fair; [1] Low
[4] The total population of the district capitals, including Dili, and the other designated cities
[5] The total population of the areas other than the district capitals designated as cities
[6] Cited from a report on the study for implementation of the "Second Bemos-Dili Water Supply Facilities Urgent Repair Plan."

fact shows that Japan placed importance on the water supply field from the beginning of the reconstruction support. Based on the results of the above-mentioned Study on the Project for Urgent Improvement of Water Supply System, Japan began to support the "Project for Improvement of Water Service Facilities in Dili" in 2000 in the form of donating funds to the United Nations Office for Project Services (UNOPS). This support greatly contributed to the improvement of water purification in Dili. The Dili Central Water purification Plant was completed in 2004.

Therefore, this project was highly consistent with Japan's ODA policies.

In light of the above, the implementation of this project is fully in harmony with Timor-Leste's development policies, development needs, and needs and Japan's ODA policies. Thus the project's relevance is high.

3.2 Effectiveness[7] (Rating: [1])

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Operation and Effect Indicators

(1) Water supply hours, water supply quantity

Table 1 shows the actual result of 24-hour water supply, one of the goals of this project, and the actual quantity of water supply.[8] As information on water supply quantity could not be obtained, the effectiveness was evaluated from the quantity of supplied water estimated from the water supply hours of each water purification plant and the quantity of purified water estimated from the water supply hours.

Table 1: Water Supply Hours and Quality of Purified Water at the Water Purification Plants

Plant name	Plan/Actual result*	Bemos	Lahane	Benamauk
Water supply hours per day	Planned	24 hours	24 hours	24 hours
	Actual	Feb. to Apr.: 8 hours May to Jan.: 10 hours	Jul. to Dec.: 2.5 hours Jan. to Jun.: 8 hours	10 hours**** (4 days per month)
	% to plan**	40%	22%	10%
Amount of purified water per day	Planned	2,000 m^3	2,600 m^3	600 m^3
	Actual***	666.4 m^3 - 883 m^3	270.8 m^3 - 866.4 m^3	0 m^3 - 250 m^3
	% to plan	33% - 44%	10% - 33%	0% - 41%

Source: The external evaluator prepared the table from materials provided by JICA and interviews with local stakeholders.

(Notes)

* Actual values are based on interviews at the time of the evaluation.

** The ratio to plan was calculated by the formula "water supply hours per day ÷ planned water supply hours (24 hours) per day." At Benamauk, however, because water supply is irregular, the ratio was calculated by the formula "(water supply hours per day × 4 days) ÷ (planned water supply hours (24 hours) per day × 30 days)."

*** As the number of water supply hours differs from month to month as shown in water supply hours per day, there is also a difference in the quantity of purified water per day.

**** At Benamauk, according to the interview with its operators, this plant operates four days a month due to a lack of fuel for a generator from May 2011 to November 2011, which is the first visit of external evaluator at the site.

[7] Rating is conducted by adding impact to the judgment of effectiveness.

[8] Because the DNSAS did not keep records, effectiveness was evaluated from the number of operating hours at each water purification plant and the quantity of purified water estimated from the number of operating hours.

As shown in Table 1, the ratio to plan for water supply hours is as low as 10% to 40%. The number of water supply hours did not reach the planned schedule, mainly because of a staff shortage. At all the three water purification plants, the number of employees is short and nighttime staff was not stationed. As water production is suspended from 6:00 p.m. to 6:00 a.m., it is impossible to supply water 24 hours a day.

In addition, the Lahane Water Purification Plant has problems: the quantity of water taken in from the water sources is small in the dry season; and water is frequently stolen from conduits connected with the plant, resulting in insufficient raw water[9]. The water supply hours even become shorter in the dry season. At the Benamauk Water Purification Plant, the electricity has been off since completion of this project. This is because DNSAS did not pay the connection fee to access the external power line, which is owned by an electric company. Until November 2011, the plant was operating for four days a month by a power source from a generator. At the time of the evaluation in May 2012, however, due to poor distribution of generator fuel, operations have been almost entirely suspended. A shortage of electricity has resulted in shorter water supply hours.

(2) Water quality

During the time period when the water purification plants operate, the plants have been producing water whose pH value and turbidity meet the standards set by DNSAS.

Table 2: Water Quality at the Water Purification Plants

Indicator	Plant name	Standard value (2003)	Target value (common)	Actual value (2011)*
pH(-)	1) Bemos	8.8	6.5-8.5	8.2
	2) Lahane	8.8		8.18
	3) Benamauk	8.8		7.94
Turbidity	1) Bemos	7.4	<5.0	2.46
	2) Lahane	6.5		0.65
	3) Benamauk	6.0		4.58

Source: The external evaluator prepared the table from materials provided by the DNSAS.
(Note)
* Processed from the data from January to October 2011, which was collected during site visits of the evaluation.

As shown in Table 2, because the facilities were repaired under this project, the water purification capacity increased. As a result, the quality of water supplied from these water purification plants has improved.[10] However, the adjustment of the amount of chemicals injected according to the turbidity and pH value of raw water cannot be observed from the records. Thus, there is room for technical improvement to make water production more appropriate. In addition, how to cope with high-turbidity water during the rainy season was not considered as a problem at the time of planning. However, according to an interview with the Dili Branch of the DNSAS, which has jurisdiction over the three water purification plants, all

[9] Action Plan (2013-2017) prepared by Department of Public Works includes the ideas to rehabilitate reservoirs and other facilities.
[10] An employee of the Benamauk Water Purification Plant said that generator fuel had been distributed until October 2011. Therefore, water quality is good according to the data obtained from the Water Quality Control Office of the DNSAS as of November 2011. After that, however, because the plant's operation has been remarkably reduced, it seems natural to think that water quality has worsened.

the plants temporarily stop water intakes during the rainy season only when turbidity exceeds the water purification capacity. Although there is no record on the frequency of the stoppage, according to interviews with employees of the Lahane Water Purification Plant, the plant stops water intake about three times a month from February to April, which is the height of the rainy season. As an alternative option, DNSAS took measures to take water from a deep well during the stoppage although the amount of the water taken in from the well is smaller than the regular one. Thus, during such a period the amount of water intake is not sufficient.

As described above, however, the Bemos and Lahane Water Purification Plants distribute water without purifying raw water taken in from rivers, mainly during the night, when the plants do not supply purified water. The Benamauk Water Purification Plant hardly distributed water at the time of the evaluation. As the employees are afraid of complaints from neighboring residents, the plant distributes water taken in from a river as is all day. After the stoppage of its operation due to suspension of fuel distribution for a generator on May 2011, the quality of water become poorer than before.

Therefore, because water quality can be improved only during the operating hours, it cannot be said that sufficient production of "safe water," one of the project goals, has been achieved.

3.2.2 Qualitative Effects

3.2.2.1 Implementation of technical components

(1) Technical guidance for the plan to establish water supply pipe networks

For the purpose of understanding the existing pipe networks, a training course was held for the employees of the Development and Repair Department of the DNSAS and the Dili Waterworks Operation and Maintenance Department under the Dili Branch. The training planned to achieve the following results: 1) a plan to install water supply pipes is prepared and the installation can start; 2) the present condition of water distributing and supply pipes is checked and management is easily facilitated; and 3) the planned capacity of water distributing and supply systems is improved. However, the data on existing pipe networks were neither grasped entirely nor managed at the time of the evaluation. In addition, according to interviews with several branch members, there is no actual instance where training results are applied for practical works.

(2) Technical guidance on preparation of a customer ledger

To collect water charges in the future, a plan was made to give guidance on how to prepare a customer ledger to the employees of the Customer Service Division of the DNSAS. The following results were expected: 1) grasp of the water supply situation through the preparation of a customer ledger; and 2) effective collection of water charges. As of May 2012, however, the number of customers registered in the ledger for Dili was only about 10,000 households. Even if each household is composed of four to five family members, and given that the water supply population in Dili was 114,100 at the time of planning, it is correct to estimate that the ratio of registered customers is very less. As a result that DNSAS lost its customers' data at the periods of domestic conflicts, DNSAS supplies water to those who do not have registration, and number of such users covers more than a half of water supplied population. At the time of the evaluation, the collection of water charges had still not started, due to the political situation in Timor-Leste.

Therefore, it was impossible to check the effect of the training. However, the provided materials by JICA verified that the training was conducted.

(3) Technical guidance for improvement of skill in water quality analysis

As water quality inspection was hardly carried out when this project was planned, training was provided to the employees of the Water Quality Control Division and the employees of the water purification plants to teach essential skill in water quality inspection for the purpose of supply of safe water. The following three results were expected: 1) thorough recognition of necessity for water quality inspection; 2) acquisition of essential skill in water quality inspection; and 3) understanding of safe water and the establishment of an essential monitoring system. At the time of the evaluation, the water quality items, such as turbidity, pH, water temperature, and residual chlorine, which the DNSAS specified to be inspected by each plant were inspected with the use of provided equipment, although the inspection was incomplete. Therefore, the skill transferred through the training has been used to some extent.

In light of the above, it is judged that although water quality was improved from when this project was planned, the number of operating hours was less than half the target. Therefore, the purpose of this project, "stable provision of safe water to residents," has not been achieved.

3.3 Impact

3.3.1 Intended impacts

The following were expected at the time of planning as impacts of the project: improvement in the rate of utilization of waterworks; reduction in the time for drawing water from a well or a river; improvement in living conditions through the establishment of waterworks; and reduction in waterborne infectious diseases. To confirm these expected improvements, a beneficiary survey was conducted on 140 residents who are receiving water supply service in four zones (zones 5, 6, 7, and 8) in Dili. These four zones were target areas where new distribution pipes were laid as planned under this project.

(1) Improvement in the rate of utilization of waterworks

According to the results of the beneficiary survey, 67% of the respondents answered that the main water source before the implementation of this project had been waterworks, followed by 26% answering a river, 6% answering a well, and 1% answering others. After the implementation of this project, 91% began to use waterworks, followed by 7% answering a river, 1% answering a well, and 1% answering others. Therefore, as a result of this project, the rate of use of waterworks increased by 24 percentage points.

(2) Reduction in the time for drawing water from a well or a river; improvement in living conditions

The rate of utilization of waterworks has increased from 67% to 91%. Among the 140 respondents, 33 (23.6%) answered that the utilization of waterworks resulted in a reduction in the time for drawing water from a river. With regard to the use of the time that became free from drawing water, 49% of the respondents answered that they used it for pastime and 33% answered that they used it for farming.

When this project was planned, drawing water from a river was considered as the work for women and children. According to interviews with residents during this evaluation, however, it

was found that adult males are also engaged in drawing water. Therefore, adult males also enjoyed the benefit of being free from that work.

With regard to improvement in living conditions, as a result of the beneficiary survey, 70% of the respondents answered that their living conditions were improved because the water supply situation became better after the implementation of this project. The respondents who answered "improved" commented that because water was supplied more steadily than before the implementation, and thus the labor of drawing water became eased.

(3) Waterborne infectious diseases

No information on the relation between tap water and infectious diseases could be gained from interviews with the DNSAS and the hospitals in the target area. At the time of the evaluation, although the DNSAS requested the Ministry of Health to investigate the causal relationship between tap water and diseases, no progress has been seen in the investigation.

On the other hand, according to the result of the beneficiary survey during this evaluation study, 4% of the respondents answered that they had experience in being in poor physical condition due to drinking tap water. Although they were mainly suffered from stomachache or diarrhea, it is unclear whether they were contagious diseases.

3.3.2 Other impacts

3.3.2.1 Impacts on the natural environment

Since the purpose of this project was repair, no environmental impact was expected. No impact was found at the time of the evaluation.

3.3.2.2 Land acquisition and resettlement

No resident had to move due to this project. With regard to the acquisition of land, a site of 200 m^2 and a government-owned site of 90 m^2 were provided for the Bemos and Benamauk Water Purification Plants respectively with free of charge through appropriate procedure.

In light of the above, the emergence of impacts due to the implementation of this project is limited compared with the plan, and both the effectiveness and impact of this project are low.

3.4 Efficiency (Rating: [3])

3.4.1 Project Outputs

As shown in Table 3, the outputs were almost as specified in the plan.

Table 3: Comparison between the Output Plan and the Results

Plan (at the time of basic design)	Actual results
(1) Outputs 1) Bemos plant (supply of 2,000^3/day) [1] Water purification facilities Purification facilities: distribution tank (newly installed) 1 tank Mixing unit (newly installed): 2 units Washing tank (newly installed): 1 tank [2] Construction facilities Control tower (repaired): 1 tower In-house power generation building (repaired): 1 building [3] Mechanical equipment Purification system (renewed): 4 units Chemical injection system (renewed): 1 set Sterilization equipment (renewed): 1 set [4] Electric equipment Electric distribution equipment (renewed): 1 set Monitoring equipment (renewed): 1 set In-house power generator (renewed): 1 set	(1) Outputs 1) Bemos plant (supply of 2,000 m^3/day) As specified in the plan
2) Lahane water purification plant (supply of 2,600 m^3) [1] Purification facilities Water conduit (replaced): 2 units Receiving well (newly installed): 1 well [2] Construction facilities Control tower (repaired): 1 tower [3] Mechanical equipment High-speed coagulation basin (repaired) [11]: 1 basin High-speed filter basin (repaired): 3 basins Chemical injection equipment (repaired): 1 set Sterilization equipment (renewed): 1 set [4] Electric equipment Power receiving equipment (newly installed): 1 set Power distributing equipment (renewed): 1 set Monitoring equipment (newly installed): 1 set In-house power generation (renewed): 1 set	2) Lahane water purification plant (supply of 2,600 m^3) As specified in the plan

[11] This is the facility to reduce turbidity by mixing the water with a chemical, coagulating and removing the materials which do not need in the purified water.

3) Benamauk water purification plant (supply of 600 m^3) [1] Water purification facilities Distribution tank (newly installed): 1 tank Elevated washing tank (newly installed): 1 tank [2] Construction facilities Control building (repaired): 1 building Managers' housing (newly built): 1 building [3] Mechanical equipment Purification equipment (renewed): 2 units Chemical injection equipment (renewed): 1 set Sterilization equipment (renewed): 1 set [4] Electric equipment Power receiving equipment (newly installed): 1 set Power distributing equipment (renewed): 1 set Monitoring equipment (newly installed): 1 set In-house power generation (renewed): 1 set	3) Benamauk water purification plant (supply of 600 m^3) [1] Water purification facilities Elevated washing tank: the width of the pillar was changed. All others are as specified in the plan.
4) Dili distributing pipes [1] Distributing channel: 19.6 km (Distributing pipes are newly installed in unsupplied areas, and water-leaking parts and old pipes are replaced. Details of installation and replacement cannot be checked by the basic design study.) [2] Water conduits: 7.3 km (Lahane Water Purification Plant)	4) Dili distributing pipes [1] Distributing channels: 14.5 km [2] Water conduit: as specified in the plan
5) Supply of equipment [1] Bemos • Set of water quality analysis tools: 1 set [2] Lahane • Set of water quality analysis tools: 1 set [3] Benamauk • Set of water quality analysis tools: 1 set [4] Distribution channel (Zone 1, 5, 6, 7, 8) • Snap taps with saddle: 1,998 taps [5] Drilling machines • Manual: 8 machines • Electrical: 2 machines • Spare drills: 33 drills	5) Supply of equipment As specified in the plan [5] Drilling machines • Manual: 4 machines • Electrical: as specified in the plan • Spare drills: as specified in the plan

6) Non-physical components [1] Technical guidance for the water supply pipes installation plan [2] Technical guidance on preparation of a customer ledger [3] Technical guidance for improvement of water quality analysis skill (No input plan is written in the basic design study.)	6) Non-physical components [1] to [3] were carried out according to plan as follows: [1] Technical guidance for the water supply pipes installation plan and [2] Technical guidance on preparation of a customer ledger (1st: 1.1 months from Jul. 4, 2005; guidance was given by a Japanese consultant) (2nd: 1.0 month from Nov. 22, 2005; guidance was given by two Japanese consultants) [3] Technical guidance for improvement of water quality analysis skill (1.1 months from Nov. 8, 2006; guidance was given by a Japanese consultant)

Main differences between planned and actual outputs are explained in detail as follows:

According to an interview with the Head of the Planning and Development Department of the DNSAS, the total length of pipes laid in Dili was 5.1 km shorter than that specified in the basic plan. This is because the Timor-Leste Government began to lay distribution pipes in a part of Zone 1 by its own budget without a prior notice to the Japanese side. The Government explained that it was urgently necessary to lay the pipes because the water supply condition was especially poor in the part. As a result, they could not wait for the start of this project. Because the project budget decreased due to the reduction of the output, this is not regarded as a factor for decreasing efficiency.

3.4.2 Project Inputs

3.4.2.1 Project Cost

Although the initially planned budget at the time of the basic design was 1,198 million yen, the planned budget is changed to 1,166 million yen. This is because 32 million yen was reduced from the contract price by the reduction in the total length of distributing pipes in Zone 1. The actual budget increases to 1,175 million yen if including the cost of evacuation due to the conflict that arose in May 2006. However, the additional cost of 38 million yen needed for the evacuation do not include in the actual total cost for this evaluation, because the conflict was unforeseeable and unavoidable. Therefore, the actual cost is 1,137 million yen, 98.1% of the planned cost.

3.4.2.2 Project Period

The project period was planned to be 29 months from May 2004, the month during which the E/N was concluded, to September 2006. In reality, the project took 37 months from May 2004 to May 2007 and became 128% of the planned period. The period was extended because the Embassy of Japan ordered the contractor to evacuate to avoid the conflict in May 2006. As a result, the project was suspended for 12 months. Actual length can be regarded as 25 months. This calculation is based on that 12 month that is a period of the evacuation is taken from 37 months, which is the actual total length in view that the conflict was an unforeseeable external event. 25 months became 86% of the planned period. Therefore, the project period can be regarded as having ended within the planned period.

In light of the above, the project was not implemented as originally planned due to the changes of the original specs and interruptions caused by fragile security conditions. However, as the reality, contents of the project did neither exceed the planned budget nor the construction period, therefore, efficiency is high.

3.5 Sustainability (Rating: [1])

3.5.1 Structural Aspects of Operation and Maintenance

3.5.1.1 Organizational system

Ministry of Infrastructure supervises the National Directorate of Water and Sanitation Services, DNSAS that controls the whole organization related to water services, including Administration Department, Planning and Development Department, Dili Water Supply Department (Hereafter called the Dili branch), and District Water and Sanitation Service Department. The Dili branch is responsible for the operation and maintenance of the water purification plants covered by this project. Therefore, the employees of the water purification plants are employees of the Dili branch. The following figure shows the organization of the DNSAS:

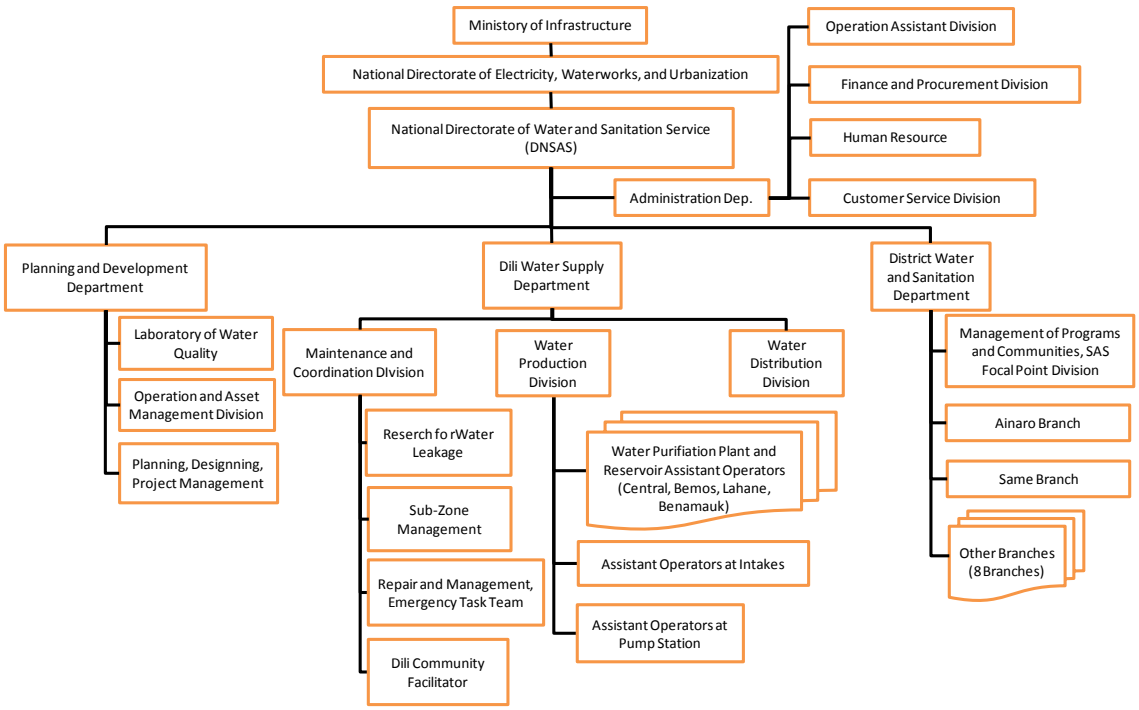

Figure 1: Organization of DNSAS and Dili Water Supply Department
(At the time of ex-post evaluation)

As shown in Figure 1, the Dili Water Supply Department is composed by Maintenance and Coordination Division, Water Production Division, and Water Distribution Division. The water purification plants supported under this project falls under the jurisdiction of the Water Production Division.

When this project was planned, it was unclear how the DNSAS and the Dili branch share duties and how the responsibilities for the maintenance of the water purification plants are shared among the DNSAS, the Maintenance Department of the Dili branch, and the employees of the water purification plants. The employees' sharing of operations was reorganized and clarified under the "Project for Capacity Development for Water Supply System in Timor-Leste," which JICA carried out from 2008 to 2011. For example, the DNSAS is responsible for the management of equipment necessary for the budgetary management and maintenance of the Dili branch (including generator fuels and chemicals, such as chlorine); the Dili branch is responsible for the distribution of employees, the execution of maintenance budget, and the provision of advice on the management of the plants; and the employees of each plant is responsible for daily operations and water production. The clarification of job distributions made occupational responsibilities clear. Also, the clarification contributed to establishing an environment for appropriate maintenance.

3.5.1.2 Distribution of personnel

A shortage in the number of employees was pointed out when this project was planned. As described in the section of effectiveness, the number of employees of each water purification plant is insufficient, and water is not supplied 24 hours a day. Table 4 shows the distribution of personnel in each water purification plant at the time of this evaluation:

Table 4: Number of Employees of Each Water Purification Plant

Plant	Number of employees (in May 2011)	Target number of employees*
Bemos	5	8
Lahane	2	6
Benamauk	2	6

Source: Prepared by the external evaluator based interviews at the DNSAS.

(Note)* The DNSAS needs three eight-hour shifts, each of which requires at least two employees. As the Bemos Water Purification Plant needs employees for not only the water purification facilities but also the water intake, eight members are needed: six members for the water purification facilities (two members for each shift × three shifts) and two members for the intake.

The number of employees necessary for 24-hour operation is estimated to be eight at Bemos and six at Benamauk. The DNSAS's application for an increase in the number of employees was rejected by the Ministry of Finance, which has insufficient budget. Although the probability of an increase is small, an increase was approved and the 24-hour system became possible at the Dili Central Water Purification Plant, which Japan supported through UNOPS. This success story indicates there are possibilities to increase these employees[12]. According to interviews with the DNSAS, because the central water purification plant's production capacity is as large as 6,000 m^3 per day when the plant submitted an application, the plant was preferentially allowed to increase the number of employees.

[12] The short and medium term action plans prepared by DNSAS indicate the increases of operational staffs in the water treatment plants.

3.5.2 Technical Aspects of Operation and Maintenance

Skills in the operation and maintenance of the water purification plants are still inadequate, including, adjustment of input of chemicals and cleaning of the flow meter and other simple repairs. Also, there is no documented maintenance plan.

According to interviews with plant employees, they do not much use the manuals prepared during the technical components of this project. It can be inferred also from the on-site inspection for this evaluation study that the manuals have not been used regularly – for example, the inspection found that some manuals have been kept in a warehouse. According to the interviews with the employees in three plants, they cannot use the manuals mainly for the following reasons: the manuals have been written almost entirely in English; the contents are too technically difficult to understand. Therefore, they do not know when to use these manuals.

On the other hand, because JICA's technical cooperation project called the "Project for Capacity Development for Water Supply System in Timor-Leste" was carried out from 2008 to 2011 after the completion of this project, written standard procedures for water quality inspection and water quality control datasheets by day/month were fully established. This results in the creation of an environment for systematically carrying out water quality inspection and recording the results. The datasheet is used to record the data of water qualities in water purification plants, and is used to report to DNSAS. In this project, these procedures and other documents were prepared in Indonesian and therefore the linguistic situation has been improved. However, the situation where the employees do not much use the manuals has still remained.

The Dili branch dispatches its employees to inspect the maintenance of the water purification facilities and the situation of water production. They are required to provide guidance when there is a problem in maintenance, such as trouble in the facilities, and to give advice about refill of consumable supplies. However, plant employees said that their visits are irregular and their advice is not much useful to solve problems.

Although the executives of the DNSAS receive training at various opportunities, the employees of the water purification plants have not been given sufficient opportunities of training after the above-mentioned technical cooperation project by JICA. It seems that they have no plans to have such opportunities in the near future.

In Timor-Leste, many of the people who spent their youth under the rule of Indonesia were deprived of opportunities to continuously receive education amid the conflicts of those days. As a result, DNSAS sometimes faced difficulty in sustaining the trained skills among some of these workers. In addition, for most of the ten years since the country's independence in 2002, both the agency and the society have been in confusion and could not afford to make the strenuous efforts to nurture young talent. It seems that these general factors prevented the agency from improving the operation and maintenance skills of its workers.

3.5.3 Financial Aspects of Operation and Maintenance

On application from each water purification plant, the DNSAS provides expenses necessary for maintenance of the plant, such as expenses for repair of facilities, spare parts necessary for repair, materials necessary for expansion of water distribution networks, generator fuel, and

electricity[13]. With regard to small-sum expenses, each plant pays them from a fixed-sum budget received from the DNSAS. The budget was fixed at 500 US dollars per month until the end of 2011,[14] but increased to 2,500 US dollars per month from January 2012. The expenditure information in detail was not disclosed.

Collection of water charges has still not started at the time of this evaluation. As the law that allows the collection has already come into force, the DNSAS has a legal right to collect water charges. However, since water charges will be paid into the national treasury, water charges are unlikely to become the own financial sources of the DNSAS even if the collection begins.

3.5.4 Current Status of Operation and Maintenance

At the time of the evaluation, there were differences in the status of operation and maintenance among the water purification plants. Among the three plants, the Bemos Water Purification Plant has maintained its facilities the best. Although there are some troubles in the facilities, the Bemos Plant has been operating its facilities more or less smoothly, keeping provided equipments for water quality analysis clean, and recording the data of water inspection accordingly. The facilities are cleaned sufficiently and kept clean. On the other hand, the Benamauk and Lahane plants have many troubled parts and their cleaning of the facilities is insufficient. Therefore, it cannot be said that they have well maintained the facilities.

Because the plants have not established a maintenance and inspection system, they have not replaced parts regularly. In addition, they have not kept any records on maintenance. Moreover, according to the interview with the staffs of the Dili Branch, they answered that Japanese parts are needed for repairing the facilities used for this project instead the ones made in Indonesia or other countries, because these parts are not compatible. However, in reality, there is a possibility that some of the spare parts imported from Indonesia may be compatible to the Japanese facilities and equipment. In Timor-Leste, these parts from neighboring Indonesia seem easier to procure in the domestic markets, and thus it is worth to confirm whether these spare parts that are not made in Japan can be applied to replace the ones of troubled.

The provided equipment for inspection of water quality has been used almost according to plan, except for that related to bacteriological testing.

Although the External Evaluator asked the Dili Branch about the status of trouble in the piping facilities in the city, faucets and other equipment in houses, it was impossible to check the frequency of trouble from past records because the branch did not keep records. The branch officer in charge of trouble testified that he repaired 10 or more troubles in the piping facilities every month. The causes for such troubles include decrepit water distribution equipment and willful destruction of the residents. Such destruction has become a great problem. The DNSAS is cautious of residents' destruction but cannot establish concrete measures to solve the problem.

In light of the above, although the maintenance of this project has shown financial improvement to some extent, the sustainability of the effects caused by this project is low, because of serious problems in institutional and technical aspects.

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[13] Although DNSAS could not allocate the sufficient maintenance budget for the consecutive two years from 2010, DNSAS plans reallocating the sufficient budget for maintenance in 2012.

[14] Although 500 dollars were allowed for maintenance every month until December 2011, the budget was increased to 2,500 US dollars for the Dili Branch and 1,000 US dollars for the other local branches in January 2012.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to supply safe water stably to the residents by restoring the function of the water purification plants and their intakes and distribution facilities in Bemos, Lahane, and Benamauk in Dili. This project is highly consistent with the Timor-Leste Government's development policy, the ODA policies of Japan at the time of planning, and development needs, and was highly relevant at the time of planning. Although the implementation of this project was temporarily suspended due to the occurrence of an unforeseeable conflict, the efficiency was judged to be high in view that the project was completed within the planned period, excluding the suspension period, and the budget was not exceeded. On the other hand, after the completion of the project, Benamauk plant has several obstacles for its smooth operations, and other two plants supply water during nighttime without purifying it. Therefore, it was judged that the goal of this cooperation project, "stable supply of safe water to residents" has not been achieved, and still has several obstacles to be overcome. With regard to the impact, as a result of a beneficiary study, some positive impacts were confirmed, such as improvement in the living environment in a wide area of Dili. However, it is judged that the effectiveness, including the impact, was low, considering the failure to achieve the project goal to be a serious problem. Although a slight improvement can be seen in the financial condition, sustainability was evaluated as low because there are many problems in both the organizational system and the level of maintenance skill in order to realize sufficient effects by the functions of provided facilities. Also, these factors are still under development. In light of the above, this project is evaluated to be unsatisfactory.

Timor-Leste is young country, which only past ten years since its independence from Indonesia. In particular after the termination of the Indonesian governance, Timor-Leste has experienced the difficulties in developing the capacities of water works engineers and in acquiring sufficient budget to maintain its water facilities. However, in order to establish the sustainable water works, Department of Public Works prepared Action Plan (2013-2017) which includes rehabilitation of water works, and DNSAS prepared short and medium term action plans. DNSAS recognized the importance to acquire necessary budgets for sustainable supply of safe water, and thus its integrated continuous efforts are highly expected.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Stable supply of safe water is a priority policy issue of the Timor-Leste Government. The biggest reason why the three water purification plants cannot operate 24 hours a day is short of budget.

One of the obstacles caused by the shortage of the budget is insufficient employees stationed at the plants. According to the DNSAS, two employees are needed for each of the three eight-hour shifts, the executing agency should consider necessary budget measures and immediately place the required number of employees. Even though the DNSAS cannot allot the employees for three shifts, it should be considered to increase hiring employees within its capacity in order to enhance operation hours of the plants. Although budget applications have been rejected so far, an increase in the number of employees at the Dili Central Water Purification Plant was approved and 24-hour operation system became possible. Therefore, the executing agency should explain these facts to the Ministry of Finance and continue efforts for 2012 to acquire of budget.

The other obstacle is the electric disconnection for Benamauk water purification plant. The plant has operated for an extremely small number of hours due to electric disconnection and a shortage of generator fuel. Its operation has completely stopped since 2012. As the DNSAS hardly has its own budget, its priority purpose is to gain a budget from the Ministry of Finance, which has continued to refuse the DNSAS's requests. The Benamauk plant should immediately pay the reconnection charge demanded by the electric company to restore the electric supply system.

Although these countermeasures aforementioned should be actively implemented, if these obstacles are not solved in a short period, the DNSAS should pursue efficient management and maintenance within its capacities.

(2) The DNSAS and the Dili branch cannot appropriately maintain or inspect the facilitators and equipments. One of the causes is that no operation and maintenance plan has been prepared. They should immediately start the preparation of an operation and maintenance plan. It is desirable to start with simple maintenance and inspection, such as regular inspection along with checkpoints, and then to gradually develop it into a comprehensive system.

4.2.2 Recommendations to JICA

(1) In May 2012, JICA dispatched a water supply improvement adviser to the DNSAS. The adviser's term of service is planned for two years. The adviser has rich knowledge and experience as an engineer who worked for a waterworks bureau in Japan. As one of the purposes of the dispatch is "to improve the operation and maintenance of the water purification facilities in Dili and those constructed through grant aid," the adviser should make efforts to establish a monitoring structure for maintenance. Then, by applying the said monitoring structure, the advisor should support that the executing agency can appropriately conduct maintenance operations along with their priorities.

(2) According to the interviews to DNSAS, although DNSAS tends to consider that the spare parts for repair should be made in Japan, DNSAS has faced difficulty to procure these parts from benders from abroad due to its insufficient experiences. Nevertheless, in reality, there are some portions that the spare parts from Indonesia, which can be procured in the domestic markets, can be applied in some cases. The advisor identifies whether these spare parts from Indonesia can be applied. Then, it is worth to consider that the advisor assists establishing the system, which enables procure necessary parts and deliver them to the sites.

4.3 Lessons Learned

(1) Countries with only a short history since independence often have a weak capacity to provide public services. In terms of this project, the weakness of the DNSAS with regard to maintenance was pointed out as an issue at the time of planning. Even though the project incorporates minor technical cooperation components, a grant aid program designed to only provide equipment and facilities is likely to face difficulty in ensuring an integrated maintenance capacity. In a case of this project, with observing a status of provided facilities and equipments even after the completion, it was appropriate that JICA implemented technical cooperation project aiming to develop a whole maintenance capacity, and then dispatched an adviser for detailed cares. For the projects under the situation that the country only pasts a short

period of time from its independence, first of all, the donor agency should design a path that surely establishes a system to maintain the provided facilities and equipments from the time of planning. Then, the agency should flexibly adjust the path even during implementing process and post-completion period. It is ideal that a donor agency provides an integrated assistance including dispatch of an advisor for follow-up and corroboration with relevant projects by other donors.

(2) Projects carried out in conflict-affected countries at the stage of reconstruction support have more difficulty in setting appropriate project objectives than those conducted in ordinary developing countries. This is mainly because it is more difficult in collecting data within a limited time. Projects should set practically achievable objectives with a deep understanding of the conditions the countries are facing at the stage of reconstruction support and of the capacity of executing agencies. One of the lessons to be learned from this project is that the parties concerned should carefully examine what effects a project is expected to produce and what targets it is likely to practically achieve when it is completed. To achieve this purpose, the donor agency should incorporate an appropriate risk management mechanism from the planning stage, and the agency is required to execute these measures during its implementation. In terms of this project, for instance, since increases of staffs are required for 24 hour water supply, the project should include the additional staff allocation in the plan as a necessary counter measure to achieve the project objective. Also, it is significant to carefully assess the contents of assistances and continue these supports in order to achieve the objective.

Nepal

Ex-Post Evaluation of Japanese ODA Grant Aid Project
The Project for Improvement of Water Supply Facilities in Urban and Semi-Urban Centres

External Evaluator: Noriko Ishibashi, IC Net Limited

0. Summary

This project places its objectives in increasing the population receiving safe and reliable water supply through improvements in water supply facilities in three local cities where there is an urgent need to improve the water supply conditions. As such, the objectives are consistent with those development needs and development policies of Nepal, as well as that of the aid policies of the Government of Japan, therefore the relevance is high. Although the outputs have been achieved almost as planned, the efficiency of the project may be rated as fair because the project duration extended compared to the original plan. The amount of water supply, population served, and water quality of the three water purification plants have mostly achieved their planned targets and the users' high level of satisfaction toward the water supply services revealed that the objective of this project, increasing the population served with safe drinking water, is evaluated to have been achieved. Therefore the project's effectiveness and impact is high. However, more efforts are required for the extension of water supply network in order to expand the effect of this project. Furthermore, despite the operators of the water supply facilities, the Water Users and Sanitation Committees (WUSCs) were able to produce retained earnings, factors such as deficiencies found in its draft business plans by not having precise and sufficient financial backing to implement the planned replacement of equipment outlined in its draft long-term business plan, and the understanding that in the short-run the establishment of support mechanism to WUSC by WSSDO (Water Supply and Sanitation Division Office) may be difficult despite the technical cooperation project currently supported by JICA, lead to the assessment that the sustainability of this project is fair.

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

1. Project Description

Project location


Clear water tank at the Gauradaha Water Purification Plant

1.1 Background

Based on its 9th Five-year Plan (1998 – 2002), the Federal Democratic Republic of Nepal has been expanding the supply of safe drinking water to its nationals, and as at the final year of this Plan, the water service coverage extended to 71.6% of the entire population, but almost a third of its nationals were still without drinking water supply services. Raising the water service coverage rate was considered as one of the top priorities among its national policies.

As at 2004/2005, three areas targeted under this project (Dhulabari, Gauradaha, and Mangadh) only had water supply coverage of about 30 % in Dhulabari, and at the remaining 2 targeted areas, 15 %. Also, their existing water service facilities did not adequately supply enough volume of water, with time restrictions and/or frequent cuts placed on the water supply. Water from the existing facilities was quite turbid and had a high content of iron, thus it was inappropriate for drinking. Upgrading the water service facilities to improve water quality and also supply a larger volume of water was an urgent issue to address.

Against such backdrop, the Japan International Cooperation Agency (JICA) conducted a project formulation study in 2003. The study confirmed that a project to improve water supply services was both necessary and feasible, and eight towns and cities including those targeted under this project were selected as priority areas for possible projects.

1.2 Project Outline

The objective of this project is to increase population receiving reliable supply of safe drinking water through the improvement of water supply facilities in the 3 targeted project areas in Nepal.

Grant Limit/ Actual Grant Amount		1,124 million yen/1,123 million yen
Exchange of Notes Date (Grant Agreement Date)		December, 2005
Implementing Agency		Department of Water Supply and Sewerage (DWSS) and Water Users and Sanitation Committees (WUSCs)
Project completion		July, 2007
Contractor	Consultant	NJS Consultants Co., Ltd. (Japan) and Nihon Suido Consultants Co., Ltd. (Japan) (Joint venture)
	Constructor	Hazama Corporation
	Equipment procurement	Hazama Corporation
Feasibility study	Basic Design Study	Basic Design Study on the Project for the Improvement of Water Supply Facilities in Urban and Semi-urban Centers 1st: June & July, 2005; 2nd: September, 2005
	Detailed Design Study	January – April, 2006 (As per Completion Report)
Related Projects	Technical cooperation	• Project for Capacity Development for Water Supply in Semi-urban Areas in Nepal (2010 – 2013)
	Grant aid	• Katmandu Water Supply Facility Improvement Project 1st: 3,372 million yen (1992 – 1994); Katmandu Water Supply Facility Improvement Project 2nd: 2,244 million yen (2001 – 2003)
	Other international and aid organizations, etc.	Asian Development Bank (ADB) • Construction of existing water supply facilities in Dhulabari (1996); • Construction of a meeting facility in Itahari (2000)

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriko Ishibashi, IC Net Limited

2.2 Duration of Evaluation Study

This ex-post evaluation was conducted as follows:
Duration of the Study: October 2011 – November 2012;
Duration of the Field Study: December 17–31, 2011; June 3 – 15, 2012

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

3.1 Relevance (Rating: [3][2])

3.1.1 Consistency with the National Development Policies

Under the 10th Five-year Plan (2002 – 2007) issued by the National Planning Commission (NPC) in 2002, with respect to the policy objectives of supplying drinking water, the following objectives, amongst others, were raised: (1) increase the water service coverage ratio to 85 %, and (2) improve the water quality in order to secure safe drinking water. The Three-year Interim Plan (2008–2010) mentions water supply and sewerage services as one of the priority issues in the social development sector, and sets the target of raising the service coverage rate to 85 %. It also depicts organizational enhancement of water supply related agencies, improved water supply services, and improved water quality among its strategies.

Both the National Water Plan (2005) and the National Policy on Rural Water Supply and Sanitation Policy (2004) mention the supply of safe water as their policy targets, and these policies are still in effect at the time of conducting this ex-post evaluation.

As described above, raising the water service coverage and improving water quality have continuously been among the policy targets set in several national policies of Nepal since 2002 onwards. The supply of safe water has also been among the targets of the local water supply and sanitation policies. Therefore this project is highly consistent with Nepal's development policies.

3.1.2 Consistency with the Development Needs of Nepal

At the time of the planning of this Project, the water services coverage rate in the targeted areas of this project, was about 30% in Dhulabari (2004), and in Gauradaha, and Mangadh, about 15% (2004 and 2005 respectively). Water from the existing sources, which were wells, contained 2 milligrams of iron per liter, much higher than the national water quality standards for drinking water of 0.3 milligrams per liter, meaning it was not appropriate for drinking (Table 1). An urgent issue was to install water purification facility at the existing water supply facilities and to develop new water sources in order to supply safe drinking water to a larger population.

At the time of this evaluation, some of the targeted areas covered by this project saw their population increase by more than 3%. The draft long-term business plans prepared in 2011 by the WUSCs which operate and administer the water supply facilities, also expect population growth, implying there will be a further need for increase in water supply. The quality of the water obtained from existing wells also had room for improvement. Therefore, this project can also be regarded as being highly consistent with Nepal's development needs.

[1] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory
[2] [3]: High; [2] Fair; [1] Low

Table 1: Water Supply in the Areas Covered by the Project at the Time of Planning

	Dhulabari (2005)	Gauradaha (2005)	Mangadh (2005)	Water supply service level definitions [1] Moderate standards
Water quality				National water quality standards
Turbidity (NTU)	High	n.a.	n.a.	Ex) Turbidity: 5 or less
Iron (mg/L)	n.a.	High: 2.2-5.7	High: 2-2.5	Iron: 0.3 or less
Duration of supply (hrs/day)	8.6	23.9	n.a	24
Water supply coverage (%)	34 [2]	14 [2]	15	

Source: Extracts from the Basic Design Study (BD) Report and the Urban Water Supply and Sanitation Policy (2009)
Note: 1) Service level defined in the 9th Five-year Plan (1998 - 2002) which was referred in Urban Water Supply and Sanitation Policy (2009)
2) Estimates calculated at the time of the BD, with the number of users of public faucets included.

3.1.3 Consistency with Japan's Aid Policy

JICA's Nepal Country Assistance Programme Implementation Plan (2001), referred in the Report of the Research Committee on Nepal Country Assistance (2003), outlines improvement of social sector services and enhancing people's livelihood, expansion of agricultural productivity, economics, improving people's livelihood through expansion of social infrastructure and promotion of business, and the protection of the environment as four priority areas[3]. The Report of the Research Committee on Nepal Country Assistance (2003) recommends providing drinking water supply as part of improving healthcare within the context of development support to impoverished areas as basic policy towards providing aid to Nepal. As such, this project which aims at providing safe water supply is along with the aid policy of Japan. Furthermore, within the implementation period of this project, the Country Data Book for Official Development Assistance (ODA) for Nepal (2006) mentions five issues, namely, social sector improvement, agricultural development, economic infrastructure aid, human resources development, and environmental protection as priority areas. In the area of economic infrastructure aid, the development of the basic social infrastructure, such as electricity, roads, water supply services and disaster prevention, was included. With its consistency with Japan's aid policy, the implementation of this project is highly relevant.

In light of the above, this project has been highly relevant with Nepal's development policies and development needs, as well as those of Japan's aid policy, therefore its relevance is high.

3.2 Effectiveness[4] (Rating: [3])

3.2.1 Quantitative Effects

The objective of this project is to increase the population receiving stable supply of safe drinking water, and in terms of its indicators for determining this, the actual increase in population receiving water supply and the water supply coverage, - population served by water supply as percent of total population in the service area -, are the main indicators. However, in order to achieve the targeted increase in the population receiving water supply and increase in water supply coverage rate, a comprehensive development of water supply operations such as

[3] Referred in the Chapter 2 of 'The Report of the Research Committee on Nepal Country Assistance' (2003).
[4] The rating is conducted based on the judgment of effectiveness coupled with impact.

expansion of water distribution and service pipe network are the necessary prerequisites in addition to the upgrade and/or establishment of the water purification plants supported as a part of this project. Therefore, in order to evaluate the effectiveness of this project, on the first instance, the operation of the water purification plants from the quantitative perspectives of water supply capacity and the quality of water supplied needs to be evaluated. Then, the achievement in quantitative targets of population served and water supply coverage rate as well as its contributing factors would be analyzed. These two factors need to be taken into consideration in delivering a holistic evaluation. Furthermore, in producing the evaluation on effectiveness, the following changes and constraints were observed, and as such, the points below will be taken into consideration when evaluating.

- **Evaluation of Effectiveness based on the Population Served by the Project**

In general, when evaluating prevalence of water supply in a service area, the number of people served and the water supply coverage rate in a service area are the main indicators used. Of the two, in evaluating the water supply coverage rate, there is the necessity that the area and the population composition of the targeted areas remain the same. The targeted service areas of this project experienced expansion and hence saw a discrepancy between the originally planned coverage area and the total local population served and those of the actual implementation. As a result, it has become difficult to make a simple comparison between the targeted water supply coverage rate set at the planning stage and the actual current water supply coverage rate and thus, the evaluation was conducted mainly with number of population served where concrete and measurable comparison was possible. With respect to the water supply coverage rate, it is used as a reference point.

- **Resetting of the 2011Target**

With respect to the planned target figures for this project, since the year 2014 was originally set as the target year when the Basic Design Study (BD) was conducted, no clear target was set for the year 2011 when the actual evaluation took place. For this ex-post evaluation study, the level of achievement as of 2011 was evaluated against the provisional target figure for 2011[5] which is calculated using average figures between 2005 and 2011 based on the 2014 targeted figure. Furthermore, for the target figures of 2014, this was planned under the presupposition that the planned expansion of the water distribution and service pipes networks, primarily by the Nepal side, would have been completed and thus the water supply capacity would have reached to its peak as a result of the implementation of this project.

3.2.1.1 Operational effectiveness indicators

(1) Operational condition of the Water Purification Plants

1) Expansion of the water supply capacity

The water supply capacity and the actual amount of water supplied by the 3 water purification plants before and after the implementation of this project are shown in Table 2. Through the implementation of this project, the water supply capacity was expanded as planned. At the time of this evaluation, the achievement of the target amount of water supply per day (corresponding to maximum amount of water supply per day) for each water purification plant

[5] The provisional target figures were set for this Ex-Post Evaluation Study after discussing with a construction consultant that had conducted the Basic Design Study for the design.

vary from 82% to 122% (2011) of the planned targets, which show by and large favorable achievement. Among three, Gauradaha fell below its target. The reasons for being short of its target may be explained by the following two factors - actual water demand per household is not as high as originally planned, and despite the actual demand, due to the slow expansion of its water distribution and service network, there are areas where the connection to the water supply system is yet to be realized. Extension of the water supply network to the said unconnected areas in Gauradaha would further increase the total amount of water supply.

Table 2: Operational Conditions of Water Purification Plans

	Dhulabari					Gauradaha					Mangadh				
	2005 bench-mark	2011 Plan	2011 Actual	Result/Plan %	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/Plan %	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/Plan %	2014 target
Supply capacity (m^3/d)	n.a.		4,200	*		n.a.		1,100	*		n.a.		2,200	*	
Amount of water supply (m^3/d)	705	n.a.	2,540	n.a.	n.a.	55	n.a.	499	n.a.	n.a.	155	n.a.	1,530	n.a.	n.a.
Maximum water supply (m^3/d)	n.a.	2,986	3,048	102%	4,200	n.a.	732	599	82%	1,100	n.a.	1,500	1,836	122%	2,200
Duration of supply (hour/d)	8.6	15-24	24	100%	15-24	23.9	n.a.	24	n.a.	n.a.	n.a	n.a	10-15	n.a.	n.a
Water Supply per capita (litter/person/d)	45	n.a.	69	n.a.	45-100	n.a.	n.a.	66	n.a.	100	n.a.	n.a.	122	n.a.	100

Source: Benchmarks of 2005and the 2014 targets come from the BD Report. The 2011 targets are validated and set based on the targets for 2014, the calculation of which presupposes possible increase in amount of water due to expected/planned water supply network expansion. The figures other than noted below are actual results by WUSCs.

Note: 1) The figures noted by (*) are already realized water supply capacity after the project implementation, while the one before the project are not shown in the BD Report.

2) Dhulabari's amount of water per capita per day (2011) was derived from the total billed amount of water[6].

3) Amount of water supply per day (m^3/day) is equal to average amount of water supply per day. Maximum amount of water supply per day (m^3/day) is the target amount of water supply of this project. Basic Design Study set the ratio of maximum amount of water supply per day / average amount of water supply per day (coefficient of variance) at 1.2 so that this evaluation calculated the target amount of water supply (maximum amount of water) using the formula of 'average amount of water supply per day x 1.2'. The benchmark figures are actual volume of water supply per day at the time of planning while the target (2014) is maximum amount of water supply. The plan (2011) is also using maximum amount of water supply per day.

a) Discrepancy against expected water demands

The amount of water supply per capita per day[7] at Dhulabari and Gauradaha is slightly lower than 70 liter and this is only 70% of the 100 liter[8] target. According to the interviews

[6] Dhulabari's per capita water supply per day would be 164 liters/person/day if calculated based upon actual amount of water supply and the actual population served in Table 4, whereas it would be 69 liters/person/day if calculated based upon water bills. In this report used the billed amount of water as it is objectively verifiable figure that reached to the user since the meter calibrations are not conducted for amount of water intake and distribution. The reasons behind this large discrepancy in the per capita amount of water supply per day is not identified clearly. Please refer to the section '3.5.3 Financial Aspects of Operation and Maintenance (3)Impact of Non Revenue Water'.

[7] Liter/person/day abbreviated by L/p/d.

with WUSCs of Dhulabari and Gauradaha during this evaluation, their overhead tanks stocking the water for local supply in the two towns were never emptied whereby verifying 24 hours water supply was already achieved. That is to say, in Dhulabari and Gauradaha, the water demand of the already connected population was met by the current amount of water supply per capita, and thus one of the reasons of the water supply volume falling short of the target is caused by the over-projection of the water demand at the time of planning.

b) Incomplete water distribution and service network

The water supply targets (for the target year 2014) set at the time of planning takes into account of the future penetration of the water supply network[9] into the service areas where the water supply distribution and service pipes were not yet connected and potential users awaiting. However, in Gauradaha and Dhulabari, the increase of connections resulting from the expansion of connection was lower than originally anticipated. Therefore Gauradaha, and Dhulabari, there are potential areas whereby, despite the demand for water, it was yet to be connected thus not feasible to provide the water supply as demanded. It is expected that water supply volume will increase once water service reaches such underserviced and/or unconnected areas in the future.

According to the WSSDO, it is generally understood that the slow expansion of the water distribution and service networks is partially due to WUSCs' inability to sufficiently secure capital investment budget for such expansion, and to the inadequate planning for the expansion of the network. Also, based on the interviews with WUSCs, it has become apparent that the plans of distribution network expansion were not based on the reasonable expectation of securing feasible funding (self-financing or from other sources), nor clear annual expansion targets of distribution network were set, hence the feasibility of the plans were low. In Gauradaha, the future expansion plan of water supply distribution pipes is available, and the WUSC estimated that, if the WSSDO would continuously provide distribution pipes and other fittings[10], the 2014 targeted amount of water supply may be achieved in the medium term. However, considering the past rate of expansion and its plan, it is unclear at this point to determine if the planned 2014 target could be achieved. Dhulabari on the other hand, securing their part of capital investment cost for pipes for expansion of the water distribution network is deemed difficult, and has no concrete expansion plan at the time of this evaluation. The delays in extension of water supply network reveal challenges in further expansion of the project effect which attributes to increasing population served. Hence, it may affect prospect of achieving the 2014 target of water supply amount as well as the sustainability of the project effect.

At the time of the planning of this project, overall plan for expanding the water supply distribution networks for each service area was present. However, the Nepal side's feasibility of funding such investments was not identified, nor none of the WUSCs have sufficient financial capacity to procure funds[11] based on a possible capital investment plans. At the planning stage of this project, potential concerns with respect to the financial prowess of the implementing

[8] Per capita amount of water supply per day at the time of planning was calculated at 100 liter for users in households with its own taps and 45 for users of public faucets.

[9] In this project, JICA side supported the expansion of main distribution lines of Dhulabari and Gauradaha whereas the Nepal side was responsible for supporting the expansion of the service/distribution networks in the target areas.

[10] The WUSC in Gauradaha was granted the pipes and fittings necessary for the expansion of distribution and service network by the WSSDO in the past two consecutive years, and the granted pipe length was mostly as they proposed. However, it is unforeseeable that the similar level of provision would be materialized in the next year onward.

[11] After the construction, WSSDOs transfer the facility to a designated WUSC, which formulates its own capital investment plan and procure necessary fund for cost share between WUSC and WSSDO; 4:6 respectively.

entities were not sufficiently examined, and as such, it can be said that more realistic project targets were not set.

2) Water Quality

In Dhulabari, no periodic water quality test was conducted and it was unable to conduct quantitative analysis and evaluation. The water quality of the other two water purification plants was as per table below. Despite the presence of minor deviations from the acceptable range for certain indicators, the water from the two plants mostly reach to the quality of drinking water.

Table 3: Water quality of distributed water

	Dhulabari				Gauradaha				Mangadh			
	2005 bench-mark	2011 Plan	2011 Actual	2014 Target	2005 bench-mark	2011 Plan	2011 Actual	2014 target	2005 bench-mark	2011 Plan	2011 Actual	2014 target
Turbidity (NTU)	High	>5	n/a	n/a	n/a	n/a	0.63	n/a	n/a	n/a	0.84	n/a
Iron (mg/L)	n/a	n/a	n/a	n/a	High 2.2-5.7	<0.3	0.37	<0.3	High 2-2.5	<0.3	0.06	<0.3
Coliform bacteria (col/ml)	n/a	n/a	n/a	n/a	n/a	n/a	nil	n/a	n/a	n/a	nil	n/a

Source: The 2005 benchmarks come from the BD Report, and actual figures from the results of water quality tests offered by WUSCs.

< Gauradaha>

In Gauradaha, the examined items are only 18 despite the national standards of 27 due to the limited test capacity of nearby water quality laboratory, the frequency of the examinations has been almost annually. The water quality test conducted in 2011 verified that 17 out of the 18 items[12] passed the national drinking water quality standard[13], aside from for the contents of iron. With respect to the iron contents, although it slightly exceeded the 2011 planned target (under 0.3mg/L), it passes the national drinking water quality standard and JICA experts[14] also confirmed that this has few impact on health. These data also confirm that significant improvements have been achieved when compared to the data prior to the implementation of this project.

< Mangadh>

In Mangadh, water quality tests that are compliant with the national water quality standards have been conducted almost annually[15], and out of the 27 checked items, 25 items have passed the national standards in 2009, and in 2011, aside from the residual concentration of chlorine[16], it has passed the national quality standards of Nepal as drinkable water.

[12] Nepal's drinking water quality standards have 27 items nonetheless the nearby laboratory can examine 18 only.
[13] National drinking water standards sets the upper limit of 0.3mg/l for iron, however, this applies if iron content can be removable. As per JICA expert, water with iron contents of less than 3mg/l is allowed as notified in parentheses.
[14] JICA Experts in the 'Project for Capacity Development for Water Supply in Semi-urban Areas' explained in '3.5 Sustainability'.
[15] Physical parameters for 15 (color, turbidity, iron, manganese, arsenic etc.), chemical ones for 10 (calcium, mercury etc.), and micro germs for 2 (coli form etc.)
[16] The result was 0.3mg/liter (2011) exceeding the national drinking water quality standards of 0.1 to 0.2mg/liter.

< Dhulabari>

According to WUSC, the water quality at Dhulabari is good enough, due to good quality of the water at the source, so that the WUSC has been conducted no water quality tests by water quality laboratory. More precisely, the main source of water in Dhulabari is from springs, and the water quality examination during the BD Study conducted at the planning stage of this project, water quality had no problem except for presence of coliform which can be treated by chlorination in the water purification process. As such, the WUSC understood that need of water quality tests was low. Taking into consideration that the water quality at the time of the project planning stage had been good, and also considering the fact that the beneficiary survey, described later part of the report, did not find any major dissatisfaction concerning water quality. It could be assumed that water quality might have no major issues, but no precise assessment is possible. It should be instructed that the operators of the facilities need to recognize the importance of water quality monitoring and to conduct periodic water quality tests according to the concerned regulations.

It should be noted that water quality control lectures have been conducted by JICA project's training. Through such project's technical support, it is anticipated that WSSDO staff will provide assistance to WUSCs regarding the necessity of conducting water quality tests, and improvements can be made in the medium term.

In summary, the water supply capacity of the water purification plants had been improved according to its original plan and the planned water supply volume target was mostly achieved. Due to over projection of per capita water demands and the slow expansion of the water distribution and service networks, the actual amount of water supply of Gauradaha was short of the targeted level, however the overall achievement of 3 plants is evaluated to be at reasonable level. The target level of water supply for 2014 can be achieved in Gauradaha and Dhulabari at the conditions of further extending the water supply network; particularly Dhulabari requires the network expansion plan as well as technical guidance on fund procurement. With respect to water quality, two of the three water treatment plants have almost achieved the national water quality standards for drinking water. Although Dhulabari's capacity in providing water quality is not verifiable, its source water can be safe with chlorination thus requires less urgency in conducting water quality examination. In sum, the all operators' capacity of supplying safe water has almost been achieved, which is commendable.

(2) Population receiving water supply and water supply coverage rate

The table below shows the population served and water supply coverage rates of the three water purification plants. It should be noted that the population served has achieved the 2011 target in two service areas except Dhulabari among three, which can be favorably assessed. In terms of the water supply coverage rate in the service area, all have come below the target.

Table 4: Population served, amount of water supply, water supply coverage and hours

	Dhulabari					Gauradaha					Mangadh				
	2005 bench-mark	2011 Plan	2011 Actual	Result/ Plan(%)	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/ Plan(%)	2014 target	2005 bench-mark	2011 Plan	2011 Actual	Result/ Plan(%)	2014 target
Amount of water supply (m^3/day)	705	n.a.	2,540	n.a.	n.a.	55	n.a.	499	n.a.	n.a.	155	n.a.	1,530	n.a.	n.a.
Maximum water supply (m^3/d)	n.a.	2,986	3,048	102%	4,200	n.a.	732	599	82%	1,100	n.a.	1,500	1,836	122%	2,200
Population served (person)	8,480	22,299	15,494	69%	31,360	1,290	5,911	7,604	129%	8,885	2,870	11,262	12,560	112%	16,440
Total population in sevice area (person)	25,818	32,794	29,237	89%	36,900	9,292	11,822	28,938	245%	13,100	19,180	25,026	30,201	121%	27,400
Water supply coverage (%)	34% *	68%	53%	78%	78%	14% *	50%	26%	53%	68%	15%	45%	42%	92%	60%
Duration of supply (hour/d)	8.6	15-24	24	100%	15-24	23.9	n.a.	24	n.a.	n.a.	n.a	n.a	10-15	n.a.	n.a

Source: Benchmarks of 2005and the 2014 targets come from the BD Report. The 2011 targets are validated and set based on the targets for 2014, the calculation of which presupposes possible increase in amount of water due to expected/planned water supply network expansion. The figures other than noted below are actual results by WUSCs.

Note: 1) The figures noted by (*) are already realized water supply capacity after the project implementation, while the one before the project are not shown in the BD Report.

2) Dhulabari's amount of water per capita per day (2011) was derived from the total billed amount of water.

3) Amount of water supply per day (m^3/day) is equal to average amount of water supply per day. Maximum amount of water supply per day (m^3/day) is the target amount of water supply of this project. Basic Design Study set the ratio of maximum amount of water supply per day / average amount of water supply per day (coefficient of variance) at 1.2 so that this evaluation calculated the target amount of water supply (maximum amount of water) using the formula of 'average amount of water supply per day x 1.2'. The benchmark figures are actual volume of water supply per day at the time of planning while the target (2014) is maximum amount of water supply. The plan (2011) is also using maximum amount of water supply per day.

1) Population served in service area

Of the 3 water purification plants, the two targeted areas covered by Gauradaha and Mangadh have achieved their targets vis-à-vis the 2011 target[17], and this achievement can be favorably assessed. Dhulabari, on the other hand, only reached up to approximately 70% of its planned target. The reasons behind this may be attributed to the fact that there had been slow expansion of water supply distribution network mentioned earlier, and the fact that around 2008 and 2009, the system of public tap had been abolished[18], and thus the reduction of those households that used to use public tap have negatively affected the achievement.

[17] Precisely, 15,494 for Dhulabari (69% of the plan), 7,604 for Gauradaha (129% of the plan), and 12,560 for Mangadh (112% of the plan)

[18] It was due to misuse of public faucets e.g. washing privately owned livestock and so on.

2) Water supply coverage rate in service area

In all 3 targeted areas, the water supply coverage rate vis-à-vis the 2011 planned target rate was at 50 to 90% of their respective target rate and fell below the planned target. Especially in Gauradaha, the water supply coverage rate vis-à-vis the target rate reached only about 50%. With respect to Gauradaha and Magandh, the water supply area and population served increased beyond what had been originally planned, and this, in relative term, lowered the water supply coverage rate[19], thus working against achieving the target. If the overall population served would have stayed as the originally planned, it would have achieved about 50% for both towns (refer to Table 5 and Table 6) and thus, they have approximately met their target. Since the planned target for population served is met, it may be assessed that the original target has been almost met. The significant expansion of the service area and increase in the population served has the following background.

a) In Gauradaha, based on discussions held with the adjoining WUSC, from 2009 onwards, parts of 2 additional Wards where water supply was not covered were added to the service area. Adding the areas not previously targeted and areas where water supply was not connected, in addition to the fact that the demand for water per household was not as large as originally planned, both led to the amount of water supply falling short of its target. Against the originally planned water supply coverage rate of 50% (set for 2011), the actual water supply coverage rate was at 49% (2008) before this expansion took place, (translating to achievement of 98% vis-à-vis the planned rate) and thus, the target was almost achieved (refer to table below). However, with the expansion in the service area, the coverage rate decreased in relative terms, and thus fell below the plan.

Table 5: Gauradaha Water Supply Coverage
(2008 Actual and before the area expanded)

2008 Actual Population served (persons)	5,012	2008 Actual total population in service area (persons)	10,301	2008 Actual Water supply coverage (%)	49%	2011 Plan Water supply coverage (%)	50%

Source: The figures other than below are actual results by WUSCs.
Note 1: The figures for population served and the coverage rate in service areas for 2008 Actual are calculated by the same method as was in BD Study due to lack of official population data provided by WUSCs.

b) In Mangadh, had the total population within the service area remained as 25,026 as originally planned (for 2011), the water supply coverage rate - which is to measure the degree of coverage against the total population in the service area - would have reached 50% (refer to table below). This in turn would have reached 110% of the planned target rate. In reality, the permanent population in some part of the service area increased beyond planned levels, and thus, the denominator for the indicator increased and this had subsequently led to the relative decline of the coverage rate. Despite such increase in population, the water supply coverage rate had reached to 90% of the planned target rate, and this may be favorably assessed as an achievement.

[19] The denominator is the total population in the service area in the calculation of coverage rate in the service area.

Table 6: Mangadh Water Supply Coverage (2011) based upon the Total Population (2011 Plan)

2011 Actual Population served (persons)	12,560	2011 Plan total population in service area (persons)	25,026	Water supply coverage (%) 2011 Actual/ 2011 Plan	50%	2011 Plan Water supply coverage (%)	45%

Source: The figures other than below are actual results by WUSCs.
Note 1: The figures for population served and the coverage rate in service areas for 2008 Actual are calculated by the same method as was in BD Study due to lack of official population data provided by WUSCs.

c) In Dhulabari, in addition to the sluggish expansion of the water distribution network, and the fact that the public water taps were discontinued from 2008-2009, have led to a decline in the population served, and this has had dragged down the achievement level.

As shown above, the capacity of the water purification plans have been improved as planned, and setting aside a few exceptions, the population served reached its planned target. Despite the fact that water supply coverage rate is short of the planned target due to the change of the denominator, the increase of the population served mostly achieved the target which is commendable. However, delays in the expansion of the water supply distribution and service network pose a challenge to this project in delivering its planned effect.

3.2.2 Qualitative Effects

(1) Feedback from users

In order to supplement the level of effectiveness of this project from a qualitative viewpoint, a beneficiary survey was conducted with those users living in the targeted area. The sample for the survey consists of 100 people living within the target area covered by the 3 water purification plants. The main results of the survey are shown in the table below, and in general, positive feedback was given with respect to the improvement in water supply conditions.

Table 7: Findings of the Beneficiary Survey (Summary)

	Dhulabari Jhapa District	Gauradaha Jhapa District	Mangadh Morang District
Water supply	Good Water available 24-hours	Good Water available 24-hours	Good Water available 10-15 hours/day
Water quality	Good	Good	Good
Charges	90% of residents can pay	Roughly 90% of residents can pay	80% of residents can pay
Livelihood changes	・Water taps closer, increase in convenience	・Water plugs closer, increase in convenience	・Increased convenience ・Easy to draw water (70%) ・Improved health (20%)

Source: Beneficiary survey as part of the ex-post evaluation study (2011)

- All the respondents expressed that the current water supply conditions were favorable. Issues such as water pressure were not raised. With the exception to those responses from Mangadh, all those replied stated that there were mostly 24 hours of water supply.
- All the respondents stated that water quality improved, with no issues experienced with respect to clarity, smell and taste of water.
- With respect to water tariffs, 86% of those who replied stated that they were at an

affordable level.

- With respect to change in livelihood, responses were given that water taps have become much closer and the usage of water easier to access.

From the above, the amount of water supplied, the population served, and the water quality mostly achieved the plan, and the level of satisfaction towards the water services from users is high. As such, from the perspective of increasing the population receiving safe and reliable water supply, it is commendable that this project has achieved the objective. In this regard, delays in expansion of water distribution and service networks, which poses challenges to the increase of water supply volume and population served, necessitates further efforts of expansion. Its expansion is expected to fully deliver the intended effectiveness of this project and to sustain the effect. In light of the above, it is evaluated that the effectiveness of this project is high.

3.3 Impact

3.3.1 Intended Impacts

At the time of planning, according to Basic Design Study, this project was expected to provide stable supply of safe drinking water to the residents and help improve their health conditions. At the time of this evaluation, there was no quantitative data available that supported any improvement in the health of the residents. However, all the respondents in the beneficiary survey pointed out the ease and convenience of water use as a change in their livelihood. In particular, in Mangadh, almost 70 % of the respondents said they could now use water more easily, suggesting to some extent that better water supply conditions have helped improve the living conditions of the residents in this water supply area. There was no specific co-relationship found between this project and invigoration of the local economy.

3.3.2 Other Impacts

(1) Impacts on the natural environment

A simplified Initial Environment Assessment[20] conducted as part of the BD Study concluded that there was no issue that would have any significant impact on the environment, and that therefore there was no need for any further environmental assessment. As a result, no further environmental assessment was conducted. A local consultant who accompanied this evacuation study team found that there were no remarkable cases of land subsidence, nor had any member of the local implementing agencies reported land subsidence. It is therefore recognized that this project had no specific impact on the natural environment.

(2) Land acquisition and resettlement

In Dhulabari, the acquisition of land was required in order to expand its water intake site and satisfy the future large demand for water there. According to the members of the WUSC, 7,800 square meters of land was purchased from three households as site for the plant. After negotiations regarding the purchase price between the land users and village officers, the local government officers, WSSDO, and other parties concerned, payment was made according to the

[20] The assessment pointed out the level of waste, geographical features and landforms, and the landscape as aspects that this project might have a slight impact on. However, according to BD Report, it was concluded that there would be no problem as long as appropriate measures were taken to mitigate such impacts. Among the specific mitigation measures were the use of existing sludge disposal sites, design to minimize the alteration of landforms, and facilities design with the landscape taken into consideration. It is concluded that these measures were carried out as a part of this project.

agreement that was reached. With no complaints filed by any former land users after the acquisition of the land, there were no negative impacts due to the land acquisition.

In light of the above, this project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Efficiency (Rating: [2])

3.4.1 Project Outputs

This project produced the outputs almost as planned. The Nepal side completed the acquisition of the site for the Dhulabari water intake facilities and the construction of a fence around the site, as well as the installation of power transmission lines. The planned and actual outputs of the Japanese side are shown below in Table 8.

Table 8: Outputs (Plan and Actual Results)

Outputs	Plan	Actual
1. Dhulabari		
1) Reconstruction of water intake facilities	Intake dam x 1 Removal of existing facilities and new construction Water intake facility capacity: 4,326 m^3/day	As planned.
2) Conduit and water pipe laying	Conduits: 3.02 km Distribution pipes: 8.8 km (11.8 km total)	As planned.
3) Water purification plant construction	Design treatment volume: 4,200 m^3/day Treatment facilities: Settling reservoir, coarse filter pond, slow filter pond Clear water reservoir: approx. 600 m^3 Disinfection facilities	As planned.
4) New water distribution facilities	Elevated water tank: approx. 450m^3 x 1	As planned.
5) Emergency home generator for existing water distribution facilities	1	As planned.
6) Distribution piping	Pipe extensions: approx. 6.7 km (conduits, distribution and supply pipes: 18.5 km total)	Almost as planned: +0.5 km (19.04 km, +0.5 km)
2. Gauradaha		
1) Water purification plant and water distribution facility improvements	Design treatment volume: 1,100 m^3/day New iron removal facility x 1 New clean water reservoir: 300m^3 x 1 Elevated water tank pump, emergency home generator	As planned.
2) Distribution piping extensions	Approx. 6.1 km	Almost as planned: 6.2 km, +0.1 km
3. Mangadh		

1) Water purification plant and water distribution facility improvements	Design treatment volume: 2,200 m3/day New iron removal facility x 1 New clean water reservoir: 300m3 x 1 Elevated water tank pump x 2, emergency generator Disinfection facility	As planned.
4. Operational components		
Training and technical guidance	Target: 3 water utilities 1)Water utility O&M staff and O&M skills training 2) WUSC organizational strengthening	As planned.
Deliverables	1) Operational component completion report x 2 2) Texts and manuals x 6 Text and manuals for water utility O&M and WUSC organizational strengthening Operation control manuals, etc.	As planned.

* Iron removal equipment: Equipment installed to remove the iron content in the water.
Source: BD Report, JICA internal documents, and interviews with the parties concerned

Dhulabari Water Purification Plant (entrance)


Gauradaha Water Purification Plant (building and facilities)

Mangadh Water Purification Plant (sterilizer)

3.4.2 Project Inputs

3.4.2.1 Project Cost

The grant ceiling specified in the Exchange of Notes (E/N) for the project is 1,124 million yen. Actual expenditures from ODA were 1,123 million yen (almost 100% of the plan). However, the total expenditure including the extra charges shouldered by the Japanese consultants is 1,163 million yen (105% of the plan). Nepalese side expenditure was originally 7 million yen at the time of plan and actual one amounts to 6 million yen (approximately 3,890 thousand Nepal Rupees) which is 85% of the plan.

For the Japanese side actual expenditure, the one from ODA was almost 100% of the plan. However, there were extra charges, shouldered by the Japanese consultants in order to complete the planned outputs. The extra charges were personnel cost and travel expenses of internal and domestic ones, all of which were incurred by suspension and delays in delivering construction personnel and materials resulted from the series of general strikes and related road blockades.

On the Nepalese side, the actual project costs came in lower by one quarter of the plan in monetary terms, and the outputs produced also saw slight decline. The project costs of the Nepalese side came lower than planned mainly because negotiations with land owners went

smoothly, making the amount of compensation for land acquisitions lower than originally estimated.

3.4.2.2 Project Duration

The project duration, including the extended period incurred by the restriction of movements placed on construction materials and workers, the actual duration was 19 months (119% of the plan) compared to the original plan of 16 months (December 2005 to March 2007).

In light of the above, efficiency of the project is fair.

3.5 Sustainability (Rating: [2])

3.5.1 Structural Aspects of Operation and Maintenance

Entities responsible for planning, construction, operation and maintenance of local water supply facility differ before and after the completion of the project. WSSDOs which are a divisional office of the DWSS, execute project planning, design and construction. After completion, WUSCs which are public entities, take the delivery of the facilities and handle operation and maintenance.

While WUSCs are local water users' organizations, they are legally obliged to manage their operations as public entities. As such, the Government of Nepal is not involved in WUSC management.

From a legal perspective, WUSCs are formed by local residents with governmental approval. They are public entities that independently operate, maintain and manage the water supply facilities, including necessary facility investments. WUSC members are elected locally for three-year terms from the water users. The WUSCs hire the staff for operations and maintenance (OM) of the water supply facilities and are responsible for the management.

The WSSDOs, under the guidance and support from the central DWSS, monitor each WUSC's work in the areas of technical and managerial dimensions, and also provide technical support through training and other means. The WSSDOs do not provide WUSCs any direct subsidies or financial support. However, WSSDOs within the limits of their annual budgets provide pipes and fittings and/or cost sharing with the WUSCs for basic water supply pipes and other high cost equipment.

The table below shows the WUSC personnel structure at the time of this evaluation.

Table 9: OM Structure for Water Supply Facilities

(Units: Persons)

	Dhulabari		Gauradaha		Mangadh	
	Plan	Actual	Plan	Actual	Plan	Actual
WUSC Members	n.a.	11	n.a.	11	n.a.	13
Operating staff						
Management	・3-shift system ・Operating staff	9	・3-shift system	1	・3-shift system	2
Technical		10		2		6
Other		10		3		4
Total operating st	26	29	9	6	16	12

Source: Interviews with each WUSC

While maintenance staff numbers have increased since the project was completed in July 2007, all but Dhulabari have fewer staff members than planned. The others are currently operating understaffed for various reasons; Mangadh is tightening its staff numbers to secure funds needed for a future well and water purification facility construction plan, and Gauradaha is operating at the current staffing level since the maximum daily volume of water supplied is at roughly 80% of its maximum capacity. No daily operational and maintenance issues could be observed in any of the two WUSCs of Gauradaha and Mangadh by having operations and maintenance staff working overtime, hiring short-term contractors, etc. On the other hand, in Dhulabari, since four posts including that of the manager's post remained vacant for over a year until March 2012, some confusion on the duties and functions among staff were found. As of June 2012, however, they are in the process of rebuilding its management system with a new manager hired and the vacant posts filled.

(1) Support structure aimed for WUSC

The WSSDO conducts surveys in the process of planning and designing for new water supply projects within its jurisdiction, handles construction and monitoring, provides technical guidance and supports to each WUSC, and runs several sanitation awareness programmes. Technical guidance is mainly for WUSC engineers and other technical staff. The personnel structure is provided in the table below.

According to WSSDO staff members, a 2 to 3 day training session for WUSC staff members were conducted before the transfer of water purification plants. Since then, as technical support aimed at 3 WUSCs, WSSDO has provided training and technical advice on operation and maintenance on average, once or twice a month average as required. However, due to personnel and budgetary constraints, they are not offering any specific practical training or guidance catered for each water purification plant.

Table 10: WSSDO Staff

(Unit: persons)

Units: Persons	Morang District WSSDO	Jhapa District WSSDO
Management	9	11
Technical Staff	13	14
Community Support Staff	2	2
Total	24	27

Source: WSSDO interviews and questionnaire responses

Note: For the targeted areas in the project, the Mangadh WUSC is under jurisdiction of the Morang District WSSDO, and the Dhulabari and Gauradaha WUSCs are under jurisdiction of the Jhapa District WSSDO.

Furthermore, a JICA Technical Cooperation Project aimed at strengthening technical support structure for WUSCs run by WSSDO is currently underway from 2010 (see table below). This Technical Cooperation Project has two aims: 1) train WSSDO staff and the three WUSCs under this project in maintenance skills and managerial aspects of water purification plants, and 2) build a technical support mechanism for WUSCs centered around the WSSDOs. While there has been training to this point for both WSSDO and WUSC staff, the midterm review survey (November 2011) conducted for the said Technical Cooperation Project indicated that WSSDOs did not have any guidance staff pertaining to managerial issues along with other issues.

Based on the report of the midterm review for the said project, it is unclear whether a technical support structure and mechanism aimed for WUSC by WSSDO, can be established

within the said project period. The report forecasts that the decision will be made in the second half of the project. According to DWSS, in order to strengthen the managerial directives of WSSDO, placement of dedicated staff to WSSDO is underway, and positioning of central level staff has been decided to strengthen the organizational structure and thus, it can be expected that future support structure will adequately be positioned.

Table 11: Overview of JICA Project for Capacity Development
for Water Supply in Semi-urban Areas
Duration of the project: January 2010 – July 2013

Target groups:		
	DWSS line Office of Eastern Regional Monitoring Supervision Office (EMRO) staff	
	Morang and Jhapa District WSSDO staff	
	Dhulabari, Gauradaha and Mangadu WUSC staff	
Project Objectives:		
	DWSS technical support system to WUSCs is implemented in Morang and Jhapa districts	
Examples of capabilities expected to be strengthened		
	Technical	**Managerial**
WSSDO	Creating construction management indicators	Construction management ability
	OM of waterworks and facility	Water supply facility OM guidance for WUSC
	Studying monitoring methods	Evaluating management and facility control indicators
	Community measures (claims, etc.)	Creating support models
WUSC	OM for water utilities, pipeline, meters, etc.	Maintaining water facility and water supply ledgers
	Meter reading, billing and water rate revisions	Fixing leaks and otherwise improving revenue water and profitability
	Non-revenue water measures, water quality control	Monitoring evaluations
	Creating monitoring items, monitoring methods	Creating medium and long-term business plans and annual reports
	Processing and handling claims	Expediting claim measures

Source: Excerpted from Project Inception Report
Note: The Eastern Regional Monitoring Supervision Office (EMRO) is the supervision office for the DWSS branch office for eastern Nepal, where Morang and Jhapa Districts are located.

3.5.2 Technical Aspects of Operation and Maintenance

In the said Technical Cooperation Project conducts a series of technical training in areas related to their work duties, the trainees of which include staff at the 3 WUSCs and water purification plants. With few turnovers of skilled and experienced OM staff in Gauradaha and Mangadh, the experienced staff members in the purification plants are mostly responsible for maintaining technical expertise. As such, the basic daily operations such as purification and distribution of water, maintenance of water quality and maintaining operational records, etc., are sufficiently met technically. If there are no major problems in the facilities, they are at a technical level where effective operation could be maintained. In Gauradaha and Mangadh, issues exist in the internal weaknesses seen in lack of mechanism for sustaining and improving technical expertise in OM, necessity for standardizing the technical skills of staff, lack of preventative maintenance measures[21], and lack of ability to respond to emergency situations as malfunctions of pumps and electrical systems are reliant on external support.

In Dhulabari, as with the other 2 water purification plants, daily operations of the water purification and supply facilities are conducted and basic level of technical capacity exists.

[21] Regular checkups that are conducted, e.g. bi/monthly and/or bi/annually, even without particular malfunction.

However, unlike the other water purification plants, the skilled and experienced staff have already left their posts, and this casts uncertainty as to the sustainability of the required technical capacity in OM. Field observation and interviews during this evaluation revealed several issues. More specifically, lack of maintaining basic records such as records of water purification operations and water pumping to the overhead tanks, maintenance records of water supply facility and equipments including purification facility, lack of water quality tests by the laboratory, non-attention to water leakages seen inside the water purification facilities, inability to respond to pumps and electrical malfunctions, etc., and the awareness towards sustainable OM seem to be low.

At all three water supply facilities, turnover of skilled and experienced staff could pose challenges to WUSCs in maintaining the skill levels of the staff, as their internal system for maintaining and improving sustainable OM skills are weak. As such, they are taking in external technical support to be fully capacitated in the long-run, and are currently working to build and establish internal systems for improving OM skills from the Technical Cooperation Project of JICA and from WSSDOs. In this regards, it is understood that the demonstration of project effects might have been earlier if the Technical Cooperation Project would have been initiated at a more appropriate timing, at the same time of the implantation of this project for instance.

3.5.3 Financial Aspects of Operation and Maintenance

(1) Balance of payments

As seen in the financial overview in the table below, all the WUSCs are currently managing to produce retained earnings. About 70% of their operating revenue is from sale of water and other miscellaneous revenues generated e.g. connection fees collected from new water users, interest income, etc. In recent years, fuel and electricity costs are rising, and there is a necessity to increase the water tariff that compensates for the respective rise in such costs. However, in accordance with WUSC procedure, any rise in water tariff requires the WUSC to consult with and obtain consent from the water users at the annual general meeting[22]. According to WUSC members, it takes an average of two years to obtain consumer consent. Thus, such factor may become a destabilizing element for the financial situations of the WUSCs.

Table 12: Financial Summary

(Units: 10,000 Nepalese Rupees)

	Dhulabari2)	Gauradaha3)	Mangadh
Operating balance (2011)	17.02	3.68	31.36
Revenue from water charges/total revenues	69%	72%	65%
Charge collection rates	95%	95%	95%

Source: Operation earning reports, business plans and interviews with each WUSC
Notes: 1) Charge collection rates obtained in WUSC interviews.
2) Results for 2010
3) The Gauradaha earnings report includes amounts for WSSDO-provided equipment in its monetary income and expenditures. However, as no actual money is transferred, this figure is not including this amount.

The current financial state conditions for each of the WUSC are as follows:

[22] WUSCs hold an annual general meeting once a year for local residents/users who are WUSC members to explain the year's performances, earnings report and plans for the following year. Here, there is also an exchange of opinions.

<Dhulabari>

- Have had retained earnings since 2007. However, the income figures for water sales as estimated from water bills do not reconcile with the accounting ledgers.
- The 2009 annual report of the Technical Cooperation Project reported problems such as no spare parts being purchased. However, in interviews at the time of the evaluation, the WUSC chairman said that there was budget in place for fuel expenses and spare parts and that the Dhulabari WUSC was procuring spare parts both locally and from India.
- In the WUSC annual general meeting in the start of 2012, consumers were consulted about raising water tariffs, but it was not possible to successfully raise the rates. Further, the cost of production has not been calculated.

<Gauradaha>

- While the Gauradaha WUSC has kept excess income for each fiscal year since 2009, its profitability is on the decline. With less secure power supply over the past three years due to a worsening power supply, Gauradaha relies upon generators for supplemental power. This has greatly increased fuel costs and electricity tariffs increased. These increases are responsible for the decrease in account surplus.
- According to WUSC members, the WUSC has the budget for fuel costs, spare parts and repairs and purchases parts available in nearby areas. As requisite chlorine was provided by the WSSDO up through mid 2011, the WUSC had no related spending on file. Further, cost of production has not been calculated.
- Tariff collection rates are at least 95%.
- According to WUSC members, Gauradaha area electricity rates are scheduled to increase in 2012, and they are aware of the need to reflect this cost increase in their water tariffs. The rate increase will require WUSC to consult with their consumers at the annual general meeting, and they expect to obtain consumer consent.

<Mangadh>

- The main source of revenue is from sale of water and other miscellaneous revenues. Revenues from water sales alone cover their total expenditures. Connection fees and other miscellaneous revenues have totaled 50-70% of water sale revenues over the past three years, keeping their revenue sources stable overall.
- According to WUSC members, the WUSC has the budget for procuring fuels, spare parts, requisite chlorine and other items. It seems to have sufficient financial capacity to sustain operations for their current activities.
- According to WUSC members, they have not raised water tariffs in the past three years, but they are reliant on generators for supplemental power due to a worsening power situation and less secure power supply. They recognize the need to reflect the increase in fuel costs and other expenses in the water tariffs and have explained this to residents in past annual general meetings. They look to gain users' approval for a water tariff increase at the next annual general meeting and the outlook for this is reasonable.

(2) Long-term business plan and equipment upgrades plans

The WUSCs' draft long-term business plans (2010 - 2025) formulated with the assistance of JICA Technical Cooperation Project incorporate maintenance costs, equipment upgrades and service area expansion plans. Mangadh has created a maintenance fund based on calculations of the expenses needed for equipment upgrades and installations. Dhulabari and Gauradaha have

similar funds[23], but their balance of the funds are not in line with the long-term business plan since targeted amount for covering necessary expenses have not been calculated. Therefore their viewpoints in management, which would be revealed in long-term business plan and capital investment plan with necessary financial backing, shows deficiency. In this sense, it might have been possible for the Technical Cooperation Project to assist them prepare a more complete long-term business plan if the said project started earlier. Mangadh, under sound management, the financial conditions are well maintained, and factors such as prospects for succeeding to raise water tariff[24] which can potentially raise profitability, possibility of securing private sector financing for capital investment[25] for facility and equipment, etc., can help raise the possibility of achieving their long-term business plan. Of the other two WUSCs, the Gauradaha WUSC is expecting at its next annual general meeting to have its water tariff increase approved, and it is expected that this can raise profitability. In Gauradaha and Dhulabari, measures for water leakages have commenced through the JICA Technical Cooperation Projects, and this can potentially help strengthen the measures against non- revenue water (NRW) mentioned in the next section. Furthermore, DWSS's efforts in improving its support structure to WUSCs can be expected to produce improvements in WUSCs' management.

(3) Impact of Non Revenue Water

The following chart gives the rate of NRW[26] for the three water supply facilities in this project.

Table 13: Non Revenue Water Rate (2011)

		Dhulabari	Gauradaha	Mangadh
Non-revenue water rate (%)	Actual	58%	33%	21%
	Plan	n.a.	n.a.	n.a.

Source: Calculated from data collected in the ex-post evaluation

With the exception seen in Mangadh, non-revenue water rates are high. It exceeds 30% of the total water production volume in Dhulabari and Gauradaha, but the cause of the high non-revenue water rate is not clearly identified.

The rates are estimated to be particularly high in Dhulabari, exceeding 50%[27]. Possible causes include leaks in supply and distribution pipes, faulty meters and leaks within the water purification plants. However, as Dhulabari has not calibrated its flow meters for water intake and distribution and does not record other water flow within the purification plants[28], none of

[23] Both towns had total reserves of roughly 500,000 yen in 2011.

[24] According to the Chairperson, in 2011 annual meeting requested for the understanding on the financial situation and possible improvement of service after water tariff increase so that the prospect of approving raising water tariff would be high.

[25] The draft business plan shows good financial situation, further increase of water demand and population in the service area, future water tariff setting and possible balance of payments. The WUSC Chairperson is confident in taking loans, based upon good financial perspective, from banking institutions in private sector.

[26] The amount of water not delivered to the users, calculated by deducting the portion of billed amount of water from total amount of water supplied.

[27] The NRW rate is calculated based upon the following data for 2011: total amount of water supplied 2540m^3/day, the total billed amount of water 1076m^3/day, and the amount of non-revenue water 1464m^3/day.

[28] According to the new manager who took office in March 2012, they have started new initiatives, including

technical staff or WUSC committee members have identified the cause. The likely causes in Gauradaha are increased water use during piping maintenance and faulty meters.

In interviews with each WUSC, the Chairpersons answered that non-revenue water negatively affected the financial situation. In order to fix the leaks, the three water supply facilities are making repairs as they are notified of leaks by residents and have started installing new type of joints to prevent leakage from the joints[29]. However, the WUSCs are only capable of limited work and have no forecasts on how much the work will reduce non-revenue water rates. They are repairing leaks for joints on pipes when notified, new type of joints are only installed when any excavation is scheduled, and are only checking faulty meters which show no reading for water flow or are otherwise obviously faulty. As this could lead to medium and long-term financial instability, the WUSCs must conduct in-depth search of all leaks, identify the faulty meters and replace them quickly.

3.5.4 Current Status of Operation and Maintenance

While this has had no impact on project's effectiveness, malfunctioning of flow meters and some problems with monitoring panel displays, buzzers that would not sound, etc., were found at the time when this evaluation was conducted. Aside from Dhulabari, there were generally few problems with day to day maintenance of the other facilities and equipment. In Dhulabari, the problems were seen with the maintenance of slow filtration facilities and the frequency in which filter sand is washed. A field survey of this evaluation in December 2011 also revealed a roughly 0.5 liter per minute leakage in the premise of the purification plant.

The plants also have issues with upgrading equipment. According to some WUSC members, WSSDOs assisted the WUSCs to procure parts which can be obtained locally, but some parts such as filter sand and flow meters are not available locally. There are also issues with preventive maintenance; neither Dhulabari nor Gauradaha plants have long-term plans for equipment upgrades with financial backing[30] or equipment maintenance plans.

From the above, the operations and maintenance of this project in part, faced some systematic and technical issues and the existence of some concerns for future financial sustainability. Therefore sustainability of this project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project places its objectives in increasing the population receiving safe and reliable water supply through improvements in water supply facilities in three local cities where there is an urgent need to improve the water supply conditions. As such, the objectives are consistent with those development needs and development policies of Nepal, as well as that of the aid policies of the Government of Japan, therefore the relevance is high. Although the outputs have been achieved almost as planned, the efficiency of the project may be rated as fair because the project duration extended compared to the original plan. The amount of water supply,

recording water distribution from the overhead tanks.

[29] Apart from the information confirmed during the interviews, the said Technical Cooperation Project is providing technical knowledge on; i) routine run of water distribution pipe routes and method of identifying and repairing leakage by checking air valves and gate valves; ii) installation and inspection of household water meter; iii) handling of claims on meter and exchange of meter.

[30] Both of the draft long-term business plans, which included equipment upgrading plan, for each WUSC were prepared as a part of assistance from the Technical Cooperation Project. However their equipment upgrading plans have few actual financial backing such as funding and installment saving that can cover the accrued expense, thus yet to demonstrate its validity.

population served, and water quality of the three water purification plants have mostly achieved their planned targets and the users' high level of satisfaction toward the water supply services revealed that the objective of this project, increasing the population served with safe drinking water, is evaluated to have been achieved. Therefore the project's effectiveness and impact is high. However, more efforts are required for the extension of water supply network in order to expand the effect of this project. Furthermore, despite the operators of the water supply facilities, the WUSCs were able to produce retained earnings, factors such as deficiencies found in its draft business plans by not having precise and sufficient financial backing to implement the planned replacement of equipment outlined in its draft long-term business plan, and the understanding that in the short-run the establishment of support mechanism to WUSC by WSSDO may be difficult despite the technical cooperation project currently supported by JICA, lead to the assessment that the sustainability of this project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to Executing Agency and Operation and Maintenance Agency

(1) Enhancing the WSSDO support system for WUSCs

As mentioned in "3.5 Sustainability," the current JICA Technical Cooperation Project is in the process of building technical support systems and mechanisms for the WUSCs. While it is not clear how this project will establish such support systems and mechanisms, in order to improve the technical guidance aimed at WUSC quantitatively and qualitatively, there is a necessity to strengthen the capacity of WSSDOs by developing its staff capable of providing managerial supports. WSSDO is responsible in providing necessary guidance and training to WUSCs. Also, the WSSDOs need to increase the allocation of personnel who are capable of providing assistance for management aspect because current WSSDO staff members are mostly engineering backgrounds.

(2) Extending water distribution and service pipe network for water supply facilities

As mentioned in "3.2 Effectiveness," through the extension of water supply and distribution network, more people in the service areas would benefit from this project, but delays in the expansions of the networks are dragging down the achievement of this project. Dhulabari's achievement in population served was short of the target due to slow expansion of the water supply network. Gauradaha's achievement in effectiveness is high but the amount of water supply, which is caused by slow expansion of the water supply network, and thus could hinder the sustainability of the project's effectiveness. Based on the draft long term business plan, in Gaurada and Mangadh, population in the two water service areas are expected to grow, and as such, in Gauradaha, further effort on expansion of water distribution and service network is necessary to sustain the project's effect and also to meet the future increase in population.

(3) Water quality checks by designated examination agency, and awareness in water quality control

As stated in "3.2 Effectiveness," Dhulabari does not have water quality inspections and has low awareness in terms of water quality control and in improving water quality based on the examination results. As safe drinking water is a key issue in water supply, the WSSDO should promote the usage of external water quality examination agencies to periodically conduct water

quality tests. The WSSDO should assist Dhulabari WUSC members and the staff in charge of water quality checks to better understand the importance of controlling water quality. Also, it needs to properly monitor inspection status and results, follow up with technical guidance on water quality control as required.

4.2.2 Recommendations to JICA

(1) Strengthening managerial support system through the Technical Cooperation Project

As stated in "3.5 Sustainability", in order for WUSC to be able to maintain and operate facilities in a fuller extent, managerial dimensions of their capacity must be strengthened. Not only should capacity building support to WUSC include facility maintenance skills but also skills for financial management. Further, there should have been a support system in place before the project commences to provide sufficient guidance both quantitatively and qualitatively for WUSCs throughout the project period. The current JICA Technical Cooperation Project needs to further strengthen short to mid-term managerial support contents[31] for WUSC by giving guidance in preparing more practical long-term business plan and strengthen the WSSDO in terms of guiding on basis of monitoring data. It is perceived that such measures could further strengthen the effects of this project and improve sustainability.

4.3 Lessons Learned

(1) Appropriateness in setting the project target

The planned water supply target of this project was set based on the presupposition that the implementing agency, through its self-support or WSSDO, expand water distribution and service pipe network to the unconnected areas. Enlarging such water distribution network necessitates investment in facilities, but no evidence was found that verifying the feasibility of procuring such necessary funds at the planning stage. When setting project targets, if major influencing factors in achieving the planned target such as expanding the water supply pipe network exist, more prudent project scope by verifying the feasibility of funding for the capital investment plan made at the planning stage and cautious target setting should be considered.

(2) Guidance given to technical and managerial dimensions in the Technical Cooperation Project.

Management and technical expertise vary from WUSC to WUSC, and at the planning stage, the WSSDOs were providing the WUSCs insufficient technical support both qualitatively and quantitatively. These may have led to the necessity of having extensive external support provided from organizations such as ADB and JICA. In this project, such supports were provided a few years after the completion of the project, and as such, it could have been expected that the effect of this project may had been produce more rapidly, should such support had been provided on a more timely basis simultaneously to the implementation of this project. Any support for projects such as water purification facilities, which require both technical and managerial expertise and skills, should consider having the appropriate combination of technical cooperation and other support commensurate to the capacities of the managing entities at the planning stage of the project.

[31] In addition, practical contents might be desirable using precise case studies to learn through discussions on problem solving and other exercises.

Ecuador

Ex-Post Evaluation of Japanese Grant Aid Project
The Project for Improving Water Supply Systems in the Cities of Huaquillas and Arenillas

External Evaluator: Tsuyoshi Ito, IC Net Limited

0. Summary

This project was implemented to realize 24-hour water supply in Arrenillas and Huaquillas, which are left behind for their socio-economic development due to the influence of the conflict over the border between Peru and Ecuador. This project is consistent with the priority areas in Ecuador's national development policies and Japan's aid policy, and is also very consistent with development needs in the target region. Accordingly, the relevance of this project's implementation is high. The project's costs and duration are both in line with the plan, indicating that efficiency is also high. The targets for clean and safe water production capacity have been achieved, but the goal to provide users with benefits such as 24-hour water supply was not achieved. Moreover, the anticipated economic and public health impacts did not materialize. For these reasons, the project's effectiveness is fair. There are major problems with organizational sustainability, such as lack of decision on the organizational approach for the local water utilities administrations in the cities of both Huaquillas and Arenillas, the project's implementing organizations. There are also financial issues. Thus the sustainability of the project's effects is deemed to be low.

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

1. Project Description

Project Locations


Water treatment plant built by the project

1.1 Background

In its national development plan running from 2001 to 2005, the Ecuadorian government aspired to meet water demand and prevent water-borne diseases by building and upgrading water supply facilities.

The cities of Arenillas and Huaquillas in El Oro province, this project's target region, are located near the border with Peru. Development in this region has been delayed due to border disputes between these two countries over the past 50 years. In order to solve problems caused by obsolete water supply systems and to prepare for the future increase in water demands in the cities, both cities devised a water supply plan for an inexpensive and reliable waterworks system whereby water would be drawn from Tahuin Dam, a multi-purpose dam in Arenillas, and then supplied and distributed using a gravity fed system. This plan was devised as part of a study

carried out with support from a Peru-Ecuador Binational Peace and Development Fund[1]. The design of the water supply system adopted an idea that the two cities share a same water source from Tahuin Dam. This idea was the only possibility because Arenillas River, which holds Tahuin Dam, was the only water source in the area.

However, due to shortage of available fund, the Ecuadorian government requested grant aid cooperation from the Japanese government in February 2002. In response, the Japanese government sent a preliminary study team to Ecuador in May 2004, followed by the first basic design study team from November 2004 to March 2005 and the second basic design study team from June to November 2005. In addition to considering the specific location for the water treatment plant and the structure and construction site for the distribution reservoir, a basic design proposal was prepared. Based on these study results, agreements on this project to be carried out with grant aid cooperation were concluded in January 2006.

1.2 Project Outline

The objective of this project is to ensure a 24-hour water supply in the two urban areas in Arenillas and Huaquillas by constructing a regional water treatment plant and providing the intake pumps, water pipes to distribute the water to the city of Huaquillas, and the water pipes within Huaquillas.

The project's implementing agency is the local water utilities administration in Arenillas and Huaqillas, which were set up by the two cities (Empresa Municipal Regional de Agua Potable de Arenillas y Huaquillas; hereinafter "EMRAPAH").

Grant Limit/Actual Grant Amount		2,058 million yen/2,043 million yen
Exchange of Notes Date		Detail Design: January 2006/Construction: May 2006
Implementing Agency		Local water utilities administrations in the cities of Arenillas and Huaqillas (EMRAPAH)
Project Completion Date		February 2009
Project Contractors	Main work	Taisei Corporation
	Consultants	Joint venture of Kyowa Engineering Consultants Co., Ltd., and Nihon Suido Consultants Co., Ltd.
Basic Design		First: November 2004 – March 2005 Second: June – December 2005
Related Projects		None

2. Outline of the Evaluation Study

2.1 External Evaluator

Tsuyoshi Ito, IC Net Limited

2.2 Duration of Evaluation Study

Duration of the Study: September 2011 – November 2012

Duration of the Field Study: November 22 – December 9, 2011, April 28 – May 11, 2012

[1] The fund was established with support from the United States in 2000 as a result of the 1998 peace agreement with Peru.

2.3 Constraints during the Evaluation Study

None.

3. Results of the Evaluation (Overall Rating: C[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Ecuador

In Ecuador's national development plan (2001-2005), which was in effect when this project was being planned, building and upgrading water supply facilities was the most important issue, and improving public health conditions in small-scale self-governing municipalities was to be pursued as a priority. The cities of Arenillas and Huaquillas, the project's target regions, were designated as priority regions for this infrastructure development.

Access to safe water is identified as a human right in the current constitution that took effect in 2008.

The latest national development plan (2009-2013), in effect during this ex-post evaluation, identifies water supply as one of the priority issues. Developing water supply infrastructure has been a national priority from the time this project was planned through this evaluation.

Accordingly, this project is consistent with policies in Ecuador.

3.1.2 Relevance with the Development Needs of Ecuador

The two target cities are located near Ecuador's border with Peru, a region in which the impact of the border disputes between the two countries has led to delays in establishing basic economic and social infrastructure compared to other regions. The Peru-Ecuador Binational Fund for Peace and Development was established in 2000 after the 1998 peace accord between the two countries. Past projects financed by the fund include three waterworks-related projects, two roads projects, two education projects and one livestock project, showing that the needs in the waterworks area were high. However, the proposed budget for the water supply project by this plan was too large for the Ecuadorian government and for most of the potential donors to consider its materialization.

Looking at the condition of the waterworks supply systems in the two cities at that time, it is noted that restrictions were placed on the water supply in Huaquillas due to lack of development and deterioration of water pipes. Underground water was the only water source, and it was directly pumped from wells, resulting in problems such as excessively high costs for pump fuel and the inability to obtain water when the pump broke down. As a result, many households had their own water storage tanks and pumps, and there were concerns that this siphoning off of water using household pumps would lead to contamination with dirty water.

Similarly, Arenillas also restricted water supply as a result of the deterioration of the water treatment plant and problems with distribution pipes. Moreover, some regions were not covered by the water supply network, and only received water via a water wagon. Since the capacity of the water treatment plant was inadequate, highly turbid water was supplied without being treated during the rainy season.

The populations of the two cities were continuously increasing at the time of this evaluation, which implies the needs for stable water supply to the urban areas in the cities remained high. Given these conditions, the development needs in the water supply sector in the two target cities

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③:High, ②:Fair, ①:Low

were high.

3.1.3 Relevance with Japan's ODA Policy

Japan's basic aid policy for Ecuador in fiscal 2005 was "to provide aid in the three priority sectors of poverty countermeasures, environmental conservation and disaster prevention, primarily through grant aid cooperation and technical cooperation." In addition, now that Peru and Ecuador had achieved peace, grant cooperation projects and technical cooperation projects carried out with the aim of providing development support in the border region between Peru and Ecuador were given priority. The "waterworks and sewage" sector was one of the individual priority sectors, included as part of "development of basic infrastructure in "poverty countermeasures." This aid policy was kept in place in fiscal 2006, when this project was implemented.

This project is consistent with Japan's aid policy at that point, given that the project was in the waterworks and sewage sector, one of the priority areas for aid, and the project contributed to the development of the region along the border with Peru.

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

3.2 Effectiveness[4] (Rating: ②)

3.2.1 Quantitative Effects

3.2.1.1 Operation Indicator

The regional water treatment plant produces 100 liters/second of water as planned.

3.2.1.2 Effect Indicator

The amount of water supplied per person, the water supply duration, and the residual chlorine concentration were set as the indicators showing the effect of this project. Information on users' satisfaction from a beneficiary survey carried out in this evaluation study was added to these indicators for analysis.

[4] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 1: Achievement of Targets in Arenillas

Indicator	Baseline (2004)	Target (2008)	2010	2011
Population (people)	15,183	16,759 (2008) 17,608 (2010)	21,326 (2010 census)	
No. of registered users[5] (cases)	2,831	-	3,926	4,047
Water supply	Water source pumps supply 4,780 m^3/day (about 55 liters/sec.)	Water supply capacity of the water treatment facility shared by both cities is 28 liters/sec (about 2,419 m^3/day) of the 100 liters/sec (8,640 m^3/day)	30 liters/sec	30 liters/sec
Amount of water supplied per person	133 liters/day	150 liters/day	No data	No data
Water supply duration	Average 46 hours per week	24 hours/day	21.5 hours/day	21.5 hours/day 24 hours of water supply in 16 of 35 zones
Residual chlorine concentration	0.12mg/liters in central urban areas only	More than 0.1mg/liters throughout the project target area	Undercuts this level in some areas	Undercuts this level in some areas

Source: Materials provided by EMRAPAH, information from the questionnaire and interviews to EMRAPAH

[5] Officially registered users connected to water distribution pipes. Generally households.

Table 2: Achievement of Targets in Huaquillas

Indicator	Baseline (2004)	Target (2008)	2010	2011
Population (people)	44,665	51,056 (2008) 54,587 (2010)	48,285 (2010 census)	No data
No. of registered users (cases)	7,683	-	12,046	12,223
Water supply	Total production volume of water source (well) is 6,680 m^3/day (about 77 liters/sec.)	72 liters/sec (about 6,220 m3/day) of 100 liters/sec (8,640 m3/day)	70 liters/sec	70 liters/sec
		Amount of well water supplied	60 liters/sec	60 liters/sec
Amount of water supplied per person	About 130 liters/day	150 liters/person/day	No data	No data
Water supply duration	Average 56 hours per week	Tap water is supplied to households 24 hours/day	Average of about 20 hours/day of service, with 24 hours/day for 60% of regions, 12 hours/day in 30% of regions, and less than 8 hours/day in 10% of regions	Average of about 20 hours/day of service, with 24 hours/day for 60% of regions, 12 hours/day in 30% of regions, and less than 8 hours/day in 10% of regions
Residual chlorine concentration	Not detected in almost all neighborhoods	Less than 0.1mg/liters region-wide	Undercuts this level in some areas	Undercuts this level in some areas

Source: Materials provided by EMRAPAH, information from the questionnaire and interviews to EMRAPAH

① Amount of water supplied per person

This data could not be determined because EMRAPAH was not able to collect it. The main reasons that this data could not be collected were that little progress has been made in installing water gauges in homes and water gauges are not read even in homes where water gauges have been installed. Data on this indicator was not even collected during the basic design study of the project, and the study applied a figure of Machala city, the capital of El Oro state as the target value of the project plan. The basic design study did not propose any method to measure achievement of the project with regard to this indicator, and this

evaluation decided not to use this indicator as a means of performance measurement of the project.

② Water supply duration

In Huaquillas, 60% of the target area receives water for 24 hours, 30% receives for 12 hours, and 10% for less than 8 hours. Overall achievement rate can be calculated as 78.3% (60x1.0+30x0.5+10x0.33). In Arenillas, 16 out of 35 zones receive water for 24 hours. EMRAPAH does not have zone wise data of water supply hours, but they explained average water supply hour in the other 19 zones is about 12 hours. Based on this information, overall achievement rate is 72.9% (16/35x100x1.0+19/35x100x0.5). Calculation of a weighted average of the achievement rates of two cities using the water division rate of 7:3 between Huaquillas and Arenillas gives a total achievement rate of 76.7%.The areas, where water supply duration is inadequate are always found in certain areas in both cities. EMRAPAH contends that this is attributable primarily to inadequate water pressure. Elevation is somewhat higher than the water treatment plant in some parts of the cities, so the water pressure of water from the treatment plant is insufficient. Moreover, in regions receiving water from the Loma Quito water treatment plant[6] in Arenillas, water pressure declines when the water supply from the Loma Quito plant is backed up, preventing water from being supplied.

Although detailed information could not be obtained, in Arenillas, the urban region outside the center of the city initially envisaged in the project is developing, and the rising population in this region could be destroying the overall water supply/demand balance, which may be another cause of the low water pressure. Indeed, the 2010 census results showed that the population of Arenillas was 21,326 in 2010, about 1.2 times the 17,608 projected in the basic design survey.

In addition, power outages are having an impact. These power outages are not very frequent, occurring a few times a week, and not all of the power outages are significant. However, according to EMRAPAH, it takes time to restore the water treatment plant and intake site pumps once there is a major power outage, and sometimes the water treatment plant is out of operation for two to three days. The unstable power supply seems to affect the potential to realize stable water supply.

The connection rate, rate of connected households in respective cities, increased from about 60% to 95% in Arenillas with the city's laying of distribution pipes in 16 channels in 2008, and stood at 100% in Huaquillas.

③ Water quality

The residual chlorine concentration of water sent from the regional water treatment plant is measured on a daily basis, and is kept above 0.1 mg/ℓ. Water quality tests are carried out every week for the end-user as well at four sites, with the testing site changed by the week. This testing has showed that the concentration falls below 0.1 mg/ℓ in some places, but overall the necessary chlorine concentration is maintained region-wide.

Daily testing and sample tests at four end-user sites by EMRAPAH indicate that there are no problems with aspects of water quality besides residual chlorine concentration.

[6] Due to serious deterioration, water supply capacity of Loma Quito treatment plant has been decreased significantly and quality of water is also in worrying situation.

Nevertheless, although there is no official data, in some areas of Arenillas at high elevation, water from the water intake is sent directly without any treatment due to the low water pressure of water from the treatment plant. In these regions, there is a possibility that the water quality is not appropriate.

3.2.2 Qualitative Effects

During this evaluation study, a beneficiary survey was conducted with 106 samples, 42 in Arenillas and 64 in Huaquills. Samples were selected evenly and randomly from regional blocks of two cities.

3.2.2.1 Beneficiaries' Satisfaction with Water Quality

According to the beneficiary survey carried out as part of this evaluation study, 28% of the respondents in Huaquillas and 19% of them in Arenillas sensed a smell other than chlorine. More than 70% of the people in Huaquillas attesting that the water smelled described it as a putrid odor. However, as a result of this project, the well water and the water from the treatment plant intermingle at the juncture of the water service pipes. Thus it is unlikely that the odor of the well water would still be present when it arrived at the end-user. The problem likely lies with the water service pipes and/or the individual households' water storage tanks.

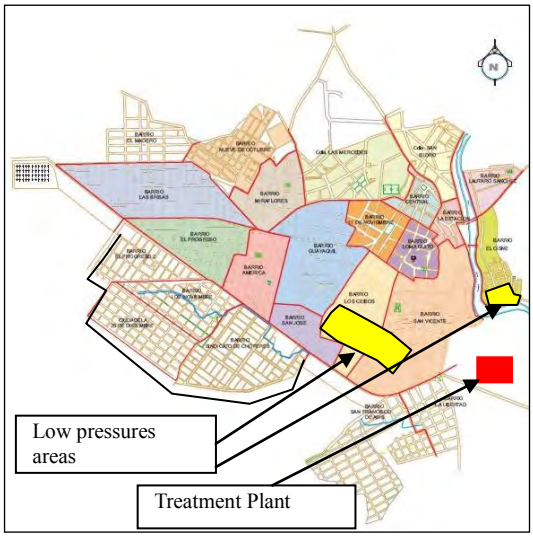
Almost no respondents in the beneficiary survey said that they drink the tap water as is. Half of the respondents boil the water and the other half buy drinking water, indicating that the credibility of tap water as drinking water among the users is low.

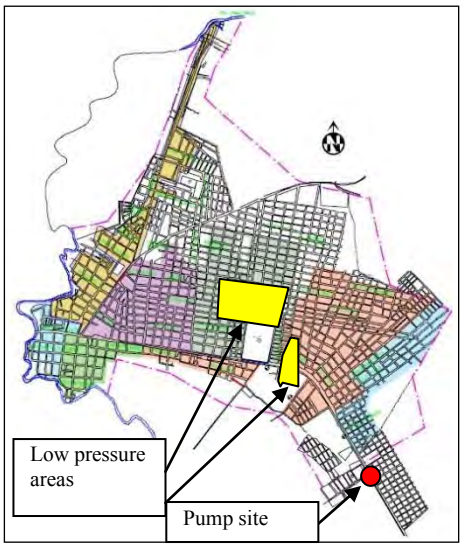
However, as noted above, water quality tests indicated no particular problems. Thus the dissatisfaction expressed by the beneficiaries is likely an issue of preferences such as taste, rather than a safety problem.

3.2.2.2 Beneficiaries' Satisfaction with Water Volume, Water Pressure and Service Overall

According to the results of the same beneficiary survey, 32% of the respondents in Huaquillas and 19% in Arenillas stated that water pressure was "low" or "absent." When the EMRAPAH offices used maps to confirm this, it was found that there were areas in which water pressure did not rise in some areas of the cities characterized by high elevation.

Selection of the location of the treatment plant was one of the priority issues of the basic design study of the project, and the selection was made considering availability of land and suitability for the water delivery system by the gravity.





Source: Materials provided by EMRAPAH and information obtained in interviews to EMRAPAH

Fig. 1: Low-pressure regions in Arenillas Fig. 2: Low-pressure regions in Huaquillas

In this survey, 63% of the respondents in Huaquillas and 52% in Arenillas said that they were satisfied with current water supply services overall (total of "very satisfied" and "satisfied" responses). This is just over half of all the respondents. This project made contribution to improve water supply hours, although it did not reach the original target, and also contributed to maintain the water quality properly. However, low credibility of water quality and dissatisfaction to the water supply service of the users are still persistent. These may be caused partly by the low quality of the water from Loma Quito and instability of water supply from the wells in Huaquillas. At the same time, shortfall of public relation activities by EMRAPAH to send correct information to its users to make them understand the improvement in the water supply service seems to be another cause.

As a result of the above, although the effect has been produced as in the initial plan of water production capacity of the regional treatment plant and proper water quality, the targets for water supply duration have not been reached.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Economic Effect of Decreasing Pump Use

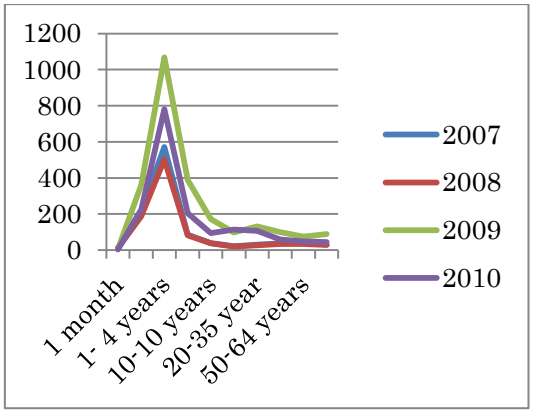
According to the beneficiary survey conducted in this evaluation study, the usage rate for pumps by household in Huaquillas stands at about 25%, almost unchanged from 23% in 2008. Most of the respondents who used a pump in 2008 still use a pump in 2011, and the usage duration was also about the same in 2008 and 2011. Given this, it is fair to surmise that reliance on the pumps is about the same as it was before the project. It was not possible to calculate the electricity costs for the parts only used by the pumps because many are electrical pumps. However, it is safe to say that there was no significant change in the cost of pump use[7].

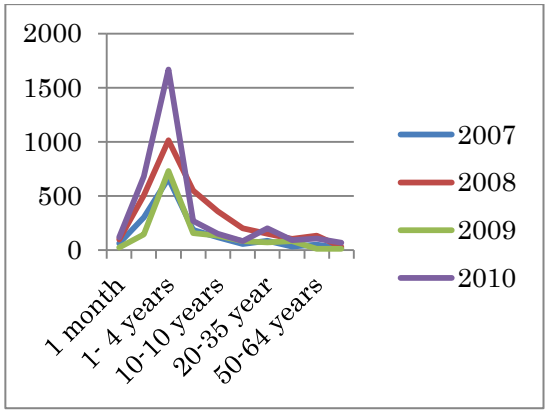
[7] The basic study report of this project mentions that before the project, most of the area was supplied water with insufficient water pressure and most of the households were using suction pumps, although the report does not show how the data was collected and no exact figure of rate of pump use among the target households was specified. Due to this situation, this evaluation conducted analysis based on the data on pump use before and after the project which

3.3.1.2 Impact on Improving Health

Water-borne illness cases by age by year between 2007 and 2012 obtained from two municipal hospitals of the cities are shown in the graphs below. Since the completion of the project was February 2009, data of 2007 and 2008 can be regarded as pre-project data, and those of 2009 and 2010 as post-project data. In all years, 1 to 4 year old group shows highest number of cases and tendency of number of cases by age among the sample years is basically the same.

However, it does not appear that the prevalence rate of water-borne diseases in the target regions improved after the project[8].





Source: Data from the municipal hospitals in Arenillas and Huaquillas

Fig. 3: Water-borne illnesses in Arenillas

Fig. 4: Water-borne illnesses in Huaquillas

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

The concentrated sludge treated in the sludge tank and sludge concentration tank are dried and disposed of on a designated site in the treatment plant premises with a proper manner. Although data on exact amount of disposal was not found, based on the on-site observation, during this evaluation, the volume was not very large, and there would be no impact on the environment.

3.3.2.2 Land Acquisition and Resettlement

Land of about 8,000 square meter was acquired for the water treatment plant from a private owner when the project was implemented, but there were no problems because appropriate legal procedures were followed, and no relocation took place.

As such, the project's goal has been achieved as planned in terms of water production and water quality, and the goal of providing 24-hour water supply has not been fully achieved with about 77% of achievement rate. Meanwhile, the anticipated contribution to economic gain by reduction of private pump use and hygienic impacts were not confirmed. Accordingly, this project has somewhat achieved its objectives, therefore its effectiveness and impact are fair.

collected through the beneficiary survey conducted during this evaluation.

[8] There can be other causes of water-borne illness than the contaminated tap water, however, this evaluation study could not include detail analysis to identify exact cause(s) of the illness.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Table 3 shows the outputs provided as part of this project's grant aid cooperation (planned and actual), and Table 4 shows the outputs provided by Ecuador (planned and actual).

The following techniques were adopted to reduce operating costs for the aforementioned facilities and equipment.

- Instead of using dam water as the water source, as proposed in the request, pre-treatment, such as aeration treatment and biotreatment, could be skipped by drawing water downstream of the dam to take advantage of contact with the air forcibly discharged from the dam and the river's self-cleansing effect.
- The west coast and east coast of the Arenillas River were considered for the site of the treatment plant. The east coast was selected for its greater ease of construction and the lower cost of pump operations.
- Since Huaquillas is characterized by flat terrain facing the ocean, the construction of four service reservoirs (overhead tanks) in the city was requested, but it was decided to supply water using the natural downward flow within the city to minimize the use of pumps.

Table 3: Output Provided through Grant Aid Cooperation (Planned/Actual)

Item	Planned	Actual
Water treatment plant	1) Water intake facility One gate, one storage shed renovation,45Kwx3 (110L/sec) pumps, installation of three new pumps, two control panels (one existing and one new), one suction pipe and internal pipework)	As planned
	2) Equipment introduced (water intake facility – water treatment plant) dia.300mm, 270m, DIP	47 air bulbs, one more than planned
	3) Water treatment plant: 100L/sec (8,640 m^3/day) Receiving well (2m×2m×3m), flocculation basin (4m×37.4m×1.7m), chemical sedimentation basin (5.3m×14.75m×3m; 2 basins), high-speed filter (4.2m×3.1m, 13.02m^2; 6 basins), transmission pumps (6.5m×14m; one-story pump), purification basin (20m×30m×3m, two basins, also used as service reservoir), outdoor drying bed 5.5m×12m×1m, four basins), administrative building (13m×20m, one-story, one chlorine room and one electricity room), chemical injection materials (aluminum sulfate, hydrated lime, two sets), chemical injection materials (pre-, intermediate- and after-chlorination	As planned
	4) Transmission facility (water treatment plant – Arenillas service reservoir) dia.250mm, 1,180m, PVC	1,080 m, 100 m less than planned; 35 drain bulbs, one more than planned
	5) Arenillas service tank 12m×14m×3m; one 500 m^3 tank	As planned
	6) Emergency power generator (675kVA) -Diesel power generator, fuel tank	As planned
	7) Civil engineering and architectural construction Water conveyance and service/transmission pump room, chemical injection building, filter management building	As planned
Water service in Huaquillas	1) Huaquillas water service tank: two 1,800 m^3 tanks 20m×30m×3m in dimension, also used as a treatment basin 2) Huaquillas water service pipes: dia.500mm, 19,860m, DIP 3) Huaquillas city water service pipes: dia.250mm–500mm, 5,020m, PVC/DIP	Water service pipes are 19,940m in length, 80m longer than planned. Water service pipes within the city are 4,670m, 350m shorter than planned.
Technical guidance	Technical instruction on maintenance and management for operating and maintenance staff	As planned

Source: Basic Design Study Report, materials provided by JICA, questionnaire

Moreover, in order to simplify maintenance and management, a decision was made to avoid using machinery that would require operating and maintenance inspections and repairs, and only the bare minimum of measuring devices and no electric measuring devices were installed. Specifically, the maintenance and management plan did not call for equipment requiring complex maintenance and management, such as internal transmission pumps and sludge collectors, and instead, called for water regulating valves that could be opened and closed by hand for easy operation.

The modest specification changes shown in the "actual" column in Table 1 were due to revisions based on accurate measurements when a detailed design was prepared in the case of the water pipes and water service pipes, while the change in the number of valves was due to adjustments in the water pressure as a result of the difference in elevation. Both were modest adjustments made to conform to actual conditions when the detailed design was drawn up.

Table 4: Output Provided by Ecuador (Planned/Actual)

Planned	Actual
Acquisition of land planned for use for water treatment facility	As planned
Construction of access road	As planned
Laying of electrical wires, electric transformer	As planned
Fence around water treatment plant's environs	Not implemented yet

Source: Basic Design Study Report, questionnaire, interviews with EMRAPA

3.4.2 Project Inputs

3.4.2.1 Project Cost

Japan's costs amounted to 2,043 million yen (49 million yen for the detailed design, 109.758 million yen for supervision of works, 1,895 million yen for the work and construction), which is 99.8% of the original estimation, is mostly as planned.

Ecuador's contribution amounted to 105,183 dollars (9,000 dollars for land acquisition, 2,000 dollars for access road upgrades, 94,183 dollars for electrical wiring and electric transformers).

The differences between the estimates for Japan's contribution and the actual amounts were primarily the result of greater detail in the design once the detailed design was prepared, and were not the result of changes in the plan.

The measures necessary by the Ecuadorian side for land appropriation and repairs to the access roads were taken and there were no problems. Fences for the water treatment plant were not constructed since the two cities did not recognize urgency of the fence construction. According to EMRAPAH, there had not been any problems thus far as a result of a lack of fences.

3.4.2.2 Project Period

The project period was 37 months, from the signing of the E/N on the detailed plan in January 2006 to February 2009. Although the environmental impact evaluation and approval took time, there were no delays, and the project duration was 97.6% of its original estimation, which is shorter than planned.

Both project cost and project period were within the plan, therefore efficiency of the project

is high.

3.5 Sustainability (Rating: ①)

3.5.1 Structural Aspects of Operation and Maintenance

3.5.1.1 Organizational Structure

This project was an initiation of the establishment of EMRAPAH[9]. The two cities reached agreement in May 2004, and the agreement was signed on June 2 of the same year. The mayors of Arenillas and Huaquillas take turns as president of EMRAPAH, with the Arenillas mayor currently serving as the president. The administrative board is made up of two people each from the city council members of Arenillas and Huaquillas. The board chairman is sent from the National Secretariat for the Water (Secretaria Nacional del Agua: SENAGUA).

The Arenillas office[10] is in charge of managing the regional water treatment plant built in this project The Arenillas office is the principal office, which also handles financial information, including that for the Huaquillas office[11]. User registration and record keeping, water charge collection are handled by respective offices independently with no integrated management between the two offices.

The new constitution revised in 2008 requires ordinance of a public company to clarify a role of the state government and to show a right number of board member according to the constitution. Consequently, revisions to the ordinance founding EMRAPAH were prepared in March 2008, and Huaquillas formally decided to authorize the revised ordinance with one revision on August 1, 2010. However, in November 2010, Arenillas requested five revisions in the articles so that the water distributed from the regional water treatment plant would be equally divided. At the time when this evaluation was carried out, the two cities had not agreed to the revised ordinance, and the organization remained in place without an updated EMRAPAH ordinance.

As mentioned in the later section, there have been very serious discussions among the stakeholders over split-up of EMRAPAH. If the split-up of the company is decided, extensive restructuring of the organization and reallocation of staff members according to new demarcation among the separated companies will be necessary. This situation gives a great uncertainty in the future if EMRAPAH will be able to maintain its ability of operational management of the regional water treatment plant and other facilities.

A closer look at how and why this problem developed shows that the two cities do not have a public agreement on dividing the water in a 3:7 ratio between Arenillas and Huaquillas. When the project's basic design study was carried out, the Japanese construction consultant proposed this water distribution ratio as a pre-condition for the design, and the cities essentially agreed to the water distribution when they agreed to the basic design. However, currently, the Arenillas mayor bases his contention that the water should be divided equally on the fact that there is no tangible agreement document on this 3:7 water distribution ratio. Given that other parties involved cannot contest this, it is fair to conclude that consensus-building on water distribution in this project was not well established.

[9] Usually in Ecuador, a municipal government has responsibility of water supply in a city, and before the establishment of EMRAPAH, the two cities operated water supply service independently.

[10] In charge of management of the Loma Quito water treatment plan; the city's water supply network; and the city's users and collecting water rates.

[11] The Huaquillas office is in charge of chlorine injection for the city, pump sites, the seven wells in the city, managing the water supply network within the city, managing Huaquillas users and collecting water rates.

The EMRAPAH administrative board has not been able to find any solution to these problems of water division and amendment of the EMRAPAH ordinance.

Both cities' mayors at least agree on the future of EMRAPAH that it should be self-supporting. In 2011, Arenillas independently hired a consultant to analyze current conditions of water supply service of EMRAPAH, and, as a result, proposed that the waterworks operations should be divided into (1) a water intake and treatment operation, (2) Huaquillas water distribution operation and (3) Arenillas water distribution operation, to be run as respective independent businesses. The Arenillas mayor agreed with the proposal to break up the operation, but asserts that Arenillas should have control over the regional water treatment plant. Discussions were held with the mediation of the Ministry of Urban Development and Housing (Ministerio de Desarrollo Urbano y Vivienda, MIDUVI) on May 10, 2012, during the on-site study period of this evaluation, and steps were taken to begin resolving this problem, but the outlook cannot yet be predicted.

Moreover, lack of integrated management of finance between the two offices of EMRAPHA, lack of holistic information management, lack of standard format of official documents are also challenging issues for appropriate coordination between the two offices.

3.5.1.2 Personnel Appointments

The appointment of the current EMRAPAH manager, who has the overall responsibility of EMRAPAH operation, ended in July 2011. However, due to the delay of revision of the EMRAPAH ordinance, the manager must remain in employment without any steps being taken for the manager's re-appointment or for the selection of a successor.

With regard to the personnel who work for the facilities constructed by the project, three people work at the water intake pump site, eight at the water treatment plan (of which one is an inspector) and two in the water quality testing room, with job rotations also carefully prepared and job records taken. This personnel system for the operation and maintenance of the water treatment plant has not led to any obstacles.

Huaquillas now has two staff members for water charge collection, and plans to hire two more. It was estimated that each staff member could deliver water bills to 100 users a day on average, but this has not been achieved. Rather, users receive water bills at a pace of about one every six weeks. Arenillas office has three staff members for water charge collection, and each staff member delivers the bill to about 70 users a day, which is better than the situation of Huaquillas but still need more recruitment.

Regarding the organizational structure, the wells that provide water for Huaquillas are all on privately owned land, and land rent is not claimed by the owner and is not paid. The rent can be claimed by the land owners in any moment of the future, and this implies that EMRAPAH has to rely on a basic infrastructure, which is not under their control, and EMRAPAH recognizes that it will be a source of concern in the future.

A more significant problem that EMRAPAH also recognizes is the weakness in technology and knowledge on management. EMRAPAH does not prepare annual plans or medium- and long-term plans. This is partly due to problems with the individual staff, but failure to ensure the organization's sustainability is the also a main factor behind this. As a result, the decision-making and command control structure remains ambiguous, with no steps taken to improve organizational management. In particular, this impedes the collection and management of information and data, with the exception of that related to the water treatment plant, such as water quality, water pressure, user records, charge collection, and leads to a negative cycle in

which the materials needed for decision-making in management cannot be obtained. If this negative cycle is not well addressed, EMRAPAH will have difficulties in preparing variety of plans such as renewal of facilities, production increase to meet increasing demand and improvement of finance through water fee rate revision and betterment of charge collection.

As such, there are still major organizational problems, and discussion on the future structure of EMRAPAH ignited by revision of its ordinance to be in accordance with the new constitution is moving toward split up of the company. Due to these situations, there is a good possibility that EMRAPAH will have a significant scale of restructuring of the organization and reallocation of staff members, which lead to possible changes in operational system of the regional treatment plant constructed by this project.

Given these factors, it is fair to conclude that organizational sustainability has many problems.

3.5.2 Technical Aspects of Operation and Maintenance

Eight operators run the water treatment plant in line with the operating manual, which runs without problems. Water quality tests are carried out daily at the water treatment plant, and a report is prepared on a weekly basis. There are no problems with the procurement of test reagents and other materials. In recent years, water has also been tested for microorganisms and heavy metals, but there is not enough testing equipment for this.

Data on the amount of water supplied and water quality at the water treatment plant is collected and managed regularly. However, information is not managed appropriately at EMRAPAH overall, so the Arenillas office and Huaquillas office do not share information with each other and the necessary information cannot be immediately retrieved.

Four staff members at the water treatment plant (two in the water quality testing room and two in operations) received technical guidance in this project. Of these, one staff member each from the testing room and operations has left their jobs, but this has not led to technical difficulties for the daily operation and the basic maintenance of the regional treatment plant.

In order to maintain the effect of the project including increased water supply hours and better water quality, not only the constructed water treatment plant, but also Loma Quito and wells in Huaquillas should be properly managed and maintained. Arenillas' Loma Quito water treatment plant and managers of the wells in Huaquillas receive technical support from the regional water treatment plant built as part of this project as necessary and information is shared within EMRAPAH to maintain and raise technical strength. As a result, there are no problems with normal operations at these existing facilities.

This project did not provide intensive technical training other than simple instruction on operation of the provided facilities when the plant was constructed, but reliable water supply and regular water quality inspections continue. No major problems were observed with the technology needed to manage the water treatment plant.

3.5.3 Financial Aspects of Operation and Maintenance

3.5.3.1 Balance of Income and Expenditure

EMRAPAH's revenue consists, roughly, of the collection of fees from users, supplementation from the city government and grant from the central government. The subsidies from the central government are paid out through the city government. The two cities share the operating costs for the intake pumps equally, and Arenillas pays 30% and Huaquillas

70% of the operating costs for the water treatment plant in line with the water distribution ratio. The annual income and expenditure data is shown in Table 5. Arenillas tends to have a deficit and Huaquillas a modest surplus, but overall this fluctuates significantly every year. EMRAPAH relies on external funds from the cities and the central government for more than 50% of its total revenue. The central government provides certain amount of money to EMRAPAH every year through the municipal governments and two cities have obligation to make up deficit of EMRAPAH. EMRAPAH's finance is managed by office-basis, meaning that each office in Arenillas and Huaquillas has an independent account book, and two cities are supposed to make up deficit of respect offices (Article 100 of the EMRAPAH ordinance states that the cities must cover EMRAPAH's losses). However, as demonstrated in the figures for the "city government's contributions" and "central government subsidies" in the table, city contributions and subsidies from the central government fluctuate significantly, which is a major factor behind the upward and downward volatility in annual revenue. Arenillas office experienced deficit for three years in the past five years mainly due to shortage of these external income, and Huaquillas also has been in trouble since 2009. Internal revenue, which comes from water charges, is on the rise, but at present a stable revenue source has not been secured.

Moreover, the fees collected (item 1 of table 5) include a 10% fee for contributions to water source conservation, but there is no organization in central government either in local government, which is responsible for water conservation. This money is merely retained by EMRAPAH essentially as a deposit, but it is not clearly earmarked on the book. This means actual revenue of the company is 10% less than it shows on the table and the actual deficit is larger. In addition, total uncollected water charges (including interest on arrears, item 2 of table 5) carried over from the period prior to EMRAPAH's establishment amounts to about 2 million dollars on Huaquillas' books, but 800,000 dollars of this consists of fees charged to users that do not exist as a result of mistakes in user records. This means that the actual amount is about 1.2 million dollars. The collection of delinquent fees accounts for quite a large percentage of their income, about 20 to 30$ for Huaquillas and more than 20% or even nearly 50% in some year for Arrenillas. This means that reliance on revenue that was not accrued in that fiscal year is high, or large amount of account receivable are not collected within the fiscal year. This is not a desired situation as healthy financial management.

Table 5: EMRAPAH's Finances Since 2007 (Unit: US dollar)

		2007	2008	2009	2010	2011
1. Revenue from charges	Arenillas	9,601.59	57,883.66	106,118.94	127,436.95	200,906.32
	Huaquillas	34,499.44	101,494.12	174,858.28	278,367.32	332,422.02
2. Collection of unpaid charges	Arenillas	54,035.70	88,967.86	89,789.24	122,369.47	102,545.82
	Huaquillas	149,638.38	144,176.67	162,190.63	217,598.53	346,422.24
3. Contribution from city government	Arenillas	90,464.52	139,413.70	128,223.21	153,051.16	91,988.59
	Huaquillas	26,945.00	26,875.89	6,500.00	12,000.00	0.00
4. Subsidy from national government	Arenillas	71,145.40	145,296.65	6,520.36	191,834.61	15,987.50
	Huaquillas	214,151.47	363,307.71	0.00	577,459.19	0.00
5. Total revenue from outside (2+3)	Arenillas	161,609.92	284,710.35	134,743.57	344,885.77	107,976.09
	Huaquillas	241,096.47	390,183.60	6,500.00	589,459.19	0.00
	Sum	402,706.39	674,893.95	141,243.57	934,344.96	107,976.09
6. Total revenue (1+2+5+other revenue)	Arenillas	226,658.31	434,434.93	313,038.19	600,282.99	427,825.07
	Huaquillas	431,973.63	637,438.96	351,891.20	1,088,871.48	747,592.95
	Sum	658,631.94	1,071,873.89	664,929.39	1,689,154.47	1,175,418.02
7. Total expenditure	Arenillas	208,318.20	446,930.48	472,083.91	500,166.50	529,030.42
	Huaquillas	262,165.90	557,978.10	646,706.88	1,032,708.75	708,256.30
	Sum	470,484.10	1,004,908.58	1,118,790.79	1,532,875.25	1,237,286.72
8. Revenue and expenditure	Arenillas	18,340.11	-12,495.55	-159,045.72	100,116.49	-101,205.35
	Huaquillas	169,807.73	79,460.86	-294,815.68	56,162.73	39,336.65
	Sum	188,147.84	66,965.31	-453,861.40	156,279.22	-61,868.70

Source: Basic design report, information obtained from questionnaire and in interviews to EMRAPAH

EMRAPAH has several new projects including renovation of Loma Quito treatment plant and construction of water tanks and they require investment money. Considered this demand on the future funding, current financial situation of EMRAPAH is not regarded as stable. Considering the current shortage of budget to repair the Loma Quito water treatment plant and to build new elevated tanks in Arenillas and the ongoing discussions on split-up of the company, possibility that the financial situation of EMRAPHA is getting better seems to be low.

3.5.3.2 Fee Collection

Table 6 provides current water charges.

Charges are levied based on the readings in cases in which houses are equipped with water meters, while a basic rate is charged for houses not equipped with water meters, but in reality all users are only charged this basic rate. Some are of the opinion that the amount of water that can be used for the basic rate, stipulated in the rates table as 23 cubic meters, is too high, but this is because rates are not charged based on meter readings. In Huaquillas, rate collection at a metered rate has been started on a trial basis with 200 households, and Arenillas wants to start a similar trial.

Data on the non-revenue water could not be obtained since data on water usage on the user side is not collected. Accordingly, the data needed to devise financial plans including rate of non-revenue water, cannot be compiled.

The payment rate remains about half. Steps are being taken to raise the payment rate, such as handing the rate collection slip directly to the user, stopping water services for those who are delinquent in paying their water charges, and requiring proof that water charges have been settled on the property in question when city government authorizes real estate transactions.

Table 6: Water Charges (Unit: US dollar)

Category	Private homes	Commerce	Industry	Government
Basic usage amount (m^3)	23	50	75	30
Unit price for usage above basic usage amount (cent/m^3)	0.12	0.2	0.4	0.06
Basic charge (USD)	2.76	10	30	1.8
Fixed fee collection (USD)	1.5	2	3	0.75
Fee for preservation of Arenillas River valley (10% of basic charge, USD)	0.276	1	3	0.18
VAT (USD)	0.25	0.75	1.5	0.15
Total cost (For basic usage amount)	4.79	13.75	37.5	2.88

Source: EMRAPAH

3.5.4 Current Status of Operation and Maintenance

The on-site investigation carried out as part of this evaluation study confirmed the following about equipment and facility conditions.

① Condition of the regional water treatment plant

- All three regulators for chlorine gas injection broke down about one year after they began to be used, and were replaced for 3,000 dollars each. However, one of the new regulators broke down. Thus intermediate injections are not being carried out now.
- The conditions of equipment other than the aforementioned chlorine gas regulators are good.

② Condition of the intake

- Cracks have formed on the floor and walls of the intakes and the regional water treatment plant's pump room, as well as on the outer wall of the distribution water tanks.
- There is a risk of collapse of the slope behind the intake pump house due to improper protection of the slope.
- The water channel leading from Arenillas River's reservoir to the intake is not well maintained. In some cases, places in which the structure has collapsed and those in which large amounts of sediment, such as sand from the slope, has collected in the channels have been left unattended. EMRAPAH is aware of this problem and estimates that it would cost 100,000 dollars to fix, but there are no prospects for raising this money.
- On only one occasion the water gate for irrigation water intake was closed to prioritize the supply to the treatment plant when the water level in the Arenillas River felt during the dry season. However, there were no other problems with water intake.

Gradient of backside of intake

Conduit to intake

③ Conditions in Arenillas

- One of the reasons why the objective of the project, 24-hour supply of water, was not achieved in Arrenillas is the existence of some areas, which elevation is high and water pressure from the regional plant was not good enough. Stable supply of clean water to these areas can be realized by upgrading of Loma Quito water treatment plant. Arrenillas city has been considering upgrade of water pipes and construction of additional elevated distribution tanks. EMRAPAH states that this would cost 800,000 dollars, while the Arenillas mayor maintains that 1.5-2 million dollars would be needed, and there has been no official earmark for these expenditures in budget plan of the city government.

④ Conditions in Huaquillas

- The floor of Huaquillas' chlorine injection facility was leaning in 2010 and was repaired. Subsequently, cracks were observed in the surrounding surface.
- The basic design of the project was prepared based on a precondition that the existing wells produce more than 40 litters/second of water so that total amount of water supplied to Huaquillas meet the demand of the city. At least three wells have to be operated to satisfy this precondition. Existing wells in Huaquillas pump over 15 liters/second at present. The water supply from existing wells is not stable due to changes in the level of water table as well as suspensions of pump operations as a result of replacement of decrepit parts and delinquent electricity fees. Moreover, of the seven wells, PH7 is not operating due to problems with water quality, and PH1 and PH4 are not in operation because, respectively, replacement parts are being awaited and electricity fees are in arrears.

⑤ Other

- The fiscal 2011 subsidies from the central government were to be used for the work to install valves in Arenillas (95,000 dollars) to control water pressure, and work to repair existing wells in Huaquillas (387,000 dollars) to maintain the total water supply capacity, but the two cities were behind in providing the funding (17,800 dollars from only Arenillas) and the plan could not be implemented. These measures are necessary for future realization of the original project target of 24 hours water supply.
- There are problems with the user registration database, which is indispensable for charge

collection. Revisions were made to ensure consistency with the city hall's resident records, but there are multiple records for the same person and records of users who do not exist, and records are not updated to reflect name and land ownership changes. As of Sepptember 2012, Huaquillas has finished revising about 85% and Arrenillas finished 80% of their records.

The defect inspection made some recommendations on facility operations and maintenance, and at the time of this evaluation, these recommendations have generally been addressed without problems except the "install an electrical stabilizer in the water intake to prevent defects of the control panel for the pumps." This has not been done. There have not been any problems thus far, but EMRAPAH recognizes that it must be installed soon.

As noted above, there were signs of aging in some of the facilities of the project, but nothing that would cause major problems. The cause of the breakage of the chorine injection regulators is unknown, but replacements were bought through their own efforts. One of these broken down and a replacement has not been ordered, but there are no problems with chlorine concentration so it does not seem to be having a severe impact.

At the same time, there are points requiring improvement, including protecting the gradient of the slope to the rear of the intake pumps and upgrading the channels leading to the intake pumps. In addition, EMRAPAH has established its own individual plans to improve facilities, but these plans have not been implemented due to failure to procure funding. These difficulties in the maintenance and operation are also potential hindrance against the sustainability.

As shown above, major problems have been observed in terms of the organizational system and financial conditions, therefore sustainability of the project effects is low.

4. Conclusion, lesson Learned Recommendations

4.1 Conclusion

This project was implemented to realize 24-hour water supply in Arrenillas and Huaquillas, which are left behind for their socio-economic development due to the influence of the conflict over the border between Peru and Ecuador. This project is consistent with the priority areas in Ecuador's national development policies and Japan's aid policy, and is also very consistent with development needs in the target region. Accordingly, the relevance of this project's implementation is high. The project's costs and duration are both in line with the plan, indicating that efficiency is also high. The targets for clean and safe water production capacity have been achieved, but the goal to provide users with benefits such as 24-hour water supply was not achieved. Moreover, the anticipated economic and public health impacts did not materialize. For these reasons, the project's effectiveness is fair. There are major problems with organizational sustainability, such as lack of decision on the organizational approach for the local water utilities administrations in the cities of both Huaquillas and Arenillas, the project's implementing organizations. There are also financial issues. Thus the sustainability of the project's effects is deemed to be low.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency (EMRAPAH) and two city governments

- Agreement on the revised founding ordinance for EMRAPAH should be reached with all due urgency. Currently, differences in opinion between the two cities and their joint management of the shared water treatment plant and the two cities' multiple independent water sources makes for a very complex management environment for EMRAPAH's current administrative and management structure. Going forward, EMRAPAH should consider simplifying responsibilities and operations as much as possible. A proposal to split up EMRAPAH has been raised, and both cities have expressed interest in this proposal. Ultimately, this should be decided based on a consensus reached between the two cities and the current public corporation, but MIDUVI should facilitate discussions as the intermediary to ensure that there is a forum in which to pursue concrete issues.
- Optimizing the method by which the two cities provide financing should also be considered when the EMRAPAH ordinance is revised. Currently, financing is supposed to be provided by covering the annual loss by the two cities. Since amount of money for the covering can be different year by year, it makes it difficult to prepare medium- and long-term financial plans for EMRAPAH and the cities. One approach would be to set a medium- to long-term schedule for EMRAPAH to achieve financial independence and then provide an amount determined in advance in line with this schedule. Whatever method is adopted, one that would stabilize EMRAPAH's finances, which enable it to strengthen the service, should be established.
- The system for compiling and managing management information, such as user records, connection records, payment books, meter installation and maintenance records, and water use records should be redeveloped to provide necessary information for the mid and long term operation plan.
- The channel leading to the intake pump house should be upgraded to prevent from blockage of the channel in future.
- Both cities need additional water sources rather than the water from the regional treatment plant to supply enough water to the cities. Water from the regional plant and water from the other water sources are mixed in the distribution pipes in the cities, and amount and quality of the water from the additional water sources directly influence the effect of the project. Therefore, proper management of the additional water sources is very important for the sustaining the effect of the project. In order to secure enough safe water for the cities, strengthening of maintenance activities to rehabilitate the Loma Quito water treatment plant in Arenillas and ensure stable operations of the existing wells in Huaquillas are indispensable.
- In some part of Arrenillas, the water is delivered directly from the water intake without any treatment. Also, due to the above mentioned reasons of instable water supply from the other water sources, there are some areas, where quality of water may be inappropriate. Regular water quality test should be conducted to understand the real situations in these areas, and correct information on the safety of the water should be provided to the users.

4.2.2 Recommendations to JICA

JICA should consider the possibility of technical support on the management side, such as help establishing medium- and long-term plans and financial plans, customer management, and

information management, on the condition that revisions to EMRAPAH's founding ordinance are completed. Failure to fully acquire these management techniques could pose significant risks to the sustainability of the project's anticipated effects.

4.3 Lessons Learned

① Cautious assessment in preparing for acceptance of implementing organization

It is extremely risky to start projects characterized by a complex political and administrative context, such as collaborative projects involving multiple organizations like this project, when the counterpart organization has not been established or not yet been operational in full scale. The timing for the project's start should be cautiously assessed. If possible, it should not be started until the establishment of the counterpart organization has been confirmed in writing, at the very least. Moreover, even after the project has been started, the project should be monitored for risk management to determine whether the formal establishment of the counterpart organization is proceeding as planned and it is equipped with technical and management capacities.

② Importance of management techniques

In relation to the above mentioned assessment of acceptability of implementing organization, there is one aspect worth emphasizing. In the case of grant-aid cooperation, technology for facility maintenance is analyzed in advance, but consideration of management techniques enabling the executing organization to run the facility for its sustainable business, including ability to prepare mid-term and long-term plans and financial management is not always adequately considered. However, in the case of this project, there were no critical problems with the facility maintenance techniques, but inadequate management techniques have led to major problems in realizing the project's effect and impact and ensuring sustainability. Preliminary study should analyze management techniques for carrying out business operations using the facility, and not merely techniques for running the facility, and necessary actions should be incorporated into the project plan.

③ Forming a separate consensus on important issues

Water allocation between regions is extremely important in water supply projects. In this project, water allocation between the two cities was stipulated as a premise in the basic design report and the two cities signed a comprehensive agreement on the substance of the basic design. Nevertheless, a consensus document on water allocation was not prepared. This lack of a consensus document on water allocation is one of major factors that is currently complicating efforts to resolve problems between the two cities.

The basic design study for the grant aid cooperation project laid out proposals for the many important issues to be considered, and the stakeholders' consensus on the basic design could be seen as an agreement on all of the proposals included in the design. However, the donor side should also be sure that an independent agreement document should be signed to ensure consensus on important areas that could be contested in the future. Alternatively, making such establishment of written agreement on critical issues among the stakeholders a pre-condition of the project implementation could be another possibility. In any cases, careful consideration on necessary conditions for the success of the project should be made at planning stage.

Egypt

Ex-Post Evaluation of Japanese Grant Aid Project
"The Project for Upgrading of El Mahala El Kobra Water Treatment Plant"
External Evaluator: Noriyo Aoki, IC Net Limited

0. Summary

The objective of the project is to improve the situation of water supply in the city of El Mahala El Kobra and ten surrounding villages in the Gharbeya Governorate of the Arab Republic of Egypt by upgrading water treatment plant facilities and water distribution network, and by implementing technical training of staff in charge of operating and managing those facilities, thereby contribute to the improvement of living environments in the area.

The relevance of the project is high because it is consistent with priority areas of Egypt's development policy and with Japanese assistance policy, and Egypt's development needs are also high. The effectiveness of the project is high because it was confirmed that major operation and effect indicators were closely in line with planned figures, and that the awareness of improved water supply as a result of the project was high through the survey of the beneficiaries conducted during this evaluation study. Both the project cost and period were within the plan; therefore its efficiency is high. Although there are no major issues with structural and technical aspects of operation and maintenance, some minor issues exist related to the procurement of foreign countries' spare parts and the maintenance of some facility; therefore the sustainability of the project effect is fair.

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

1. Project Description

Project Location

Coagulation Sedimentation Basins

1.1 Background

El Mahala El Kobra is an industrial city with textile industry in the Nile Delta. The city's population has been increasing ever since its textile industry began expanding in the 1980s; however, water supply facilities had not been upgraded enough to keep pace with the population growth, and water supply shortages became evident. Certain areas within the city limits had not enjoyed water supply chronically, and water supply facilities were in urgent need of upgrades to secure a consistent supply of water. A water treatment plant, small and simple purification facilities (compact units), and wells served water in the planned area. However, the situation of water supply had not been profoundly resolved, and the city needed new expansion of its purification facilities including repairs of the existing facilities which were worn out.

1.2 Project Outline

The objective of the project is to improve the situation of water supply in the city of El Mahala El Kobra and ten surrounding villages in the Gharbeya Governorate by upgrading its

water treatment plant facilities and water distribution network, and by implementing technical training of staff in charge of operating and managing those facilities, thereby contribute to the improvement of living environments.

Grant Limit/Actual Grant Amount	2,423 million yen / 2,387 million yen
Exchange of Notes Date	June 2006
Implementing Agency	National Organization for Potable Water and Sanitary Drainage (NOPWASD)
Project Completion Date	March 2009
Main Contractor	Dai Nippon Construction (DNC)
Main Consultants	Yachiyo Engineering Co., Ltd. and Tokyo Engineering Consultants Co., Ltd., JV
Basic Design Study	July-December 2005
Related Projects (if any)	The Project for Improvement of Management Capacity of Operation and Maintenance for Water Supply Facilities in Nile Delta Area (April 2011-March 2014)

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriyo Aoki, IC Net Limited

2.2 Duration of Evaluation Study

The external evaluator performed an evaluation study as follows in the course of the ex-post evaluation:

Duration of the Study: September 2011-November 2012

Duration of the Field Study: February 6-21 and April 21-May 2, 2012

2.3 Constraints during the Evaluation Study

None in particular.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Egypt

The Egyptian government identified two priority objectives for the water supply sector in its fifth five-year National Economic and Social Development Plan (2002-03 to 2006-07): raising water supply capacity from 19 million m^3/day to 26 million m^3/day and expanding the water distribution network from 26,000 km to 30,900 km by 2007.

Based on these national objectives, the National Organization for Potable Water and Sanitary Drainage (NOPWASD) has combined project plans for all large-scale water supply and sewerage facilities in the country except those in Greater Cairo and Alexandria into one five-year plan and has been implementing projects with authorization from the Ministry of Housing and Utilities[3], the supervisory authority.

By the time of the ex-post evaluation, the Egyptian government had also called for upgrades

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

[2] ③: High; ②: Fair; ①: Low

[3] The name of the ministry had changed to "Ministry of Housing, Utilities and Urban Development" by the time of the ex-post evaluation.

of water supply and sewerage facilities amongst its priority objectives for upgrading utilities in its sixth five-year National Economic and Social Development Plan (2007-08 to 2011-12). The objectives are to raise water supply capacity from 21.9 million m^3/day to 27.8 million m^3/day and expand the distribution network from 29,200 km to 36,100 km by 2012.

NOPWASD has identified two priority measures in accordance with the aforementioned five-year plan: building a new water purification plant to achieve 100% coverage of water supply and improving the operating efficiency of the existing purification plant.

At the time of the evaluation, the Gharbeya Potable Water and Sanitation Company (GHAPWASCO)[4] had developed a new Gharbeya Water Supply and Sewerage Master Plan (2011-2037)[5] and aims to increase the water supply capacity of existing facilities from 360 L/s to 800 L/s within the plan year by further improving capacity of operation and maintenance.

In light of the above, the project was in line with Egypt's development plan at the time of both ex-ante evaluation and ex-post evaluation.

3.1.2 Relevance to the Development Needs of Egypt

Water from the old water treatment plant[6] in El Mahala El Kobra (hereinafter called "Old Treatment Plant"); small simple purification facilities (hereinafter called "Compact Units"); and wells has been provided to the target area in the past, however the Old Treatment Plant is aging rapidly and the salinity of well water is high due to groundwater pumping. The entire target area has suffered problems with water pressure, quantity and disruptions of water supply.

Water is supplied and distributed by pumps' pressure, however water supply from the Old Treatment Plant and Compact Units stops during power outages, causing water pressure to fall, sewage to seep into water distribution pipes and contamination of the water inside those pipes.

The plan of the project addresses the needs, and the external evaluator confirmed the needs of implementing the project in terms of both the supply side and the demand side.

3.1.3 Relevance to Japan's ODA Policy

Japan established the Official Development Assistance Charter in 2003 that emphasized the supply of safe water as one major issue to address in the course of reducing poverty and ranked it as a vital area of assistance for improving the quality of life.

Japan's "Country Assistance Program for Egypt" has considered the upgrade of water supply as a priority area of Japan's assistance since the early 1980s. Before the project, Japan implemented projects related to water supply in the Sharkiya Governorate, Giza and Greater Cairo, and no projects targeted the Gharbeya Governorate, the third-most populous governorate in Egypt. The project in the Gharbeya Governorate will likely serve a huge number of beneficiaries, and its relevance is evident in terms of the priority of assistance as well.

GTZ is the major donor for assistance to Egypt in the water supply sector, and it provides

[4] As explained in the section on sustainability, the sector was reformed and the Gharbeya Potable Water and Sanitation Company changed its name because it changed from a government agency to a corporation with an independent accounting system.

[5] After the sector was reformed in 2005, it was possible to make plans on the governorate level.

[6] This is the treatment plant built in Phase 1 and Phase 2 in 1984 and expanded in Phase 3 in 2001, all with assistance from Czechoslovakia. It stands on the property of the treatment plant targeted by the project. There are other treatment plants in the city limits built by Great Britain in 1924 that are also undergoing repairs, and these have also been referred to as "Old Treatment Plants." For the purposes of this report, "Old Treatment Plant" refers to the facilities built with assistance from Czechoslovakia.

assistance focusing on establishing and bolstering a central maintenance and monitoring agency. Japan focuses on maintenance and transfer of technology as it cooperates with the organizations in charge of the water supply and sewage at a governorate level, and there is a clear divide between the areas to which Japan provides assistance and those of other donors.

In light of the above, the project has been highly relevant to the country's development plan, development needs, as well as Japan's assistance policy; therefore, its relevance is high.

3.2 Effectiveness[7] (Rating: ③)

3.2.1 Quantitative Effects

3.2.1.1 Operation Indicators

As shown in Table 1, the project has achieved the target value of 800 L/s according to the plan by adding 400 L/s of purified water from the new treatment plant to the 400 L/s of purified water from the Old Treatment Plant on the same property.

Table 1: Operation Indicator

Indicator (unit)	Benchmark (2005)	Target Value (2010)	Actual Value (2010)	Pct. of Planned Value
Water supply quantity in L/s	400 L/s	800 L/s	800 L/s	100%

Source: Questionnaire responses of GHAPWASCO and NOPWASD

3.2.1.2 Effect Indicators

The population served by water supply in the urban areas within the target area reached 479,467 in 2010, exceeding the target value by approximately 25,000 people, and this increase has affected the average daily quantity of water supplied per person in the urban areas. The increase in population served over and above the plan in urban areas has caused that average to fall from the target value of 215 liters to 192 liters (89% of the planned value). In rural areas, the population has not grown, as was expected, and the average daily quantity of water supplied per person has reached 125 liters as planned.

Table 2: Effect Indicators

	Benchmark (2000)	Target Value (2010)	Actual Value (2010)	Pct. of Planned Value
Average Daily Quantity of Water Supplied Per Person				
Urban Areas	163L	215L	192L	89%
Rural Areas (over 10,000 people)	89L	125L	125L	100%
Rural Areas (under 10,000 people)	89L	125L	125L	100%
Water Supply Rate	100%	100%	97%	97%
Population Served				
El Mahala El Kobra	431,954	454,746	479,467	105%
10 Surrounding Villages	126,591	144,139	133,521	93%
Total	558,545	598,885	612,988	102%

Source: Questionnaire responses of GHAPWASCO and NOPWASD

3.2.1.3 Drinking Water Quality

Using Egypt water quality standards set in place as objectives at the time of project planning, the project has yielded treated water of quality better than planned.

[7] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 3: Water Quality Standards and Actual Quality of Treated Water

	Planned Water Quality (Treated Water*)	Actual Water Quality (Treated Water)
pH value	6.5-9.2	7.47-7.95
Color	Maximum of 20-30 on the Platinum/Cobalt scale	None
Taste	An acceptable range	An acceptable range
Odor	None	None
Turbidity	5 JTU	0.3
Residue on evaporation	1,200 mg/L	105 mg/L
Iron	0.3 mg/L	0.01 mg/L
Manganese	0.1 mg/L	0.01 mg/L
Copper	1.0 mg/L	0.002mg/L
Zinc	5.0 mg/L	None
Hardness	500 mg/L	130 mg/L
Calcium	200 mg/L	80 mg/L
Magnesium	150 mg/L	45 mg/L
Sulfide ions	400 mg/L	20 mg/L
Chlorine ions	500 mg/L	30 mg/L
Sodium	200 mg/L	-
Aluminum	0.2 mg/L	None
Calcium balance	±0.1	-

Source: Information from the Basic Design Study Report and from GHAPWASCO

*Plan based on Egypt water quality standards

3.2.1.4 Water Pressure of Distribution Network

The project aimed to maintain water pressure of at least 30 m within the network of pipes. In actuality, water pressure of 25 m was achieved in the network of pipes[8]; however, there are areas where the pressure falls to 5 m during peak usage hours[9]. Major reasons for the drop are a lack of quantity, especially during peak hours, because of the population increase in urban areas and the inability to store water due to the lack of distribution reservoirs en route to outlying areas[10]. Some areas still use old distribution pipes just as they are, and there may be leaks in those areas[11]. However, the issue of maintaining pressure at peak hours in urban areas expected to be improved upon through the connection of distribution pipes in suburban areas after the project. Furthermore, there is a plan to expand the treatment plant in the future[12] and the land has been secured for it.

3.2.2 Qualitative Effects

3.2.2.1 Improving Water Quality, Pressure and Quantity

[8] According to Egyptian standards, 25 m is the minimum water pressure for consumers in terminal areas of the distribution network (the standard is the pressure that can be directly provided to a four- or five-story building).

[9] The process of setting water pressure values is written in detail on the Basic Design Report, but Egypt also created distribution pipe plans based on analytical models of pressure used by NOPWASD after the Basic Design, and they hold that there may be cases where pressure values set forth in the Basic Design are not achievable (according to hired local Egyptian water systems experts).

[10] Information from water treatment plant personnel.

[11] Information from GHAPWASCO. The Project for Improvement of Management Capacity of Operation and Maintenance for Water Supply Facilities in Nile Delta Area, a technical cooperation project, will also take action in the Gharbeya Governorate to improve on the non-revenue water rate. Transfer of technology concerning leakage will take place in the future.

[12] Information from water treatment plant personnel.

The beneficiaries' survey was conducted to confirm the effect of the project[13], and the respondents in rural areas answered differently than their urban counterparts, with 100% of them saying that they were aware of improvements to water supply and pressure. Respondents in rural areas were also more aware than those in urban areas of improvements in the taste[14], odor[15] and turbidity[16] of water supplied. In urban areas, many people live in high-rise buildings where it is difficult to identify the sources of odors, turbidity and taste because of the effects of the aging and cleaning schedules of pipes within the buildings[17]. GHAPWASCO confirmed that each area makes plans for cleaning distribution pipes in El Mahala El Kobra and that they are regularly cleaned. There are hopes that, if completed, the current plan of looping the network of distribution pipes will further lower the likelihood of water contamination[18] caused by municipal distribution pipes.

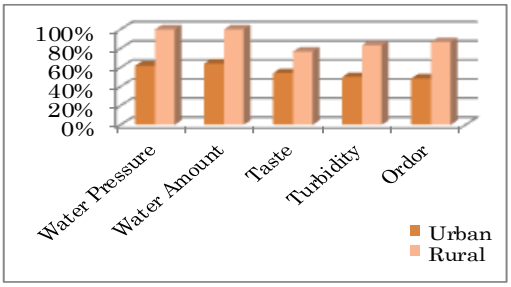


Figure 1: Respondents Who Affirmed Improvement upon Comparing Before/After

3.2.2.2 Improving Water Supply Times

Of respondents polled on the improvement of water supply times, 89% in urban areas and 96% in rural areas affirmed that they were able to enjoy water supply 24 hours a day[19].

Table 4: Improvement of Water Supply Hours

	Urban	Rural
24-hour	89%	96%
18-hour	1.4%	0%
16-hour	1.4%	0%
12-hour or less	7.2%[20]	3.3%[21]

Source: Results of surveys of beneficiaries

[13] 70 samples from El Mahala El Kobra City (El Mahala El Kobra City is divided into the First Zone and the Second Zone. The 35 samples were taken from the First Zone and the 35 samples from the Second Zone) and 30 samples form the rural areas. Totally 100 samples were surveyed. From a view point of total number of beneficiaries, the beneficiaries' survey is a kind of case study, and it does not pursue the statistical significance. Since the main users are small scale consumers, the households were targeted in the survey. The average number of household member is 4.52 persons. The survey was conducted in January, 2012. It is difficult to investigate the situation and its reasons of turbidity and odor by the results of the relative question, asking "improved or not". It simply stands a point of view that the beneficiaries' survey could understand the situation of beneficiaries as a whole and it is able to pursue the possible reasons to be presumed.

[14] Chlorine residue affected the taste of water in areas close to the treatment plant, and taste is thought to be related to the status of the network of old distribution pipes and pipes in residential buildings (information from water treatment plant personnel).

[15] Since the odor at the treatment plant fell within standard values, the cause of odors is thought to be the aging distribution pipes or infiltration of sewage at joints. However, the treatment plant in El Mahala tests water quality at various locations within city limits, and no contamination (coliform, etc.) has been found.

[16] The turbidity at the treatment plant is measured every two hours, and values are extremely low, so any turbidity is thought to have occurred in the distribution network or in pipes in residential buildings.

[17] According to hired local Egyptian water supply experts, cleaning is generally not a part of pipe management in high-rise buildings.

[18] Information from GHAPWASCO and hired local Egyptian water supply experts.

[19] Results of surveys of beneficiaries. According to the baseline study performed prior to the project (Basic Design Study Report), 48% of respondent households in urban areas had experienced planned water supply disruptions while 37% had experienced unplanned disruptions. This baseline study does not show water supply times, but there has been improvement in the state of planned disruptions, near 24-hour supply was achieved, and supply disruptions have been improved upon as shown in Section 3.2.2.3.

[20] This is considered to be occurring for households on the upper floors of apartments and other such buildings that lack suitable water pumps (information from water treatment plant personnel).

[21] These are households with terminal distribution pipes. The main reason is thought to be insufficient water pressure.

3.2.2.3 Improving on Random Cut-off

Of respondents on random cut-off of water supply disruptions, 81.4% in urban areas and 96% in rural areas affirmed that the situation had improved[22].

Table 5: Improvement of Random Cut-off

	Urban	Rural
Improvement of Random Cut-off	81.4%	96.0%

Source: Results of surveys of beneficiaries

3.2.2.4 Changing Water Sources

Fully 100% of respondents in urban areas affirmed that they were able to get water out of their tap water faucets of each household. The respondents in rural areas, as the same as before the project, get water out of their tap water faucets[23].

Table 6: Change of Water Sources

	Urban	Rural
Before the Project		
Tap water faucet	92.9%	100%
Mosque water	2.8%	0%
Carrying water from lower floors to upper floors	11.4%	0%
After the Project		
Tap water faucet	100%	100%

Source: Results of surveys of beneficiaries

3.2.2.5 Output of Soft Component

A soft component that included technical support to maintain existing facilities was implemented in the project. Specifically, the component consisted of instruction on maintenance techniques based on data and control technology for the purification process. This included technical instruction on a monitoring system, which has made it possible to use a computer to confirm values for amount of intake water, turbidity and chlorine residue.

This instruction has resulted in the ability to use the monitoring system to manage the water quality control process and analyze and use data for the purpose of treatment system management[24], and in the ability to add chemicals[25] and enter, store and process data according to the instruction. However, since facilities lack personnel trained in IT, they are not able to handle errors and other problems with monitoring system software. As chemical treatment management at treatment plants during the hottest season, not only increase of water volume,

[22] Results of surveys of beneficiaries
[23] Results of surveys of beneficiaries
[24] A monitoring system by which values can be confirmed via computer screen has been introduced at the new treatment plant being built in the project. This type of digital monitoring and automatic control has not been introduced at the Old Treatment Plant, but soft component instruction has made it possible to measure flow rates and turbidity and add required chemicals at the Old Treatment Plant. Because these are old facilities, this is not automatic control as at the new plant, and water quality control is performed based on the results of measured values.
[25] Mainly aluminum sulfate and chlorine.

but measures to counteract the increase of bacteria in the treatment process and distribution pipes had been taken by increasing the volume of chlorine used. Meanwhile, during the winter season, it is necessary to increase the amount of aluminum sulfate and to adjust chemical treatment in response to changing circumstances in order to handle the increase in turbidity caused by the lower volume of water in canals. Since the end of the project, this soft component instruction has enabled the chemical treatment in line with both intake rates and turbidity based on data. There have been no major changes to the quantity of chemicals added, but it is now possible to execute the proper controls for maintaining water quality.

It is considered that residents have benefited immensely from the increased water volume and pressure, improved water quality and reduced water supply disruption rate achieved by the project.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Impartiality of Water Distribution

In the target area, the volume of water supply has increased and water volume, quality and pressure have improved. There is a difference between urban and rural areas in the extent of these improvements. Water supply conditions differ because of the high population density and high-rise buildings in urban areas as opposed to detached housing in rural areas.

The external evaluator selected various areas in an attempt to verify the effects of distribution pipe construction in order to identify area differences of the water supplies owing to the way distribution pipes were installed (or not installed) according to the Egyptian project. However, new distribution pipes that were installed by the project and old distribution pipes installed before the project were mixed on a regional basis in urban and suburban areas, and it was unable to obtain information that allowed us to reach a conclusion on the project's contribution to the impartiality of distribution.

3.3.1.2 Other Improvements on Living Conditions

60% of respondents [26] reported that their living conditions improved, though that improvement was not striking because they were already receiving water prior to the project.

Table 7: What Kinds of Changes Have You Noticed Owing to Improved Water Supply?
(Respondents were able to give multiple answers.)

	Number of Respondents who Noted Improvement (60 Respondents Total)
I can clean more frequently	95% (57)
I can do laundry more frequently	85% (51)
I sleep longer at night[27]	55% (33)
I am able to save time	28% (17)
I have stopped worrying about water	15% (9)
It takes less time to draw water	15% (9)

Source: Results of surveys of beneficiaries

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

In order to alleviate impacts on the environment, the project does not discharge the untreated water outfall to the drainage canal and the sludge treated in sludge tanks and sludge thickeners

[26] Results of surveys of beneficiaries.

[27] Prior to the project, households on upper floors drew water from the lower floors at nighttime, when water pressure rose on the lower floors; after the project, there was no more drawing of water from lower floors at nighttime. Concerns about water were eased in households that had been saving water for late nights when water pressure rose.

is carried to the existing wastewater treatment plant eight kilometers away from the treatment plant of the project, and a treatment of sun drying sludge became possible. The drainage treatment is able to be implemented according to the Egyptian Ministry for Environmental Affairs' legislation preventing the contamination of the Nile River and its canals.

However, the quality of water in the drainage canal[28] is not improving because waste is thrown into it[29] and the Old Treatment Plant still discharges sludge generated by the treatment process into it[30]. Thus the project has not significantly improved the contamination in the drainage canal. As it happens, the quality of water in the drainage canal was not monitored before and after the project[31].

The sheet piles were used to make a temporary closure and water was changed out as part of intake facility construction, and as a result, preventing contamination of water quality in the El-Mala Canal as much as possible[32].

3.3.2.2 Land Acquisition and Resettlement

No land acquisition or resettlement was required to execute the project since the land of the existing treatment plant was used.

3.3.2.3 Effects of Construction on Area Residents

Since the treatment plant was surrounded by residential zones, construction was performed using methods that caused little noise and vibration to neighboring areas. Thus residents in the area were not affected[33]. During the construction, the monitoring was implemented by the staff of the water treatment plant, and it was found out that the residents and surrounding areas were not affected by the construction.[34]

Even though the water pressure in the final distribution network was slightly lacking only during peak hours because of an urban population increase that exceeded expectations, other effect indicators were achieved. Furthermore, the external evaluator was able to confirm the impacts such as impartiality of distribution and improvement in living environment, and was able to see evidence that the implementation of the project yielded results almost as planned. Therefore, its effectiveness and impact are high.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Table 8 shows the output provided by the Japanese side in the project (planned and actual), and Table 9 shows the same by the Egyptian side.

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[28] There are two canals, and the regular canal runs parallel to the drainage canal. The drainage canal is narrower than the regular canal.

[29] The external evaluator has not been able to confirm whether the waste is from residents in neighboring areas.

[30] A vacuum truck provided through the project carries sludge from the new plant to a wastewater treatment facility, but no such vacuum truck exists for the Old Treatment Plant, so sludge is still being discharged into the drainage canal. In relation to the sludge generated by the Old Water Treatment Plant is not out of scope of the project(the Basic Design Study Report)

[31] Legislation preventing the contamination of canals does exist, however it does not call for water quality monitoring. There are no penalties or other regulations, either.

[32] Information from the implementing and operating agency and the maintenance agency.

[33] Information from water treatment plant personnel.

[34] Information from water treatment plant personnel.

Table 8: Outputs Provided by Japan (Plan and Actual)

Output	Plan	Actual
Facility Upgrades	1) Intake/conveyance facilities (440 L/s intake rate) - Intake Inlet, raw water pit, water conveyance pump, intake pipes (three), raw water pit	As planned
	2) Water treatment facilities (from receiving basins to coagulant sedimentation basins, 440 L/s (approximately 35,000 m^3/day) water treatment capacity) -Receiving basins (including rapid mixing basins), vertical baffled channel flocculation basins, coagulant sedimentation basin, rapid filtration basins, filtration basin flushing cisterns, chlorine injection facilities, chlorine neutralization facilities, sludge treatment facilities (drainage tanks, sludge tanks, sludge thickeners)	As planned
	3) Supply/distribution pump facilities (520 L/s x 60 mk supply capacity)	As planned
	4) Operation management facilities -Control panels, monitoring panels, measuring instruments, etc.	As planned
	5) Power receiving/substation facilities (11k V/380 V, 1250 kVA) -Incoming panels, transformers, distribution panels	As planned
	6) Emergency power generator equipment (675 kVA) -Diesel generators, fuel tanks	As planned
	7) Civil/architectural structures Water conveyance/distribution pump housing, chemical injection buildings, filter control buildings	As planned
Equipment Procurement	1) One 10-ton vacuum truck for transporting sludge 2) Maintenance tools,Measuring instruments, safety equipment	As planned
Technical Instruction	Provide technical instruction on maintenance to operation/maintenance management personnel[35] and present fruits of technical instruction -Applications for processing data (basic designs, design specifications, user manuals)	As planned

Source: Basic Design Study Report, documents provided by JICA, questionnaire responses

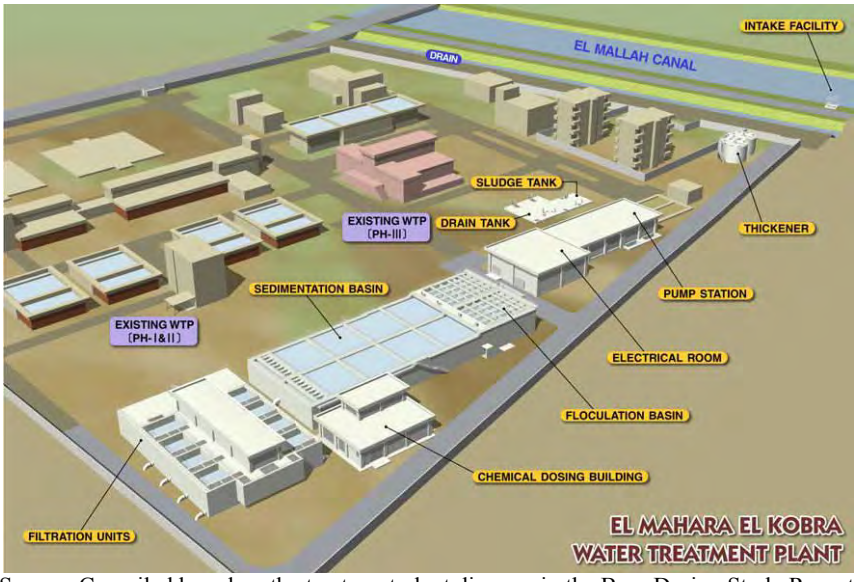
Table 9: Outputs Provided by Egypt (Plan and Actual)

Plan	Actual
Land Leveling planned for treatment facilities	As planned
Connect 10.5k V power lines	As planned
Rehabilitate/connect distribution pipes	As planned

Source: Basic Design Study Report, interviews with related personnel, documents provided by consultants

The Egyptian side was responsible for rehabilitating/connecting distribution pipes running from the treatment plant targeted by the project to the central part of the city, and these rehabilitation and connection were completed by 2009 as planned. The construction on the new network of main distribution lines to run around the city along the outer-ring road of El Mahala El Kobra city was set to begin as soon as the budget was secured, and that it was treated as a post-project undertaking although it was initially planned as the project component at the time of the Basic Design[36].

[35] Soft component that included technical support for maintenance of existing water treatment plants was implemented during the project.
[36] Gharbeya Governorate NOPSWASD plan.



Source: Compiled based on the treatment plant diagram in the Base Design Study Report

Figure 2: El Mahala El Kobra Water Treatment Plant of the Project

3.4.2 Project Inputs

3.4.2.1 Project Cost

The amount of grant limit was 2,423 million yen, but the actual cost according to the contract amount was 2,387 million yen, so the project cost was lower than planned (98.5% of the budget). At the time of Basic Design Study, the cost for the Egyptian side was estimated at 1,102 million yen, including the cost for distribution pipes along the outer-ring road of El Mahala El Kobra city. At the implementation, this distribution pipes along the outer-ring road became out of scope, and the actual expenditure was lower than the planned budget of the Basic Design. The cost for the new network of distribution lines along the outer-ring road of El Mahala El Kobra city was estimated at 358.22 million yen. In case this amount is subtracted from the estimated cost of the Basic Design, 1,102million yen, it was equal to 743.78 million yen. This 743.78 million yen was replaced as the planned amount, and the actual total expense was 728.58 million yen. It was 97.9% of the plan, and the cost for the Egyptian side remains within the planned budget.

The soft component's detailed action plan called for 3.3 MM of Japanese experts and 5.0 MM of local assistants, while more human resources, 3.8 MM of Japanese experts and 6.5 MM of local assistants, were actually spent[37]. The increased human resources allowed instruction to be given such that the maintenance called for by the project (including maintenance for the Old Treatment Plant) would be implemented faithfully[38].

3.4.2.2 Project Period

According to the pre-project schedule, the project was to include detailed designing, bidding, material procurement, transportation, construction, inspection, test operation and technical instruction, and last around 32 months. Detailed designing began in July 2006 and technical instruction was completed in February 2009, a period of 32 months, meaning that the project period was as planned. There were no major changes of outputs, so there were no effects on project period. The Egyptian side completed construction on distribution pipes to run around from the treatment plant to the El Mahala El Kobra city within the time allotted.

[37] Documents provided by JICA and consultants. The soft component applied to both new and old treatment plants, and the implementation period was extended.

[38] Information from consultants.

In light of the above, both the project cost and period were within the plan; therefore, its efficiency is high.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

3.5.1.1 Implementing Agency

NOPWASD did not undergo any organizational changes since the planned period of the project.

3.5.1.2 Agency Supervising the Operation and Maintenance Organization

The maintenance agency for water supply and sewerage projects has undergone sweeping organizational reform since 2004[39]. The Holding Company for Water and Wastewater (HCWW) was established by executive order (No. 135/2004) as an organization to supervise and monitor public water supply and sewerage companies under the jurisdiction of the Ministry of Housing, Utilities and Urban Development. HCWW spurs the systematization and standardization of operations at the 23 affiliated water supply and sewerage companies in Egypt, coordinates budgetary requests from the affiliated companies and determines how the budget will be allocated, and evaluates the performance of each public company.

HCWW has established 64 performance indicators in categories such as technology, operation, customer satisfaction and water quality; requires public water companies in each governorate to submit reports every three months; performs year-end comprehensive evaluations; and awards bonuses to employees of high performing company[40]. The company in Gharbeya Governorate has scored well on past performance evaluations compared to companies from the other 22 governorates, and it received 17 months' worth of bonuses last fiscal year.

3.5.1.3 Gharbeya Governorate Operation and Maintenance Organization

The Gharbeya Company for Water Supply and Sanitary Drainages (GACWASD) at the time of planning changed its name to GHAPWASCO as a result of organizational restructuring in 2005. GACWASD was a government agency while plans were being prepared. Even it became GHAPWASCO, it receives public assistance when revenues are deficient even though it became a financially independent corporation under the supervision of HCWW.

GHAPWASCO employs 5,940 people, and this number has not changed since the planning stage of the project. Wages have increased slightly in line with inflation; however, they have basically stayed the same.

Before the sector was reformed, GACWASD was unable to develop plans, policies and strategies on its own because higher-ranking agencies handled such development; however, GHAPWASCO is able to develop independent plans and strategies now. The final national master plan is now developed from master plans developed by each governorate, approved by HCWW and passed through a process to select the top priority projects for Egypt.

The president of GHAPWASCO is selected from outside the company and can serve a three-year term on one-year contracts. The decision to allow the president's term to continue is based on HCWW's evaluation of the company's operational performance.

[39] GTZ is, as a ten-year plan since 2005, assisting in the establishment and functional enhancement of a supervising agency to centrally maintain water supply and sewerage. The project has also benefited from improved maintenance owing to these new efforts, and it can be said that desirable environment for improving sustainability, in particular, has been arranged.

[40] Providing incentives such as granting bonuses for each employee. In the past, employees of public companies received wages only; bonuses did not exist.

3.5.1.4 El Mahala El Kobra Branch of GHAPWASCO

The personnel chart at the El Mahala El Kobra Water Treatment Plant for the project shows Water Quality Control Division, Operations Division and Maintenance Division operating under the supervision of an engineer appointed as the plant manager. The Water Quality Control and Maintenance Divisions are also in charge of managing water quality and maintenance at the Old Treatment Plant. Only the Operations Division deals with the operations of the plant from the project. In the Operations Division, three people are working alternating shifts on a 24-hour operation schedule.

The El Mahala El Kobra Water Treatment Plant was required to employ more personnel during the defect inspection. Thus, at the time of the evaluation, the number of workers called for by plans is fulfilled as shown on Table 10. The number of skilled workers increased while the number of engineers decreased; however, it is also GHAPWASCO's policy to increase the number of skilled workers who can apply their techniques on the field level. The number of chemical engineers has risen because of the important role they serve in water quality control and chemical treatment.

Table 10: Actual Allocation of Personnel (at the time of the evaluation)

	Number of Employees at Existing Facilities	Increase as a Result of the Project (Planned)	Increase as a Result of the Project (Actual)	Total Increase (Actual)
Plant Manager	1	0	0	1
Engineers	7	2	-5	2
Skilled Workers	14	7	17	31
Chemical Engineers	2	1	5	7
Office Workers	0	1	2	2
Laborers	11	4	-2	9
Total	35	15	17	52

Source: Information from GHAPWASCO and the El Mahala El Kobra Water Treatment Plant

3.5.2 Technical Aspects of Operation and Maintenance

Technicians had sufficient skills for operating and maintaining the Old Treatment Plant prior to the project, but by the time the project had been completed, they had reached the level of skill related to operation and maintenance required to achieve the capacity for automated control of operations and maintenance. They have prepared a maintenance and inspection system. The plan of operation and maintenance plan was set following SOP (Standard Operation Procedure) which the consultant firm and contractor made. The logs of operation and maintenance are recorded in details on water purification process and maintenance. In accordance with the plan, the operation and maintenance is implemented.

S.O.P.

Maintenance Log

Sludge Truck

3.5.3 Financial Aspects of Operation and Maintenance

The allocation budget to the NOPWASD is determined by the national development plan. The large increase in that allocation in the sixth plan is the result of the plan the government forged to expand water supply facilities in rural areas.

Table 11: NOPWASD New/Old Five-Year Plan Budgets

	Fourth Plan	Fifth Plan	Sixth Plan
Fiscal Years	1997-2002	2002-2007	2007-2011
Total Project Cost*	12,000 million LE	17,949 million LE	37,500 million LE*

Source: Information from NOPWASD.

*The total project cost includes a sewerage system project.

The Gharbeya Governorate's budget ranked second among the 23 governorates in both the fifth and sixth plans.

Table 12: Gharbeya Governorate Planned Budget
(Percentage of the national budget for total project costs*)

	Fifth Plan	Sixth Plan
Gharbeya Governorate	10.2%	12.4%

Source: Information from NOPWASD.

*The total project cost includes a sewerage system project.

The maintenance budget is funded based on an approved budget plan submitted to the Egyptian Ministry of Finance from the governorates through HCWW. HCWW confirms grounds for budget increases and other matters with public companies as needed. HCWW provides subsidies to Gharbeya Governorate in response to requests closely in line with plans[41].

Table 13 shows the condition of revenue and expenditures for GHAPWASCO. Revenue from operating activities has increased. This is a result of GHAPWASCO improving collections rates and making other operational efforts. The shortage of expenses[42] is supplemented to GHAPWASCO[43] by the government as subsidy of HWCC.

Table 13: GHAPWASCO Balance Sheet (Units: LE)

	2009-10	2010-11
Revenue		
Revenue from operating activities	182,760,280	205,111,506
Grant aid	30,440,746	39,470,350
Investments and interest	10,811,520	11,672,817
Other revenue	14,918,148	4,106,738
Total Revenue	**228,930,694**	**260,361,411**
Expenditures		
Fuel, parts, electricity, etc.	41,871,243	44,657,144
Employee wages	136,695,622	185,657,534
Depreciation, taxes, interest, etc.	82,384,381	101,450,802
Debts, loss, etc.	85,850,880	6,011,073

[41] Information from GHAPWASCO. The prospect of fiscal year (2012-13) was not able to be confirmed as there has been a political power shift.

[42] GHAPWASCO submits a request of subsidy (Information of GHAPWASCO).

[43] Actual amounts of HCWW's subsidies to GHAPWASCO were 74,100,000 LE(Egyptian Pound) in FY2007-08, 72,007,683 LE in FY2008-09, 117,871,432 LE in FY2009-10 (information from GHAPWASCO). The figures for FY2010-11 are not available (Information of GHAPWASCO). The amount increased in FY2009-10 due to the increase in funds paid to put the new treatment plant into operation and install plant facilities to satisfy environmental standards.

Total Expenditures	**346,802,126**	**337,776,553**
Balance	**-117,871,432**	**-77,415,142**

Source: GHAPWASCO Financial Affairs Division

HCWW prepares a preliminary draft of water rates of the governorate, and then the Ministries of Finance and of Housing, Utilities and Urban Development approve the draft. Then, legislation about water rates is officially announced once the People's Assembly of Egypt approves it. Consideration is given to citizens' ability to pay when rates and legislation are determined, so the sustainability of facility construction and maintenance, and water supply project operation is not considered. However, as Table 14 demonstrates, rates have been raised compare to before the project.

Table 14: GHAPWASCO Water Tariff Rate (LE/m^3)

User Classification	2005	2011
General Household (less than 30 m^3)	0.23	0.35
General Household (30 m^3 or more)	0.30	0.47
Construction Sites	0.50	4.38
Public Facilities	0.35	1.40
Public Facilities (Physical Exercise Facilities)	0.40	2.63
Small Places of Business	0.50	1.52
Large Places of Business	0.53	1.52
Tourism/Investment Place of Business	0.85	2.63
Public Housing (One-Room)	2.5 LE/month	10.5 LE/month
Public Housing (Two-Room)	3.0 LE/month	12.6 LE/month
Public Housing (Three-Room)	4.0 LE/month	16.5 LE/month
Public Housing (Four or More Rooms)	5.0 LE/month	20.1 LE/month

Source: Information from GHAPWASCO.

Table 15 shows revenue and expenditures for the El Mahala El Kobra Branch of GHAPWASCO. At present, the branch is collecting 90% of water rates due from customers. This rate has risen because of exhaustive efforts to collect by increasing the time spent on dealing with customers, and offering bonuses and other incentives to employees engaged in that work. The rate was 30% prior to the sector reformation.

Table 15: GHAPWASCO El Mahala El Kobra Branch Balance Sheet (Units: LE)

Fiscal Years	Revenue	Expenditures	Shortage
2006-07	24,369,569	33,396,422	9,026,853
2007-08	33,821,969	40,606,709	6,784,740
2008-09	44,538,128	52,601,131	8,063,602
2009-10	43,490,135	54,816,097	11,325,962
2010-11	53,056,404	67,459,903	14,403,499

Source: Information from GHAPWASCO.

Table 16 shows the maintenance costs incurred by the El Mahala El Kobra Branch of GHAPWASCO. Costs have risen because two new treatment plants began operating in FY2009-10 in the branch's region and because of construction done at the El Mahala El Kobra Water Treatment Plant to fulfill environmental standards required for TSM[44].

[44] Technical Sustainable Management (TSM) is a standard for the environment and maintenance at treatment plants. Plants can earn certificates by satisfying requirements.

Table 16: GHAPWASCO El Mahala El Kobra Branch Maintenance Costs (Units: LE)

Fiscal Years	Actual Figures
2006-07	19,345,267
2007-08	20,995,347
2008-09	20,909,801
2009-10	32,137,152

Source: Information from GHAPWASCO.

3.5.4 Current Status of Operation and Maintenance

Local water systems experts hired to visit facilities and conduct visual inspections and interviews have reported that the use and maintenance of facilities and equipment now, three years after project completion, is still good. However, there are cracks in two of the walls of coagulation sedimentation basins, and they both need to be repaired[45].

Facility personnel are generally using the manual prepared by the project, and they have posted the essentials of its maintenance and inspection methods in Arabic on the walls of each facility. Frequencies and conditions for daily and regular inspections are also being kept in maintenance logs.

They have created spare part replacement logs, and make requests of suppliers when they run out of spare parts. Facility personnel are making efforts to procure spare parts, but the time of ex-post evaluation, when they cannot procure automatic equipment, they handle operations manually as is done at old facilities. This is how they handle the challenge of procuring spare parts made outside the country, which take time to procure.

Workers from the local offices of consultants respond to and resolve computer maintenance issues since the water treatment plant lack personnel familiar with IT.

The defect inspection of the project conducted two years ago revealed no particular flaws and that rigorous cleaning, regular maintenance and other recommendations made had nearly all been improved upon. However, they did not act upon the recommendation by the defect inspection about regular training to improve awareness of safety precautions.

Records of conditions in the treatment process at each facility are being kept in maintenance logs. Chlorine leaks are also being recorded in a ledger. Emergency procedures have been determined for when chlorine leaks and leaks are treated in accordance with those procedures[46]. Laminated procedure charts written in Arabic are posted on the walls of chemical buildings in chlorine neutralization facilities[47]. Workers have a firm grasp of how to deal with situations safely[48]. Though a monitoring system is in operation, workers from the local office of consultants respond to and resolve any computer maintenance issues.

In light of the above, due to necessity of the procurement of foreign countries' spare parts and the maintenance of some facility, the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The relevance of the project is high because it is consistent with priority areas of Egypt's

[45] There are no issues with facility operation; however, workers have to pump water out of the settling basins when they want to clean them because leaks in the walls prevent them from becoming empty even if they try to discharge the water. The water supply has to be stopped for the repair work. However, the repair has not yet been done.

[46] Chlorine leaks do occur when chlorine tanks are changed out; however, such leaks are minor and have not caused any accidents thus far.

[47] Contractors conducted them during OJT (On the Job Training).

[48] Training for emergencies has only been implemented once thus far.

development policy and with Japanese assistance policy, and Egypt's development needs are also high. The effectiveness of the project is high because it was confirmed that major operation and effect indicators were closely in line with planned figures, and that the awareness of improved water supply as a result of the project was high through the survey of the beneficiaries conducted during this evaluation study. Both the project cost and period were within the plan; therefore its efficiency is high. Although there are no major issues with structural and technical aspects of operation and maintenance, some minor issues exist related to the procurement of foreign countries' spare parts and the maintenance of some facility; therefore the sustainability of the project effect is fair.

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

4.2 Recommendations

4.2.1 Recommendations to Implementing Agency NOPWASD

- The construction of distribution lines to run around the city along the outer-ring road of El Mahala El Kobra city that was cleared to proceed once the budget was secured from 2009 on should be completed by securing the budget. Looping the pipes can help improve water pressure and quality in urban areas because it will allow water pressure to be maintained and have a significant effect on the cleanliness inside the pipes.

4.2.2 Recommendations to Operation and Maintenance Organization GHAPWASCO

- There are cracks in the walls of coagulation sedimentation basins. At present, there are no issues with facility operations, but workers have to pump water out of the settling basins when they want to clean them because cracks in the walls cause water to enter the basins even when they have already tried to discharge the water. This should be handled in an appropriate timing.
- In relation to the operation and maintenance of the monitoring system of El Mahala El Kobra Water Treatment Plant, there are no personnel familiar to IT in the Water Treatment Plant. IT specialist of GHAPWASCO needs to grasp the monitoring system to be ready for trouble shooting if necessary.
- In relation to the spare parts, GHAPWASCO needs to make preparations so that it can procure the following fiscal year's supply of spare parts that need to be replaced regularly because procuring spare parts from outside of Egypt involves complicated importation procedures and requires time. GHAPWASCO should consider ways to resolve problems by sharing information about spare parts with monitoring agencies like HCWW.
- El Mahala El Kobra Water Treatment Plant needs to regularly implement training for responses to chlorine leaks and other emergencies.
- El Mahala El Kobra Water Treatment Plant and related Governmental Organizations need to try to change the awareness of citizens in areas around the El-Mala Canal so they do not dispose of waste near intakes in the canal.

4.2.3 Recommendations to JICA

None in particular.

4.3 Lessons Learned

- Since the beginning of the sector reformation, HWCC has begun to function as an agency that monitors water supply maintenance, and water supply maintenance in Egypt has shown improvement. HWCC has spurred the systematization and standardization of operations at public water companies in each governorate; established performance indicators in categories such as technology, operation, customer satisfaction and water quality; evaluated each company; and encouraged the sharing of information such as the

transfer of maintenance technology. This kind of sector reformation created in water supply personnel a drive to improve maintenance that did not exist before, and there is much to learn from this positive example.

Jordan

Ex-Post Evaluation of Japanese Grant Aid Project
"The Project for the Improvement and Expansion of the Water Supply Networks in North/Middle Jordan Valley"

External Evaluator: Noriyo Aoki, IC Net Limited

0. Summary

The project was conducted in the North Shuna region in the Northern Jordan Valley and in some parts of the Middle Jordan Valley to develop water supply networks and introduce water resources management so that safe water can be supplied in an efficient manner.

The project is highly relevant as it is consistent with Jordan's development policy and the priority issues of Japan's assistant policy, as well as the fact that the country has high needs for development. Its effectiveness is also high as the project has achieved targets in most of the major effect indicators, with significant effects obtained, and the findings from the survey of the beneficiaries suggest there are improvements in the water supply conditions. Its efficiency is fair as the project cost was within the plan, although the actual project period was longer than planned. The sustainability of the project's effects is also fair as, despite no major problem having been found in the project in terms of operation and maintenance techniques, there is some concern about the structural and financial conditions.

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

1. Project Description

Project Location

Adasiya Pumping Station

1.1 Background

In Jordan, water is quite a scarce resource, even compared with the neighboring countries. Under its framework development study, the Government of Japan conducted several studies, including the Study for the Project for the Improvement Plan of the Water Supply Networks in the Zarqa Region, and the Study for the Water Resources Management Plan. Based on the findings from these studies, Japan continuously offered Jordan grant aid for projects such as the one on the improvement and expansion of water supply networks. The Capacity Development Project for Non-Revenue Water Reduction was carried out between 2005 and 2011 as a technical cooperation project (phase I and phase II). At present, a grant-aid environmental program for the improvement plan of energy efficiency in the water supply networks is being carried out. These aid undertakings were, and are, mainly intended to upgrade Jordan's water pumps and supply pipes, reducing the non-revenue water rate and saving electricity charges. As described above, the Government of Japan has provided assistances to help Jordan improve its techniques for water supply services and minimize losses in the management of water resources. The project was conducted as part of a series of the assistance measures above.

1.2 Project Outline

The project was conducted in the North Shuna region in the northern part of the Jordan Valley and some parts of the Middle District to develop water supply networks and introduce the water resources management so that safe water can be supplied in an efficient manner to help improve the living conditions of the community people.

Grant Limit/Actual Grant Amount		53 million yen/53 million yen (detailed design) 2,011 million yen/1,978 million yen (main construction work)
Exchange of Notes Date		December 28, 2004 (detailed design) June 30, 2005 (main construction work)
Implementing Agency		Water Authority of Jordan (WAJ)
Project Completion Date		February 20, 2008
Main Contractors	Main construction work	Dai Nippon Construction
	Consulting	Yachiyo Engineering Co., Ltd.
Basic Design Study		July 2004 - December 2004
Related Project		None

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriyo Aoki, IC Net Limited

2.2 Duration of the Evaluation Study

A study was conducted as follows for ex-post evaluation of the project:
Duration of the Study: September 2011 – November 2012
Duration of the Field Study: November 26 – December 12, 2011; April 12 – April 21, 2012

2.3 Constraints during the Evaluation Study

The Northern Governorate Water Administration (NGWA) was originally a government institution operating as a division of the Water Authority of Jordan (WAJ), the implementing agency. Under the commercialization policy of the government, the NGWA was reorganized as the Yarmouk Water Company (YWC) in September 2011. In the same month, YWC started working on management reforms under the guidance of a French consulting firm specializing in water supply services. This ex-post evaluation study was conducted in the midst of the period that YWC was striving to implement structural and financial reforms. As a result, the evaluation study had difficulty in collecting information about the form that the organization had taken before the reforms and in obtaining data concerning the project. The consulting firm had already presented YWC with a clear direction of action that it should take for the reform of its operations, but no agreement has been reached between them. Whether the reform plan that the consulting firm showed the external evaluator will be carried out is still uncertain.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Policy of Jordan

Before the project was planned, the Government of Jordan had formulated a three-year plan called the Social and Economic Development Plan 2004-2006. In this plan, the government

[1] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory
[2] ③: High; ②: Fair; ①: Low;

declared several targets for the water supply services sector, including a reduction in non-revenue water, the control of groundwater pumping, enhanced efficiency of the organization, the development of human resources, improvement in the financial conditions, and reduced dependence on the national treasury. Another target was promotion of the optimal use of water resources that should generate maximum economic returns. As issues to be emphasized, the Water Sector Policy at that time mentioned control of the excessive pumping of circulating groundwater, a reduction in unaccounted-for water and leakages, and the introduction of a supervisory control and data acquisition (SCADA) system[3] from the water supply networks.

On the other hand, it is addressed in the Jordan National Agenda 2006-2015 (a national development plan at the time of the study for ex-post evaluation) that relevant projects will be carried out focusing on the improvement of water supply networks as well as measures to reduce non-revenue water and for water pollution, in order to strive for the vision of effective management of limited water resource while cooperating with other donors.

In Jordan's Water Strategy 2008-2022, the latest water supply policy, the government also declared that it intends to promote the supply of appropriate and safe drinking water, measures to reduce non-revenue water, the effective use of existing water resources, the introduction of know-how from the private sector for improving the financial fundamentals, and the adoption of new technologies for upgrading water supply techniques.

Both the national development and water supply policies that were in effect when the project was planned and this ex-post evaluation study was being conducted referred to the effective use of existing water resources and the supply of safe drinking water. Therefore, the project is consistent with Jordan's development policy.

3.1.2 Relevance to the Development Needs of Jordan

Jordan has adopted a policy of prohibiting the development of new groundwater sources to prevent the excessive pumping of water from wells. Thus the country needs to maintain the pumping capacity of the existing wells and use these water resources in an effective manner.

In 1978, Jordan laid water distribution pipes in the Northern and Middle Districts of the Jordan Valley, and asbestos pipes were used for parts of the networks. As the pipes were dilapidated, a significant amount of leakage was found. Deterioration was also conspicuous in the pumping equipment and reservoirs, which meant that they were unable to supply sufficient water for the increasing number of people living on higher land on the hillsides. The problem of low feed-water pressure in highland residential areas and excessively high pressure in the lowlands was evident.

As a solution to these issues, the water service areas was divided into smaller areas, and the valves installed in the water distribution areas were adjusted. However, ad hoc repairs to the water distribution system have resulted in increasing the complexity of the system. The need has thus arisen for a fundamental upgrading of the water distribution system.

The project enabled the upgrading of the water distribution pipes and involved reconstruction of the water supply networks, and was thus successful in reducing the leakage rate. Deteriorated equipment and facilities were also repaired and the capacity of these was expanded, so that the water supply could be managed more efficiently to satisfy the needs of the users. Highland residential areas were supplied with water at an appropriate pressure, and the problem of excessively high water pressure in the lowlands was solved.

[3] The SCADA system is composed of measuring instruments for remote monitoring (flow meters, water-pressure gauges, and water level indicators), central monitoring devices and data transmission equipment. The system has been installed to monitor the amount and pressure of the water supplied and the existing wells.

These achievements demonstrate the great consistency of the project to the needs of the water service operator and the community people.

3.1.3 Relevance to Japan's ODA Policy

Japan's Country-wise Assistant Policy for Jordan refers to the issue of water supply, especially the need to secure domestic-use and irrigation water, in a section about improvements in meeting basic human needs (BHN), which is a priority issue of the policy. JICA's National Project Implementation Plan for Jordan (FY2005) also stated in the section on improvements in BHN, a priority issue of the plan as well, that JICA should help the country expand its water supply capacity, with the effective and efficient use of water taken into consideration. Specifically, the Plan stated that JICA should offer the country support mainly for the development of water supply networks and cooperation activities for reducing non-revenue water.

In light of the above, as the project is fully consistent with Jordan's development policy and development needs, as well as Japan's assistance policy; therefore, its relevance is high.

3.2 Effectiveness[4] (Rating: ③)

3.2.1 Quantitative Effects

3.2.1.1 Operation Indicators

Table 1 below shows benchmarks of the operation indicators observed before the project started, the targets set for the project, and the actual results measured after the project completion. Reservoirs have been expanded to ensure water reserve capacities as planned, and it achieved larger water supply capacities than planned.

Table 1: Operation Indicators

	Benchmark (2003)		Plan (2010)		Actual (2010)		Comparison Actual/Plan	
	Capacity (m^3)	Supply (m^3/h)	Capacity (m^3)	Supply (m^3/h)	Capacity (m^3)	Supply (m^3/h)	Capacity (m^3)	Supply (m^3/h)
Moa's Reservoir	625	194.2	1,600	194.2	1,600	230.0	100%	118%
Tabaqat Fahil Reservoir	650	165.2	2,500	299.2	2,500	300.0	100%	100%
Kreyma Reservoir	600	41.0	600	61.0	600	100.0	100%	164%[5]

Source: Information provided by the North Shuna Office

3.2.1.2 Effect Indicators

Table 2 below shows the benchmarks of the effect indicators observed before the project started, the targets set for the project, and the actual results measured after the project completion. The leakage rate has been lowered, and the water supply provision to the population and the volume/person/day reached 100.4% and 97.0% respectively. The water pressure also achieved the maximum of the target range of six bar,[6] which enables water to be supplied to the highlands.

[4] Sub-rating for Effectiveness is to be put with consideration of Impact

[5] After the project was completed, a reverse osmosis membrane water treatment plant was constructed near the Kreyma Pumping Station as a build-operate-transfer (BOT) project with WAJ. The plant, capable of processing water with excessively high salinity, enables water resources that had been useless to be supplied to the Kreyma Pumping Station. The percentage includes the capacity that was expanded in the plant (100 m^3/hr.).

[6] At the minimum water pressure of 2.5 bar, water can be supplied directly to the fourth floor of a building. Pressurized at six bar, water can reach the highlands.

Table 2: Effect Indicators

Indicator (unit)	Benchmark (2003)	Plan (2010)	Actual (2010)	Comparison Actual/Plan
Leakage rate (%) (Note 1)	30	20	22	90%
Water supply population (persons) (Note 2)	117,674	137,426	137,992	100.4%
Average water supply volume/person/day (L)	114	129	125[7]	97%
Water pressure	–	2.5*-6 bar	6 bar	100%

Source: Information provided by the North Shuna Office

(Note 1) The benchmark and actual value of the leakage rate are calculated based on the non-revenue water rate[8] derived from the volume of water supplied and the water used by customers in the jurisdictional area of the North Shuna Office on the assumption that half of the proportion of non-revenue water comes from physical leakage ([Non-revenue rate] x 1/2[9]).

(Note 2) This is the total of the water supply population in the jurisdictional areas of the North Shuna Office and the Kinanah Office, as well as in two areas in the Middle District. The basic design assumed a water supply rate of 100 percent, setting the target of the water supply population at the same number as the jurisdictional population. The actual result was derived from customer data and the rate of collection of water charges.[10]

As shown in Table 3, all the three reservoirs satisfy Jordan's water quality standards.

Table 3: Water Quality Standards and the Actual Water Quality of the Reservoirs (Test Results as of the Evaluation Study)

	Planned water quality (treated water) (Note)	Kreyma Reservoir	Tabaqat Fahil Reservoir	Moa's Reservoir
pH	6.5-8.5	7.99	7.48	7.28
Color	Max. 20-39 in cobalt-platinum scale	< 13	5	2
Taste	Acceptable range	Drinkable	Drinkable	Drinkable
Smell	No smell	No smell	No smell	No smell
Turbidity	5 Jackson turbidity units	< 0.56	0.33	0.3
Evaporation residue	1,200 mg/L	596	598	493
Iron	1.0 mg/L	< 0.035	< 0.035	0
Manganese	0.1 mg/L	< 0.05	< 0.05	0
Copper	1.0 mg/L	≤ 0.05	< 0.05	0
Zinc	4.0 mg/L	< 0.08	< 0.08	0.05
Hardness	500 mg/L	186	412	376
Calcium	200 mg/L	42	109	97
Magnesium	150 mg/L	19	34	32

[7] The actual result failed to reach the target as some of the wells in Wadi Arab that were supposed to be available for the project are actually used to meet demand in another area, Irbid.

[8] The non-revenue water rate was 44 percent in 2010. The national average was 41 percent, and the average of the four northern governorates was 38.28 percent. The non-revenue water rate is defined as the amount of water which is not treated as the charged water amongst the total amount of water supply which is brought by the water supply system. It includes the amount of a physical loss, a loss of illegal connection and a loss due to defects of the meters of water supply, The Basic Design Study Report states that the benchmark as of 2003 was 53 percent, and that the target set for 2010 was 40 percent.

[9] Neither WAJ nor YWC analyzed the components of the non-revenue rate (a finding of the field study) and nor has the North Shuna Office. After consultations with WAJ and YWC, a physical leakage rate which is calculated as the non-revenue rate multiplied by 1/2 was adopted for the evaluation to calculate the physical leakage rate. The coefficient is used for reasons of expediency to compute the physical leakage rate when the instruments required to measure leakage are unavailable.

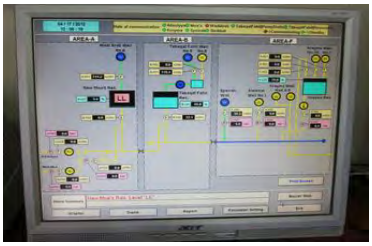
[10] The water tariff collection rate in the North Shuna Office's jurisdictional area was 85 percent in 2011.

	Planned water quality (treated water) (Note)	Kreyma Reservoir	Tabaqat Fahil Reservoir	Moa's Reservoir
Sulfide ion	400 mg/L	9.86	37	23
Chlorine ion	500 mg/L	312	83.4	44
Nitrous acid	2 mg/L	< 0.1	< 0.1	0.019
Nitrate	50 mg/L	16	14	16
Aluminum	0.1 mg/L	< 0.03	< 0.03	0

Source: Data from the Water Quality Laboratory, YWC
(Note) The plan was formulated according to Jordan's water quality standards.

3.2.1.3 Effects of the Soft Component

The soft components of the project were carried out by focusing on the operation of the SCADA system. The staff in the central control room and those at the reservoirs or pumping stations were interviewed separately to examine the current status of SCADA system operation and the related abilities. The staff who was being trained as a candidate for an operator of the system when the soft components were carried out, is now the operator of the system. Three of the four technical workers who received the training now work at the Moa's Reservoir, Kreyma Pumping Station, and Tabaqat Fahil Pumping Station.[11]



Monitor in the SCADA System Control Room

The results of interviews have shown that what they learned in their training concerning the operation of the measuring instruments, operation of the SCADA system, and the maintenance of equipment & instruments still remains useful for their work. Though they also learned about the analysis and the effective use of the data, as well as the detection of abnormal data and the action to be taken regarding water distribution, the collected data is not utilized for water distribution since the data control system was not established[12].

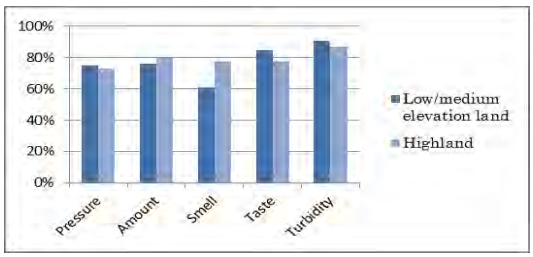
3.2.2 Qualitative Effects

3.2.2.1 Supply-Side Management

Now that water pressure can be adjusted more easily, the frequency of valve adjustment has reduced to one-third of the pre-project level. As information on several water sources and the amount of water held in the reservoirs can be monitored by the North Shuna Office's control room, water supply and distribution can be managed more easily.[13]

3.2.2.2 Evaluation of the Improvements by the Beneficiaries

A survey of the beneficiaries was conducted as a means of quantitative examination of the effects the project had generated.[14] Figure 1 shows the percentage of the respondents who answered "Improved" to questions about improvements in each item based on a comparison of before and after the project.



Source: Results of the beneficiaries survey

Figure 1: Percentage of the respondents who answered "Improved" based on a comparison before and after the project

[11] One of the technical workers was transferred out of the jurisdictional area.
[12] YWC requires no reporting of data (daily, seasonally, or annually), such as the amount of water taken from wells or that supplied from reservoirs which are able to obtained from SCADA system, and the North Shuna Office does not take a record on these data periodically.
[13] Based on information from the workers engaged in maintenance at the North Shuna Office.
[14] The study was conducted using 100 samples collected from the target areas; 45 samples from low/medium elevation land and 55 from the highlands. Households were used as the survey unit as the surveyed areas were residential areas. An average household consisted of 7.2 members. The survey was carried out in November 2011.

To the question about water pressure, 75 percent of the respondents from low/medium elevation area and 73 percent of those from the highlands answered that improvements had been made in comparison with the situation before the project. Asked about water quantity, 76 percent of the respondents from low/medium elevation land areas and 80 percent of the highland respondents said it had increased. Improvements in the smell were recognized by 61 percent of the respondents from low/medium elevation land areas and 78 percent of the highland respondents.[15] Better taste was perceived by 85 percent and 78 percent of the respondents in the low/medium elevation land areas and highlands, respectively. Improvements in turbidity were observed by 91 percent and 87 percent of the respondents in the respective areas.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Improvements in Living Conditions

The survey of beneficiaries conducted as part of this evaluation study shows that 74 percent of all the respondents answered "improved" to the question whether their living conditions had been improved. Among all the respondents, 62 percent answered that the quantity of water had increased, leading to better hygienic conditions. Among respondents living in higher land areas, 42 percent said they had purchased water from mobile tank water suppliers before the project, and all of those former tank water users perceived more convenience compared to before the project. Since tank water is more expensive than tap water, the project allows households who used water from tank suppliers to save an estimated 11.3 Jordan Dinars (JOD) (equiv. approx. 1,296.74 yen) per month.[16]

3.3.1.2 Fair Allocation of the Project Benefits

Beneficially surveys were separately conducted in low/medium elevation lands and the highlands where the water distribution pipes had been laid, and both the residents of low/medium elevation lands and the highlands answered that water supply had been improved. The highlands that had no access to piped water are now supplied with tap water. Other areas that were not supplied with tap water have also gained access to piped water.

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

Construction work for the water pipelines caused no damage to the natural environment.[17] Existing asbestos pipes were not removed or crushed but buried under the ground[18] in order to prevent being scattered around. The location of the buried asbestos pipes was plotted on a GIS (Geographic Information System: GIS) map, which was submitted to WAJ. WAJ can identify the location of the asbestos pipes based on the information on buried objects recorded in the GIS map. No land subsidence has been caused by the pumping up of groundwater.[19]

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[15] The smell of the water in the low/medium elevation lands may be caused by, for instance, dirty water seeping under pressure into the connectors between the water pipes when water supply is halted. However, no empirical study has been conducted concerning this hypothesis. (Locally employed experts of the water service)

[16] Water sold from tanks by private-sector suppliers costs 3 JOD per cubic meter. An average household in this region consumes four cubic meters of water every month. As the amount is below the upper limit of tap water available at a monthly basic charge, a household with piped water has only to pay a monthly charge of 0.7 JOD, 11.3 JOD lower than they would have to pay for tank water, or a saving of 1,296.74 yen at the exchange rate as of April 25, 2012 (1JOD = 114.756 yen).

[17] Information provided by parties related to the North Shuna Office

[18] The Ministry of the Environment and WAJ discussed and decided that the existing asbestos pipes should be buried and left underground instead of being removed(Basic Design Study Report).

[19] Confirmed by a local water supply expert employed for the field study.

3.3.2.2 Resettlement and Land Acquisition

No residents were relocated. To acquire the sites for the Tabaqat Fahil Pumping Station and the Adasiya Pumping Station, vacant and arid land of 2,436 square kilometers was purchased.[20] The land was acquired in compliance with Jordanian law[21] without any legal disputes. Landowners agreed to the purchase prices and the other conditions offered.[22]

3.3.2.3 Historical Remains

The project had no impact on any historical remains. As the Tabaqat Fahil Reservoir lies beside the Pella Ruins, which are ancient relics of the Roman and Byzantine era, the detailed design of the reservoir and connecting pipes underwent environment monitoring by the Authority of Archeology. Specifically, the Authority of Archeology gave directions that the reservoir should be constructed at a lower elevation than the existing pumping stations and that the walls should be painted in a color that matched the ruins behind the walls. When the ground was dug to lay the pipes, the Authority of Archeology and WAJ attended the construction site.

3.3.2.4 Considerations for the Residents and Measures to Ensure Smooth Traffic Flows during the Construction Work

During the construction of water distribution pipes, water was sprinkled from water trucks to prevent dust from being stirred up. The Tabaqat Fahil area has a large population; hence, construction work alongside roads was carried out during the night instead of the daytime in order to avoid the traffic disturbance. As a measure to ensure traffic safety on highways where the construction work was being conducted, construction signs and road cones were placed along the roads as early as possible. Traffic controllers, wearing fluorescent vests, were designated to direct traffic around the construction sites,[23] keeping both the traffic and construction safe. Safety management was emphasized, and plans for the workers' safety and health rule were prepared, and the traffic controllers were thoroughly instructed to adhere to those arrangements such as wearing a hard hat, secure footholds, place tools and equipment in a safe place, and take sufficient days off.

3.3.2.5 Impact on Health

There was some concern that the aging asbestos pipes might have a harmful impact on the health of residents. However, this concern was resolved by adopting other safe water distribution pipes such as ductile cast iron pipes[24]. As stated above, construction workers avoided removal of the existing pipes and left them buried underground to prevent the asbestos from being scattered around. Therefore, there were no harmful impacts to construction workers and the local residents.[25]

3.3.2.6 Environmental Monitoring

No environmental monitoring was conducted for any specific issues, other than for the historical ruins.[26]

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[20] The land was purchased for 39.2 JOD per square kilometer and a total of 95,515 JOD was paid. (Information provided by WAJ)

[21] The acquisition of the sites generally proceeds in the following order. Firstly, based on a design plan, a consultant informs WAJ of the land sites needed to be acquired. Then WAJ's Expropriation Department sets a price for the land, and offers the landowners the purchase conditions. If they do not accept the price or any other conditions, WAJ continues negotiating with the owners until they reach an agreement. During the process, some modification may be made in the design, if necessary. Once the owner's consent is obtained, WAJ notifies the consultant to start the construction work. Land sites for the project were acquired according to these general procedures.

[22] Information provided by WAJ

[23] Confirmed with photographs and a report submitted by WAJ and a consulting firm

[24] Ductile cast iron pipes cause no harm to human health and have great resilience, corrosion resistance and other properties required for distribution pipes.

[25] Information provided by WAJ and a consultant

[26] Information provided by WAJ and a consultant

As mentioned above, it should be concluded that the intended impact of improvement in the living conditions and the fair distribution of water between areas has been achieved.

In light of the above, the project has succeeded in generating outcomes that were almost as planned; therefore, it should be concluded that its effectiveness is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

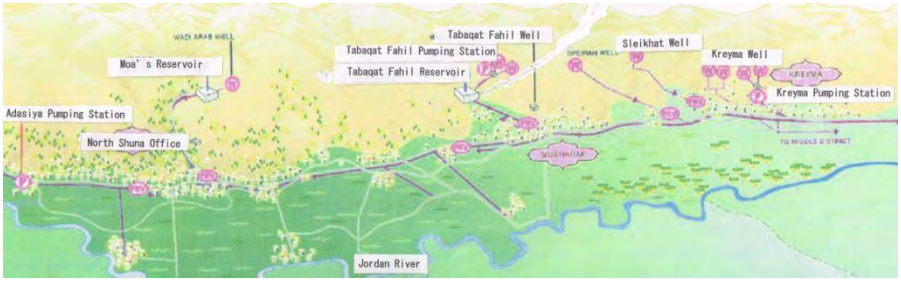
Table 4 and 5 below show the outputs (plan and actual) of Japan and Jordan respectively.

Table 4: Outputs of Japan (Plan and Actual)

Item	Plan	Actual
1. Replacement of the main and branch distribution pipes	1) Northern District: 57,739 m 2) Middle District: 3,580 m Total: 61,319 m	Completed almost as planned[27]
2. Procurement of branch distribution pipes	1) Northern District: 72,778 m 2) Middle District: 875 m Total: 73,653 m	Completed as planned
3. Replacement of pumping stations (Northern District only)	1) Adasiya Pumping Station 56 m^3/h×274 m×2 units 32 m^3/h×74 m×1 unit Pump house: 1 2) Tabaqat Fahil Pumping Station 160 m^3/h×10 m×1 unit 188 m^3/h×64 m×3 units Water tank (380 m^3×1 unit) Pump house: 1 3) Kreyma Pumping Station 163 m^3/h×40 m×2 units Pump house: 1	Completed as planned
4. Reservoir remodeling (Northern District only)	1) Moa's Reservoir 1,600 m^3×1 unit 2) Tabaqat Fahil Reservoir 2,500 m^3×1 unit	Completed as planned
5. Construction of a SCADA system (Northern District only)	1) North Shuna Office (i) Remote monitoring (telemeter panel, personal computers, CRT, printers, software, etc.) 2) Pumping stations, reservoirs and wells (i) Electromagnetic flowmeters, water pressure meters, telemeter panels, and water level indicators	Completed as planned
6. Technical transfer for the SCADA system (soft components)	1) Deliverables (plan) (i) Equipment management manual (ii) Manual for effective use (iii) Evaluation report on the level of understanding of the training participants (iv) Soft components completion report (English) (v) Soft components completion report (Japanese)	Completed as planned

Source: Basic Design Study Report, materials provided by JICA and the responses to questionnaires

[27] According to a CAD drawing provided by YWC, 60,250 meters of pipes have been laid.



Source: Drawn based on the completion drawing in the Basic Design Study Report

Figure 2: Image of the Water Supply Facilities in the Northern Jordan Valley

Table 5: Outputs of Jordan (Plan and Actual)

Plan	Actual
1. Acquisition and creation of sites for reservoirs	Acquisition and creation of sites for the Tabaqat Fahil Reservoir and the Adasiya Pumping Station
2. Construction work for laying the branch distribution pipes	Branch distribution pipes totaling 79,807 meters were laid.
3. Construction work for laying the connecting pipes for individual houses	Connecting pipes totaling 54,250 meters were laid for 7,901 households.
4. Bringing power lines into the facilities	Completed as planned.
5. Bringing telephone lines into the facilities	Completed as planned.
6. Acquisition of water to meet the additional distribution requirements[28]	Completed almost as planned.[29]
7. Securing of technical workers engaged in training and instruction for water purification facilities operation and SCADA system management	Completed as planned.

Source: Basic Design Study Report and interviews with the related parties

3.4.3 Project Inputs

3.4.3.1 Project Cost

The project, prepared with 2,064 million yen as E/N grant limit, was completed with an actual expenditure of 2,031 million yen, or 98 percent of the estimate. The input of the soft component of training was one month (17 person-days of training), with no change from the plan. Regarding the project cost of Jordan side, against its estimated total expenditure[30] of 296 million yen,[31] it actually expended 298.74 million yen.[32] Taking into account changes in the exchange rate between the times of estimation and project implementation, it should be concluded that the actual total expenditure remained within the plan.

[28] It was necessary to obtain water from other regions and secure a sufficient quantity of water to supply the target areas that the project was designed to cover.

[29] Some of the wells that were supposed to be available for the project turned out to be unavailable as they were needed to supply water to another area that became short of water. As a result, the total amount of water available in the regions that the project was designed to cover fell short of the quantity assumed in the plan.This shortfall was covered by installing a reverse osmosis membrane water treatment plant that was constructed near the Kreyma Pumping Station as a BOT project with WAJ, although the plant is not included in the scope of the project.

[30] The Basic Design Study Report

[31] The estimation was made in August 2004, and the exchange rate at that time (the average over the past six months from August 31, 2004) was 110.49 yen to the US dollar and 156.06 yen to the JOD.

[32] The estimation was made in July 2005, and the exchange rate at that time (the average over the past six months from July 31, 2005) was 114.94 yen to the US dollar and 162.99 yen to the JOD.

3.4.3.2 Project Period

The project was originally planned to be completed in 35 months.[33] It actually took 37 months (106 percent of the planned period) for completion[34]. The parts of the project done by Jordan side were completed within the planned period.

To oversee the progress of the project, WAJ formed a project supervisory team with representatives from WAJ, Authority of Archeology and the municipalities, as well as the contractors and consultants. They had regular meetings in the headquarters or on site as needed, to ensure and make adjustment of the progress and the challenges of the work, negotiate and solve the problems, and to establish a scheme for the efficient implementation of the project.[35] When a construction is carried out in Jordan, the Jordanian parties often fail to complete the preparations on schedule, such as for land actuation and the acquisition of approvals or permits, which affects the progress of the main construction work.[36] The completion of the project without delays was due to effectiveness of these supervisory arrangements.

In light of the above, the project cost was within the plan, but the actual project period was longer than planned; therefore, it should be concluded that its efficiency is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

NGWA, a branch of WAJ, was reorganized as YWC[37] in September 2011, and the North Shuna Office was also transferred to YWC as its branch. A French water service consulting firm concluded a five-year contract with WAJ for management reform after it had won a competitive bid.[38] Specifically, they are trying to carry out reforms to reduce deficits, save power consumption for the pumps, respond to the increase in the population with the inflow of refugees and migrants, lower the non-revenue water rate, provide better services to customers, and maintain, upgrade and replace facilities and equipment.

The French consulting firm submitted a plan for the organizational reform of YWC[39] to WAJ, but many YWC employees[40] rejected it. At the time this evaluation study was being conducted, the organizational structure remained unchanged from what it had been as the NGWA.

The North Shuna Office is composed of Departments of the Customer, Engineering & Maintenance, and Finance & Administration. It has 79 employees including an engineer[41] and 15 diploma holders. Other than employees that work in the office building, most of the employees are technical workers who maintain the facilities and turn out on tractors and power shovels to

[33] Ex-ante Evaluation

[34] February 2005 - February 2008 (37 months)

[35] Findings from an interview with the then WAJ manager in charge of the project

[36] There is a particular case that a project conducted with another donor for the improvement of a water distribution network in the Northern District, which was completed significantly behind schedule due to delays in the work of the Jordanian implementing agency.

[37] YWC is fully owned by WAJ, and its budget is financed by WAJ. It is not a financially independent entity.

[38] Part of the payment to the contractor is financed by the European Union (EU), which has provided grant aid of €900,000 for financial audit techniques and the dispatch of a chief supervisory officer and administrative engineers. In line with the contract, KfW (Kreditanstalt für Wiederaufbau) has offered an interest-free loan of €4.2 million for investment in facilities in the Northern District. The EU and Germany are working in coordination to provide support for the management reforms.

[39] The French water service consulting firm focused on functions in designing the organizational structure that it proposed, which was composed of IT, Human Resources, Operation and Maintenance, Finance and other Departments. YWC's existing organization is made up of regional branches.

[40] The proposal included the major reform of the organizational structure that YWC had inherited from the former NGWA, and its employees rejected the proposed reform, and started a campaign against it. The Minister of Water and Irrigation intervened, and decided that the existing organization should be maintained.

[41] Engineers, defined differently from Japanese ones, are obliged to have a bachelor's or higher degree.

solve problems, such as water leakages and accidents related to the water supply and distribution pipes.

To date, YWC has not established a scheme to collect, manage, or effectively use information obtained through SCADA concerning, for instance, the trend in changes in the water level of water source wells.

3.5.2 Technical Aspects of Operation and Maintenance[42]

At the time the project was completed, technical workers engaged in operation and maintenance had already obtained the level of technical skill required for routine operation and maintenance. For the project, WAJ staffed the central control room with employees familiar with information technology, and those staff had attended training courses under the project and obtained considerable expertise in the SCADA system.

No specific training or technical guidance has been offered for maintaining or raising technical level other than the training by soft component or the training provided by the constructor during and after the construction work. However, what was taught in these training courses is transmitted and shared among the operation and maintenance workers of the North Shuna Office through their work on the ground.

As for training needs, YWC has examined what kind of training is necessary for each organization and prepared a training plan, which has been sent to WAJ for approval. The present state suggests they need training for developing a scheme to manage, analyze, and effectively use information obtained through SCADA and other data. From the medium- and long-term viewpoint, some technical guidance is needed concerning the removal of dirt in the pumping stations, the adjustment of drainage, and other issues that have no specific impact on present operations but could cause trouble someday.

A management plan for the facilities and equipment and a maintenance and inspection scheme have been established. The frequency and method of daily and regular inspections have also been set out. Maintenance logs are produced and the water pressure and quantity, and chlorine adjustment are recorded.

Pump glands must be kept wet, with a small quantity of water deliberately leaked onto them for the purpose of lubrication maintenance of the main shaft, and so that any air is removed from inside the pumps. However, this technique is not employed at present. If the present condition continues, the pumps will be damaged as the gland packing will heat up and/or its life will be shortened. Technical guidance should be offered.

3.5.3 Financial Aspects of Operation and Maintenance

WAJ and YWC are authorized to manage the financial affairs of the North Shuna Office. The office has no budget that can use for maintenance at its discretion. Every fiscal year, the office notifies YWC of the number of maintenance parts, such as pipes and meters needed to be repaired. It cannot obtain them unless YWC and WAJ give their consent. Judging from answers that Jordanian water supply experts gave when the external evaluator asked in detail about the present state of maintenance, it is hard to say that sufficient expenditures are being made for operation and maintenance for the medium- and long-term needs.

[42] In the project, technical guidance was provided mainly to the North Shuna Office in the Northern District. The external evaluator has no information of maintenance in the Middle District mainly because it is administered by another organization, just as the basic design was.

Water rates were revised in January 2011.[43] Water rates are revised through general procedures; WAJ proposes a revision to the Water Rate Commission of the Ministry of Water and Irrigation, and then puts the proposal to the parliament to ask for its approval. Water rates are set based on the socio-economic conditions of each region, rather than the economics of WAJ. Each regional water service agency is operated on the basis of the water rates set for the region, but generally they would make a loss if they were dependent solely on the water charges. YWC stated that the cost of water supply in the Northern District as a whole[44] is 1.1 JOD per cubic meter.[45] WAJ has a plan to save electricity charges by replacing pumps and fixing distribution pipes to lower the cost of water supply[46]. Table 6 shows YWC's water charges.[47]

Table 6: YWC's Water Tariff Rates (2011: in JOD)

User category	Rate
Households (< 7 m^3)	0.700
Households (< 13 m^3)	0.145/m^3
Households (< 19 m^3)	0.500/m^3
Households (< 25 m^3)	0.940/m^3
Households (< 30 m^3)	0.145/m^3

Source: YWC

WAJ also operates at a loss.[48] Table 7 shows the revenues and expenditures in 2009 and 2010. Revenues increased to nearly 1.4 times the level one year before while expenditures decreased by 14.3 percent. As a result, WAJ's deficit fell at least over these two years.[49]

Table 7: WAJ's Revenues and Expenditures (in JOD)

	2009	2010
Revenues		
Water sales and charges	34,249,747	39,681,779
Equipment rental fees	9,269,000	12,260,000
Sewerage charges	9,246,100	7,116,782
Meter management revenues	3,110,414	2,395,587
Contract household water service connection charges	1,697,496	1,744,546
Other revenues[50]	797,137	682,566

[43] Water charges revised in January 2011 were set to be paid monthly. At the time of the second field survey in April 2012, the system had been changed to pay every three months. The change was revised again in January 2012, as it turned out that the collection rate was higher for payment once every three months than for monthly payments.

[44] Water supply costs are higher than the income from water rates not only in the Northern District, but everywhere in Jordan. The government must bear the cost, as the more water customers consume. Hence, the more people are called on to save water or water supply restrictions are imposed nationwide.

[45] The exchange rate was 108.79 yen to the JOD as of December 31, 2011.

[46] Another donor provided YWC with technical aid to improve its schemes and organizations, including the methods of water cost analysis and price-setting; however, socio-economic aspects are also considered for the actual raise in water rates. A raise in water charges in proportion to the increase in water service costs was strongly opposed by the parliament and citizens, and YWC failed to set the rates proposed by the donor.

[47] The survey of beneficiaries revealed that water rates were seen as high by 66 percent of the beneficiaries, as a little high by nine percent of them and as reasonable by 25 percent of them. Most of the households that had used tank water previously responded that the water rates were reasonable as even the raised water charges were lower than the price of water sold by the tank water suppliers.

[48] To cope with its different water conditions from other countries, Jordan buys or borrows water from Israel and Syria during summer, when demand is high. The Yarmouk River, which has Lake Tiberias as its riverhead, flows 300 meters below sea level, and is 170 kilometers from Amman. The highland metropolis needs to pump up water from the river lying 1,200 meters below it and the electricity charges for running the pumps raise the maintenance costs. WAJ's deficits are made up for by the state budget.

[49] Parties related to WAJ explained that part of the decrease was the result of a 10 percent reduction in the number of employees.

	2009	2010
EBITDA	12,208,126	19,033,670
Other revenues	1,811,210	2,108,512
Foreign exchange losses	0	15,818,037
Total revenues	**72,389,230**	**100,841,479**
Expenditures		
Water purchases	3,313,754	3,821,944
Salaries and wages	20,668,595	19,690,810
Operation and maintenance expenses	21,146,904	20,324.226
Administration expenses	1,032,515	1,010,610
Expenditures for the sewerage business	22,543,533	13,398,752
Depreciation expenses	67,568,402	68,491,052
Uncollected water charges	2,920,107	1,000,000
Expenses before interest and taxes	79,012,706	61,747,622
Financial fees	21,637,189	24,117,242
Foreign exchange losses	9,335,762	0
Total expenditures	**249,179,467**	**213,602,258**
Annual earnings	**-176,790,237**	**-112,760,779**

Source: Data obtained from WAJ's Financial Department

As the reform of YWC started in 2011, financial data on the former NGWA was only available for the time this evaluation study was being carried out. Table 8 shows the revenues and expenditures of NGWA in 2009 and 2010. In both years, NGWA made a loss, and electricity charges accounted for 56 percent of the maintenance expenses. YWC intends to oblige employees to keep the necessary records, such as operation logs for pumps and vehicles, as a way of reducing expenditures, especially power charges and the fuel expenses for vehicles.[51]

Table 8: NGWA's Revenues and Expenditures (in JOD)

	2009	2010
Revenues		
Sales of water to other governorates	12,508,932	13,127,018
Water service customer connection charges	1,435,095	1,555,153
Sewerage charges	1,168,948	1,196,063
Sewerage connection charges	470,656	823,724
Sales of water tanks	481,217	496,954
Sales of water to WAJ	359,465	269,790
Metered customer charges	257,671	246,142
Agricultural water charges	4,356	3,046
Other revenues	2,175,870	94,984
Total revenues	**18,862,210**	**17,812,874**
Expenditures		
Maintenance expenses (Breakdown shown in Table 10)	16,040,301	17,950,738
Personnel expenses	7,669,266	7,773,076
Depreciation expenses	2,921,137	3,437,685
Administration expenses	686,491	779,366
Total expenditures	**27,317,195**	**29,940,865**
Annual earnings	**−8,454,985**	**−12,127,991**

Source: Data obtained from YWC's Financial Department

[50] Including revenues from water supplied to other regions.
[51] Information provided by YWC's Financial Department

Table 9: Breakdown of the Maintenance Expenses (in JOD)

	2009	2010
Electricity charges	8,986,031	10,204,111
Maintenance expenses	2,776,535	2,672,168
Purchase of water from private wells	1,370,417	1,476,486
Fuel expenses	1,304,785	1,423,509
Compensation	313,224	1,037,801
Transport expenses	503,938	654,256
Expenditure on chemicals	277,761	227,179
Machine and vehicle expenses	462,597	203,509
Purchase of water from WAJ	45,013	51,719
Total maintenance expenses	16,040,301	17,950,738

Source: Data obtained from YWC's Financial Department

3.5.4 Current Status of Operation and Maintenance

Local experts on water supply stated that there are some issues in the operation and maintenance of the facilities and equipment, but in general the local offices perform maintenance themselves as far as they can, and no specific problems found in the appearance or performance inspections. They also said that a sufficient quantity of parts is supplied for maintenance,[52] but actually slight improvements are still needed in the maintenance work. For instance, as local offices have difficulty in procuring some types of spare parts, such as the larger sizes of valves for the distribution pipes, it may not be possible to stop water leakages until such parts are obtained,[53] and the water supply may cut off in the meantime in the affected area.

The Tabaqat Fahil Pumping Station was constructed in a low site to preserve the appearance of the historic ruins. The pumping station was hit by unprecedented torrential rain[54] in May 2008 during the defects liability period, and its pumping facilities were inundated. To control the rainwater, the pumping station was surrounded by U-shaped trenches capable of draining off 50 millimeters per hour, and the pump room had an automatic drainage pump with a water gauge installed on the floor. However, when the floodwaters began coming into the station, operators urgently turned off the power to shut down the main pump,[55] causing the drainage pump to stop working as well. The consultant, after discussions with WAJ, made the necessary repairs to the machines and electrical equipment and replaced the broken parts. After the incident, the constructor and consultant built protective walls to prevent the inflow of rainwater. Specifically, the Japanese consultant constructed 60 centimeters in height cut-off walls (breast walls) outside the U-shaped trenches surrounding the pump station. WAJ also built earthen banks.

In addition, the following facts were observed.

- No water leakage had occurred in the pumping stations, except some pumps at the Tabaqat Fahil Pumping Station. At Tabaqat Fahil Pumping Station, the leaked water was being pumped out, but some water was observed gathering in cable pits or gutters formed like U-shaped trenches that were used to lay the wires from the control panel to the pumps[56].

[52] Information provided by a maintenance manager at the North Shuna Office

[53] The North Shuna Office says that the Irbid Branch is almost 80 kilometers away, and that it takes more than one day and a half to contact the branch and acquire the necessary parts.

[54] It was such torrential rain, even by local standards, that the meteorological data could not be measured. (Information provided by WAJ)

[55] It is insisted that this action was also necessary to prevent workers from receiving electric shocks.

[56] The Inspection Report has already pointed out this situation.

- At the Tabaqat Fahil Pumping Station and the Kreyma Pumping Station, some equipment was rusted and stained with calcium carbonate contained in the groundwater[57].
- After the project was completed, a reverse osmosis membrane water treatment plant was constructed near the Kreyma Pumping Station, and a new pump was added to the Station. However, information on the new pump was not added to the SCADA system due to systemic restrictions of the program used.[58]
- The SCADA system is designed on the assumption that reservoirs maintain a certain amount of water, and when the water declines below a certain level, the system gives a warning. Therefore, the warning switch was kept off when the SCADA system was in use.
- Some of the communication cables for the SCADA system were stolen and new cables had been installed. However, they were later stolen again and had been abandoned without repair. The cable system is set to be restored with some safety monitoring arrangements, when SCADA systems are introduced throughout the Northern District with the aid of the Spanish government.[59]

In light of the above, there was no major problem found in the maintenance techniques for the project, but some issues remain in its structural and financial conditions, thus the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project is highly relevant as it is consistent with Jordan's development policy and the priority issues of Japan's assistant policy, as well as the fact that the country has high needs for development. Its effectiveness is also high as the project has achieved targets in most of the major effect indicators, with significant effects obtained, and the findings from the survey of the beneficiaries suggest there are improvements in the water supply conditions. Its efficiency is fair as the project cost was within the plan, although the actual project period was longer than planned. The sustainability of the project's effects is also fair as, despite no major problem having been found in the project in terms of operation and maintenance techniques, there is some concern about the structural and financial conditions.

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

4.2 Recommendations

4.2.1 YWC

Organizational scheme:

The North Shuna Office has no stock of some important spare parts in its warehouse, and needs to contact YWC's Irbid Branch to acquire them. A scheme should be set up to allow local offices to manage spare parts themselves.

The North Shuna Office has no document produced to record the monthly water distribution or water reserves, and has no way to monitor long-term trends in seasonal changes in the

[57] In relation to this point, the Inspection Report has already pointed out as the same as note 55.

[58] There was no one besides the original programmer who was able to modify or expand the SCADA system program. (Information provided by the consultant)

[59] According to the information provided by a member of YWC's Strategic Planning Office, a decision has been made to introduce SCADA systems in the four northern governorates with the aid of the Spanish government. At the time the second field survey was being conducted, the plan had already been approved by WAJ, and it was before the Jordanian parliament for its approval. Once approved, the systems will come into operation in 2012. Control rooms will be installed in the four governorates and a central control room will be set up in the YWC headquarters in Irbid. With the introduction of the new SCADA systems, the North Shuna Office's system will also be connected to the central control room at YWC. A plan has been prepared to lay new cables to replace the stolen ones and install surveillance cameras around them to prevent theft.

groundwater level. YWC has not established a data management scheme to analyze information obtained from the SCADA system and use it for control, forecasting, or estimation of water supplies. A scheme to manage the data should be developed.

Financial scheme:

YWC and WAJ retain all information and authority concerning financial affairs. Power to make decisions concerning the supply of parts and the repair of tools for maintenance should be transferred to local offices.

Technical management scheme:

At the time of the defects study, some problems had already been pointed out, such as the need for adjustment of the pump gland leakage in the pumping stations, painting of the pumps, repair of the cable pits with water leakage at the Tabaqat Fahil Pumping Station, and the removal of rust on the pumps and stains from calcium carbonate contained in the groundwater. However, no improvement was observed in the field study. So far no supervisory or maintenance system has been established for the inspection and maintenance of these basic details. YWC's prevention and maintenance team visits the work sites to give guidance to people working on the ground. To ensure that this guidance work effectively and the maintenance work is conducted according to the actual conditions at the sites, YWC should set up an internal system to supervise and monitor its maintenance.

4.2.2 North Shuna Office

Technical transfer within the organization:

As reform is set to start at YWC, it should make sure that the techniques and expertise of the maintenance work for the project is transferred to the employees in the North Shuna Office in order to minimize the negative consequences of the redeployment of personnel or any other changes.

Emergency response drills:

As the possibility cannot be ignored that unexpectedly heavy rain such as that experienced in Tabaqat Fahil may cause similar trouble, crisis management arrangements should be established by, for instance, giving operators and other parties concerned regular drills to prepare for unexpected incidents, so that they will keep crisis management in mind in their daily work.

4.2.3 Recommendations for JICA

None in particular.

4.3 Lessons Learned

It was appropriate that the implementing agency assigned employees familiar with information technology to the North Shuna Office when the SCADA system was introduced. This arrangement was carried out based on a suggestion given by the Japanese side to WAJ. Before the project started, the North Shuna Office had no personal computers, and the Japanese side concluded that this office should be staffed with a worker qualified to control the SCADA system, and made a suggestion to this effect. As seen in this case, the SCADA system can only be introduced after the necessary personnel are assigned since they make a great difference to the operation and maintenance once the system comes into service.

Serbia

Ex-Post Evaluation of Japanese Grant Aid Project
"The Project for the Improvement of Water Supply System in Belgrade City"

External Evaluator: Hisamitsu Shimoyama, IC Net Limited

0. Summary

In this project, Belgrade Waterworks and Sewerage (Beogradski Vodovod i Kanalizacija, BVK) in the Republic of Serbia was provided with a supervisory control and data acquisition (SCADA) system[1], distribution pumps, control equipment, and water quality testing equipment. The project aimed to provide Belgrade with a safe and stable drinking water supply by these procured system and equipment. This would help Belgrade properly operate and maintain existing city water and sewer facilities while also improving the water supply in regions experiencing water shortages in the city. This project conformed with Belgrade development policy and needs, as well as Japanese ODA policy, and its relevance is high. During the planning phase, Belgrade had issues with citywide droughts in summertime and water shortages due to inefficient water supply in zones 3 and 4[2] where are at higher altitudes than zone 1 and 2. Because of the contributions from the project, along with those of other donors and BVK itself, issues are now solved and its effectiveness is high. The project efficiency is fair; although both project cost and period of Japanese side were within the plan, Serbia side did not complete its project component, and the project period significantly exceed the plan. BVK is generally good on the technical front and be able to develop the SCADA system themselves; however, due to Belgrade's inability to install the pumps within the planned budget and its financial vulnerabilities, sustainability of the project effect is fair.

Considering all the elements above, the project is evaluated to be satisfactory.

1. Project Description

Project Location

The pump installed in PS 15 by the project

[1] In Japan, SCADA (Supervisory Control and Data Acquisition) systems are generally referred to as monitoring control systems. For this cooperation project, the system monitors Belgrade city water service operations and allows remote operation of some facilities from a central control room.

[2] BVK defines each zone according to differences of altitudes.

Zone	1	2	3	4
Altitude (m)	75-125	125-175	175-225	225-310

1.1 Background

The project region is Belgrade, the capital of Serbia[3]. The Belgrade population at the time of the planning was 1.32 million, with 84% of them receiving water supply. BVK manages the city water and sewer services. The existing water supply facilities showed extensive signs of deterioration and malfunctioned frequently. Coupled with less groundwater being drawn, this resulted in water shortages, particularly in summertime. Water was not being appropriately distributed due to the large number of facilities involved in water supply management, keeping facility water supplies away from working together as one system. Thus, many regions were plagued with chronic water shortages. Furthermore, much of the water quality analysis equipment was unusable, hindering smooth water quality management.

1.2 Project Outline

The project aimed to provide Belgrade with a safe and stable drinking water supply. It would accomplish this by building a SCADA system and updating the distribution pumps and water quality analysis equipment. This would help Belgrade properly operate and maintain existing city water and sewer facilities while also improving the water supply in city regions experiencing water shortages.

Grant Limit/Actual Grant Amount		754 million yen / 661.97 million yen (I/II) 454 million yen / 370.82 million yen (II/II)
Exchange of Notes Signed (/Grant Agreement Signed)		July, 2005 (I/II) October, 2006 (II/II)
Implementing Agency		Belgrade Waterworks and Sewerage (BVK)
Project Completion		February, 2008
Project Contractors	Work Contractors	Ebara Corporation
	Consultant	Tokyo Engineering Consultants Co., Ltd.
Basic Design Study		March, 2005
Related Projects (if any)		Other agencies: 1) Kreditanstalt für Wiederaufbau (KfW): Water meters and piping upgrade for non-revenue earning water (8.909 million EUR) 2) European Bank for Reconstruction and Development (EBRD): Expansion Project for Makis 2 Water Treatment Plant (20 million EUR)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisamitsu Shimoyama, IC Net Limited

2.2 Duration of the Evaluation Study

Ex-post evaluation studies of the project were conducted as follows:
Duration of the Study: September 2011 – November 2012
Duration of the Field Study: March 13-27 and June 17-25, 2012

[3] Serbia was Republic of Serbia and Montenegro in 2004 during the planning phase.

2.3 Constraints during the Evaluation Study

In terms of evaluating the project effectiveness, a vague project objective of "improving water supplies in regions with water supply shortages" limited quantitative evaluation of operational indicators. Specifically, it was unclear if the objective was to be achieved by improving water distribution amounts or distribution efficiency. Therefore, judgment on the project effectiveness is restricted.

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

3.1 Relevance (Rating: ③[5])

3.1.1 Relevance to the Development Plan of Serbia

In 1995, the Republic of Serbia in the Federal Republic of Yugoslavia formulated the "Master Water Plan for the Republic of Serbia", which specifies the need to ensure and protect water resources, as well as maintain and develop integrated water management. At the time of planning the Basic Design study was conducted, Belgrade had written the "General Urban Plan of Belgrade 2021". The plan stated that the city would implement plans within its power to solve water problems, such as with water resources or water supply and sewerage management. Even at the time of ex-post evaluation, this plan was still an integral part of water supply policy for the city. Moreover, the "Urgent Improvement Plan" formulated in 2001 designed to reduce a rate of leakage from 33% to 28% and to increase quantity of water intake and water distribution by renovating pumps. The "Prospective Development Program for Water Supply System for Belgrade", formulated according to the Master Water Plan, set forth objectives in line with demand for safe drinking water and stable supply. As the project was to help give Belgrade a stable water supply by renovating pumps and building efficient water supply system to monitor all the relevant water facilities in the city, it has been consistent with the development plan of Serbia.

3.1.2 Relevance to the Development Needs of Serbia

In the planning phase, Belgrade had problems with summer droughts and frequent water outages. Zone 3 and 4 where are at higher altitudes than zone 1 and 2 always face water outages not only in summer but all the time. The reasons for the problems were mostly due to the frequent failure of its aging facilities and overall management issues, which was caused because there was no measure to get the operational situation of the citywide water supply system. The Development Plan of Water Supply Facilities, which was formulated in a previous year of the project planning, estimated to increase demand of water supply per day in Belgrade from 950,400 cubic meters (2005-2010) to 1,209,600 cubic meters (2010-2020). As the city expanded, the water-supplied population increased from 1,319,188 in 2003 to 1,583,857 in 2011, in particular, the population in the zone 4[6] where is located in the suburb increased from 17,092 to 36,429. It was highly necessary to appropriately supply water in each zone with efficient management of water supply in order to adjust such a rapid growth of water demand. It follows that water supply needs are still high in the ex-post evaluation. The project aimed to improve the water supply situation and it has been consistent with the development needs.

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[4] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

[5] ③: High; ②: Fair; ①: Low

[6] All regions of Belgrade expansion into the suburbs are included in zone 4. Specifically, zone 4 is classified into four districts. Note that the district originally set as zone 4 takes the generic name Zone 4 District. Districts: Zone 4 District, Southern District, Avala District, and Vinca District.

3.1.3 Relevance to Japan's ODA Policy

During the planning phase, infrastructural reconstruction assistance, including that for water and sewerage, was an important objective in Japan's ODA policy for Serbia. Infrastructural development in Belgrade, Serbia's most populous city, has great significance as a rehabilitation after economic sanction led by the Balkan conflict. By installing a SCADA system, a system used in Japanese water departments with a reputation for being easy to use, the project built the latest water management system. This is highly relevant in terms of Belgrade independently developing the system after the project completion. Thus the project is highly consistent with Japan's ODA policy.

From the above, the project has been highly relevant with Serbia's development plan, development needs and Japan's ODA policy.

3.2 Effectiveness[7] (Rating: ③)

At the planning phase, supply amounts of water, distribution amounts of water, operational conditions of facilities, and operation and maintenance for facilities and equipment were set as indicators. Since the project objective was an improvement of water supply in water shortage areas, the evaluator initially defined that the project objective is to improve efficiency of water supply, and to eliminate the gaps of water supply in terms of regions as well as seasons. Thus, population of water supply in each zone and flow of annual water demand were set as the indicators to evaluate effectiveness. However, since the implementing agency did not record these indicators, the original indicators were replaced to following ones; estimated populations of water supply in each zone, supply amount of water, and planned value for leakage rate.

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Improvement of water supply volume in Belgrade

The Belgrade water-supplied population in 2011 was 1,583,857, or 120.1% of the 2003 figure of 1,319,188. As of an amount of water supply, in 2008, the maximum daily supply volume for all four zones was 105.7% that of the 2004 level. The water supply volume in zone 1 was 116.6% of the 2004 level in 2008, and 110.5% in zone 2. While the water supply volume is increased in a whole city, zone 3 and zone 4 were respectively 72.4% and 79.7% of the 2004 levels in 2008. This showed the regional gaps were available. However, SCADA system was introduced in 2007 and distribution pumps were mounted in 2008. If comparing maximum daily supply volumes in 2011, which is the year that the water supply system became fully operational, for all four zones to 2004 levels, levels decreased to 97.9% in 2011 and the gaps among four zones became shrunk. This is because improvements in distribution efficiency have enabled to provide for a greater water-supplied population with less water by volume.

Table 1: Maximum Water Supply Volume by Zone

Water supply volume: m^3/day

Zone	2004 (Baseline Year)	2008	2008 vs. Baseline Year (%)	2011	2011 vs. Baseline Year (%)
1	381,165	444,532	116.6	397,804	104.4
2	240,332	265,603	110.5	248,128	103.2

[7] This rating for effectiveness also takes impact into account.

3	143,697	104,052	72.4	104,975	73.1
4	20,499	16,337	79.7	17,916	87.4
Total	785,693	830,524	105.7	768,823	97.9

Source: Created by the external evaluator based on data provided by BVK

As mentioned above, the Belgrade water-supplied population increased 121.7% from the levels of 2003 to 2011. The largest population growth in volume was 178,874 in zone 1 from 2003 to 2011, and the growth in rate was the highest in zone 4 and became 213.3% over the reference year of 2003. In proportion to the expansion of Belgrade into its suburbs, this is mainly due to expansion of the water-supplied population of zone 4. BVK explained as follow that the maximum water supply volume decreased to 87.4% over the reference year of 2004 despite the fact that the water supply population became double.

At the planning stage, BVK needed to supply more water per person in zone 4 where is the highest altitudes in all four zones, because BVK added water pressures to deliver the water in zone 4. For example, in 2003, BVK supplied 0.59 cubic meters per day in zone 1 while 0.83 cubic meters per day in zone 4. However, BVK installed booster pumps to add water pressures at reply points by itself after the project, BVK no longer needed to supply excessive amount of water with additional water pressures from pump stations. As a result, at the time of ex-post evaluation, amount of water supply per person in zone 4 decreased to 0.49 cubic meters per day.

Table 2: Water Supply Population by Zone

Zone	2003 (Baseline Year, ppl)	2011*	Increase (%)
1	639,980	818,854	127.9
2	403,520	513,169	127.1
3	241,269	215,405	89.2
4	17,082	36,429	213.3
Total	1,301,851	1,583,857	121.7

Source: Created by the external evaluator based on data provided by BVK.
Note: In order for BVK to get a grasp on the exact numbers, the water-supplied populations of each zone for 2011 were assumed from the percentage of total 2011 water supply volume by zone.

Beneficiaries have also given testimonies that there have been very few water outages even in summertime since 2009. As shown in Table 3 below, 92.1% of the residents in zone 3 and 77%[8] in zone 4 who experienced problems of water shortages in the planning phase responded that they have had a continuous supply of tap water.

Table 3: State of Water Supply in Zones 3 and 4 (%)

Beneficiary Response	Zone 3	Zone 4
Have stable water supply	92.1	77
Do not have stable water supply	7.9	23

Source: Survey of beneficiaries by the External Evaluator in the ex-post evaluation.
Note: Figures are given as percentages of 76 respondents in zone 3 and 53 in zone 4.

Excluding temporary outages from burst water pipes and frozen pipes in winter, water

[8] While 23% of residents in zone 4 reported experience with water outages, the External Evaluator found that water pressure was extremely low in this responding region due to illegal water connections.

limitations due to shortages have decreased. This is because the levels of water in reservoir were stable, and water limitations in zone 3 and 4, where outages were problem at the planning phase, were more or less eliminated according to the beneficiary survey. Thus, it can be said that most regions have a 24-hour water supply in a real sense.

(2) Seasonal differences in amount of water supply

Summer in Belgrade starts in July and water consumption starts increasing, with overall city water consumption peaking in August at 12.6 million cubic meters. The water supply system in the city corresponds to 135% of the annual minimum of 9.3 million cubic meters consumed. August is also the peak for water consumption in zone 1 at 6.2 million cubic meters, or 167.6% of the lowest consumption month (November) at 3.7 million cubic meters.

When the external evaluator checked the monthly average water levels in reservoirs in 2011 provided by BVK, it is found that no reservoirs registering close to empty in any zone and confirmed that there were no water shortages for an entire year[9]. A survey of beneficiaries in zones 3 and 4, those hit hardest with droughts during the planning period, revealed that they noticed no water shortages. Given this, it is fair to say that water supply in Belgrade is sufficient.

Table 4 Average water levels in reservoirs in 2011 (%)

	Month											
Zone	1	2	3	4	5	6	7	8	9	10	11	12
1	61	64	59	60	62	63	56	63	59	60	54	55
2	70	70	69	68	69	68	57	55	54	56	65	67
3	60	61	59	56	59	52	50	52	52	55	52	52
4	71	71	67	67	68	66	63	66	65	64	64	68

Source: Created by the external evaluator based on data provided by BVK

(3) Improvement of water supply efficiency and effects by related projects

While a total amount of water supply was decreased, BVK even supplies sufficient amounts of water to the larger populations in Belgrade city. In addition to the project, there is a compound effect here; KfW replaced distribution pipes and it is planned that water leakage reduce by 5% from 33% to 28%, and BVK also worked to reduce its own leakage rates. In zone 4, while water-supplied population increased to 213.3% from 2003 to 2011, the maximum amount of water supply decreased to 87.4% of the level in 2004.

Although no data was available on designed capacity of water treatment plants, it is considered that there have been no closed plants since the planning phase or changes in design water supply capacity. At the time of ex-post evaluation, the Makis 2 water treatment plant was under construction. The French Development Agency and European Bank for Reconstruction and Development are working on a project aiming to start its operation by the end of 2012. Once Makis 2 is completed, the older Bele Vode and Vinca plants are scheduled to be closed. However, as the water supply volume and regions to be supplied are highly expected to continue increasing as Belgrade continues to expand, the closure of these water treatment plants will

[9] With water supply work in neighboring Petlovo Brdo, zone 2 had a planned service outage from July to October 2011, reducing reservoir levels. BVK explained that this was not indicative of the regional drought situation.

likely be postponed for now.

Pump upgrades by BVK and the US Agency for International Development have prevented declines in the water volumes drawn from the wells dug along the Sava River, which was an issue in the time of planning. BVK monitors that the water intake from these wells is slowly decreasing annually, and plans to have sufficient water supply through Makis 1, which draws surface water from the Sava River, and the Makis 2 currently being expanded.

(4) Changes in water safety from improved water quality inspections

According to the BVK water quality control manager, the quality of water continues to be inspected as stipulated according to the Official Gazette of FRY 42/98 at the time of ex-post evaluation as it was in the planning phase. It was confirmed that the water met all criteria at the time of ex-post evaluation. This includes criteria for turbidity, residual chlorine, ratio of included minerals and bacteria, which are prescribed in 23 physical science items and seven biochemical items.

While there is no visible proof that water quality has improved with the introduction of the new equipment compared to before, it can be said that water quality inspections are more efficient and refined, and its accuracy has improved. Thus water quality is stably inspected now.

3.2.2 Qualitative Effects

The qualitative indicators of "enabling accurate understanding of operational status of the facility and water distribution status, and appropriate facility operation and maintenance" were achieved by installing the SCADA system. More specifically, instances of low water pressure have been reduced by monitoring Belgrade's complex water supply network, understanding the overall water pressure situation throughout the city and prompting the system to pressurize low pressure areas. Also, the Maintenance Department can foresee the measures necessary for equipment maintenance from pump operational data, meaning that the department can replace parts before they fail. For instance, if the system confirms a fixed water pressure for pumps at a pump station and water distribution by pumps falls below normal levels, it points to a possibility of motor irregularity. This allows staffs to inspect and repair pumps before the system halts due to a failure. Further, a system that checks residual chlorine in each header tank in real-time was established. This allows it to adjust the appropriate chlorine levels at water treatment plants with more details than before[10].

3.3 Impact

3.3.1 Intended Impacts

(1) Achievement of Overall Goal

The overall goal was to sufficiently supply safe drinking water to Belgrade. The following gives the extent to which the indicators for this overall goal were achieved. While the Project Design Matrix (PDM) had a reference indicator of 240 liters of water supplied per day per capita, the supplied water reached to 304 liters per day per capita[11] in 2011. Furthermore,

[10] The reagent for the instrument which checks residual chlorine levels in each reservoir may be depleted if procurement process is lengthened. If this happens, staff will have to inspect the tanks manually.

[11] As previously mentioned that water leakage rate was set at 28% at the time of ex-post evaluation, an average water supplied per capita from water treatment plant, 423 liter per day, is multiplied by the rate of water to be supplied

water-supplied population has grown significantly to 1.58 million while the target was 1.32 million.

(2) Improvements of Living Environment

As shown in table 3, from a result of beneficiary survey of 129 households in zones 3 and 4, which both had problems with summertime droughts, it is confirmed high rates of continuous water supply in both zones. As water supply has improved and residents can avoid the impacts of outages and droughts, it can be said that their living environments have improved. In concrete terms, these residents can now obtain a continuous access to tap water even during summertime, and thus they have less trouble with water outage at the time of washing clothes and preparing meals.

(3) Promotion of water supply projects across Serbia

In the basic design study, the project's indirect effect was expected to "promote projects for safe and adequate water supply within Serbia." However, there were no facts showing any link between the project and promotion of other water supply projects in Serbia at the time of ex-post evaluation. Novi Sad, which has the second largest population in Serbia, and Nis have expressed interest in installing SCADA systems and came for visits. According to BVK, Novi Sad did not end up installing a system due to lack of funding, but Nis did install a small-scale water supply monitoring system with its own funds.

3.3.2 Other Impacts

There were no environmental impact and indirectly negative effects of resettlement and land acquisition as assumed during the basic design study. This is because the project rehabilitated existing facilities and did not acquire new lands to construct facilities.

As seen above, the project has achieved its objectives; therefore, its effectiveness is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The outputs of the Japanese side were produced mostly as planned, but Serbia had not yet completed a part of the required installation of procured equipment at the time of the ex-post evaluation. Beside these installations, the Serbian side supplied other required equipment, such as, transformers, communication equipment, and etc. They were provided as planned, and please refer the details in Table 5.

3.4.1.1 Output List and Summary of Differences

(1) Distribution pump station equipment

Installation of equipment scheduled for Pump Station 23 in the Studentski Grad region (hereinafter PS 23) had not been completed at the time of ex-post evaluation. This equipment included five pumps, two rotation speed controllers, three soft starters and five flap gates.

Installation of equipment was put in Serbia's scope at the time of planning. While BVK recognized the need to replace aging pumps, it explained that the equipment could not be

(100% - water leakage rate 28% = 72%).

installed due to lack of funding from the Belgrade city government. In particular, since the world-wide economic crisis negatively affecting the Serbian economy in 2008 when the project was completed, the Belgrade city government also severely curtailed its expenditure. As a result, BVK has not received sufficient budget to install those remaining equipment. In fiscal year 2012, BVK appropriated 100 million dinars (approx. 89 million yen[12]) needed for whole renovation of PS 23, but did not decide a specific work plan to install. In order for zone 1 and 4, which show rapid population growth, to match water needs, it is necessary to install these pumps, to improve efficiency of water distribution, and to strengthen capacity of water supply.

a. Pumps

(No. of pumps)

Pump Station Name	Units Upgraded (During Project)	Units Upgraded (Completed)	Installed Units
PS 1a Bele Vode	3	3	3
PS 1b Bele Vode	4	4	4
PS 18 Tansmajan	4	4	4
PS 19 Bezania	3	3	3
PS 23 Studentski Grad	5	5	0 (not installed)
PS 17 Zvezdara	3	3	3
PS 20 Zeleznik	2	2	2
Total	24	24	19

Source: The number of renewal equipments is confirmed with the materials provided by JICA, and the external evaluator confirmed the number of installed units at sites.

b. Pump station ancillary equipment

Equipment	Units Upgraded (During Project)	Units Upgraded (Completed)	Installed Units
Rotation Speed Controller	8	8	6[2)]
Soft Starters	16	16	12[3)]
Control Panels	7	0[1)]	-
Flap Gates	23	23	18[4)]
Pressure Transmitter	75	75	75

Source: The number of renewal equipment is confirmed with the materials provided by JICA, and the external evaluator confirmed the number of installed units at sites.

Notes:

1) Control panels are built into the soft starters and rotation speed controllers, and are not counted as lost output.
2) Installation is incomplete for two rotation speed controllers at PS 23.
3) Installation is incomplete for three units at PS 23, and one unit at PS 1a is removed after installation.
4) Installation is incomplete for five flap gates at PS 23.

All equipment was provided as planned, but installation of two rotation speed controllers out of eight and three soft starters out of 16 remains incomplete. This is because these equipments are supposed to be installed with the pumps in PS 23, which are not installed yet. Also, another one soft starter has been removed and is currently not in use. In 2010, BVK removed one of the

[12] Calculated using local exchange rates for June 20, 2012: 1 Dinar = 0.89 Yen.

two soft starters installed at the pump station and replaced it with a rotation speed controller they purchased with their own budget. Their reasoning was that rotation speed controllers served more practical use than soft starters and the one planned by the project was not enough, so they bought an additional one. Soft starters only contribute to reduce damage to pumps caused by high pressure at the beginning of pump operation while rotation speed controllers can freely control water flow and adjust the amount of water distribution, which contribute the efficiency.

The removed soft starter could technically be diverted to another pump station, but there were no such prospects at the time of ex-post evaluation.

Flap gates are installed along with pumps. Since five pumps in PS 23 remain incomplete, five flap gates also have not been installed yet.

c. Residual chlorine analyzers for distribution reservoir
As planned.

(No. of units)

Equipment	Qty During Project	Qty Completed	Installed Units
Residual chlorine analyzers	20	20	20

Source: The number of procured equipments is confirmed with the materials provided by JICA, and the external evaluator confirmed the number of installed units at sites.

(2) SCADA system

There were some changes, but overall function of the SCADA system was not affected. Thus the entire unit is deemed to have installed according to the plan[13].

(3) Water quality testing equipment

(No. of units)

Equipment Name	Qty (During Planning)	Qty (Completed)
Scientific Analyzers		
Atomic Absorption Spectrometer	1	1
Total Organic Carbon Analyzer	1	cancelled
Ultraviolet-Visible Absorption Spectrometer	1	cancelled
Ion Chromatograph	-	1
Microbial Analyzers		
Autoclave	1	1
Microscope	1	1

Source: Created by the external evaluator based on data provided by JICA

[13] Due to the large number of components in the SCADA system and limited pages in the report, this chart has been omitted.

During the planning phase, the water quality laboratory was in urgent need of a total organic carbon analyzer and ultraviolet-visible absorption spectrometer, making BVK decide to purchase the equipment with its own budget before the project implementation. As such, the next most urgent piece of equipment after these two, an ion chromatograph, was purchased instead.

3.4.2 Project Inputs

3.4.2.1 Project Cost

As shown in Table 5 below, Japanese project cost was kept to 88% of those planned. Data was unavailable for the Serbian expenses[14].

Table 5: Variance Analysis of Project Costs

1) Costs borne by the Japanese side	Planned Cost	Actual Cost	Vs. Plan
Equipment: Distribution pumps, motors, inverters, SCADA system, water quality analyzing equipment, etc.	1,094 million yen	952 million yen	87%
Detail design, construction management	83 million yen	81 million yen	98%
Total	1,177 million yen	1,033 million yen	88%
2) Expenses borne by Serbia side			
Transformers (14)	250,000 EUR	Unknown[2)]	
Communication facility, dedicated radio line and antenna (1 set)	40,000 EUR	Unknown	
Installation materials, cable materials, ladders, racks	200,000 EUR	Unknown	
Total	490,000 EUR	Unknown	
Total cost in yen[1)]	66 million yen		

Source: Documents provided by JICA

Note:

1) Exchange rate: 1 EUR = 134.62 Yen (July 2004)

2) BVK could not provide data of expenditure in these items due to complexity of accounting system.

3.4.2.2 Project Period

The Japanese side finished its portion of the project as totally planned (100% of planned time). On the contrary, the Serbia side greatly exceeded its plan, not having completed its portion of the work as of the ex-post evaluation[15].

Table 6: Planned Work Duration and Actual Work Time

Phase	Planned Duration	Actual Duration	Vs. Plan
Phase I: SCADA system procurement and installation	17.5 months[1)]: Sept. 2005 – Feb. 2007	16 months: Nov. 5, 2005[2)] – Feb. 28, 2007	91%

[14] As a sub-rating for the project cost in the Japanese side, which completed within the planned period, is evaluated as ③ while it was impossible to judge the one of the Serbian side due to a lack of relevant information.

[15] As sub-rating of the project period, Japanese side, which completed its portion as planned, was evaluated as ③. On the contrary, the Serbian side was evaluated as ① due to its portion is on-going, and thus the total evaluation became ②.

Phase II: Procurement of distribution pumps and water quality analyzing equipment	17.5 months: Jun. 2006 – Dec. 2007	14 months: Dec. 28, 2006[2)] – Feb. 28, 2008	80%
Total	28 months (2 years, 4 mos.)	28 months (2 years, 4 mos.)	100%

Notes:
1) In the basic design, Phase I construction was expected to take 20 months. As Phase I start time was shifted, the phase period was shorted to 17.5 months in the project feasibility study conducted after the basic design in August 2005. The major change from the initial plan was that equipment needed for SCADA system construction was procured in Phase I.
2) Signing day for construction consulting contract.

As seen above, while the cost and period of Japanese side were within the plan, the period of Serbia side greatly exceeded its plan. Thus efficiency of the project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

BVK changed its organizational structure in 2010. From the planning phase to 2011, it reduced personnel by 531 to 2,594. Most of the reductions were basically natural attrition from retirement and curbing of new hires. In interviews, BVK said there are no noticeable staff shortages from the reductions as being a corporation, its personnel numbers were high in the first place. The External Evaluator also asked for opinions on sufficiency of management quality and personnel numbers with the consulting company entrusted with SCADA system maintenance, and the company replied that there were no problems of significance.

The Central Information Technology Unit, which is placed in Makis Water Treatment Plant and was intimately related to the project, employs 16 staff. They manage the SCADA system 24 hours a day in shifts from the SCADA system central control room. Similarly, each of the four regional control centers has their five employees managing the center 24 hours in shifts. The External Evaluator asked those staff if they felt understaffed, and they responded that staff numbers were sufficient in the current operation.

The External Evaluator also inquired about the sufficiency of staff numbers at the seven pump stations that the project centered around, and it is found that no one felt that they were understaffed or had any staffing problems.

3.5.2 Technical Aspects of Operation and Maintenance

(1) In interviews, BVK and the contracted management and maintenance company reported that no SCADA system administrators in any of the central or regional control centers have resigned since the systems were installed. All the administrators were well trained in the technology when it was installed. Since SCADA system installation, center personnel have incrementally increased their skills through trainings and routine activities in necessary system operation and maintenance, and are deemed to have sufficient skills to this point. This is backed by the fact that they have yet to experience a SCADA system outage due to a system failure.

According to BVK, future personnel will be trained on the job by veteran staff within the organization. Additionally, there is the contingency plan of training by technicians from

contracting company for maintenance of the SCADA system if necessary.

(2) The External Evaluator interviewed some of the administrators for the seven pump stations which the project focused on about utilization of the administrator's manual. They all confirmed that they had a manual on site and refer to it when necessary. However, they did express that they rarely have to check the manual in their daily tasks as administrative work has been so simplified.

Meanwhile, the administrators also said that the development engineers frequently referred to technical manuals on topics such as SCADA system programming and electric circuits due to the constant development of the system. The manuals have been updated as necessary with additional features.

(3) Preventive maintenance became easier as it can monitor the operational status for each pump in detail by the SCADA system. However, it has only been four years since the project completion, and there have been no noticeable pump failures yet. As of the ex-post evaluation, no failures requiring extensive repair have occurred.

Regarding older pumps outside the project scope, pump station personnel will switch them over to spare pumps when a failure occurs or there is a possibility of failure. Even this level of response capability is sufficient. Pump components are easily procured, and their technical capabilities do not pose any major problems.

3.5.3 Financial Aspects of Operation and Maintenance

(1) BVK Finances

Table 7: BVK Finances

1999 to 2003

Million dinars

Year	Total Expenditures	Total Revenue	Balance
1999	895	565	-330
2000	1,841	664	-1,177
2001	2,386	1,855	-531
2002	3,409	2,909	-500
2003	4,909	4,170	-739

2007 to 2010[1)]

Million dinars

Year	Total Expenditures	Total Revenue	Balance
2007	11,163	6,813	-4,350
2008	10,287	6,267	-4,020
2009	6,840	7,012	172
2010	7,181	7,226	45

Source: The data from 1999 to 2003 is based on the documents JICA provided while the data from 2007 to 2010 is based on the information in BVK website.
Note: 1) BVK does not disclose financial data from 2004 to 2006

As seen in Table 7, BVK balance sheets were chronically in debt before the project. In the ex-post evaluation, however, BVK cleared its accrued interest-bearing debt in 2007 and 2008, and improved finances enough to turn a profit from 2009 onward. BVK has not disclosed information for 2011 and later, but when interviewed said that it turned a small profit.

A number of elements factor into the financial improvement of BVK. One reason is reduced labor costs. BVK reduced 275 employees from 2869 in 2007 to 2594 in 2012. BVK has also reduced maintenance costs with efficient water supply due to the installation of the SCADA system and updating to pumps with lower power consumption. Further, it has expanded its supply area and reduced their non-revenue water rate.

(2) At the time of the ex-post evaluation, BVK allotted 100 million dinars (approx. 89 million yen) for PS 23 installation expenses in its 2012 budget. It has not, however, made any restrictions in the use of those 100 million dinars, meaning that the budget may not be implemented as recorded. If BVK has a project it wants to give priority, it could divert the budget. Installation will wind up costing this much because it will also involve incidental work, such as improvements to the pump station electrical and piping systems. While the budget for installation work was allocated for fiscal year 2012, the Belgrade city government has not yet granted permission for the expenditure. According to BVK, no installation plans are currently set.

While BVK's financial situation has improved, it has some issues with budget shortfalls when the Belgrade city government has not allocated the needed budget. This includes the pumps and control equipment procured for PS 23 not being installed. There are several factors contributing to the Belgrade budget shortfalls. While all of Serbia has been impacted by the world-wide economic crisis since 2008, Belgrade has also been unable to allocate budget to install existing equipment procured for the past four years. The likelihood is thus high that similar issues will arise for future equipment upgrades.

3.5.4 Current Status of Operation and Maintenance

(1) The External Evaluator has confirmed that the equipment procured is maintained according to ISO9001 international standards[16]. More specifically, in line with standards accepted by the International Organization for Standardization (ISO), it improves transfer of water quality control skills by creating manuals and other documentation, and project continuity by using a PDCA cycle[17] in water utility monitoring.

BVK explains that its maintenance program also monitors facility updates and repairs according to ISO9001. However, some pumps have not been replaced despite exceeding their service life due to budgetary issues, as in the case of PS 23.

(2) BVK has continued developing its SCADA system independently. It has expanded both the number of facilities the system controls and the area it monitors. Particularly impressive is that

[16] ISO9001 is the standard to manage the system delivering services. International Organization for Standardization defines ISO standards.

[17] PDCA cycle is an abbreviation for a cycle of Planning, Doing, Checking and taking Action. It is a method for making production management, quality control and other management work progress smoothly.

the system can monitor 234 facilities as of the ex-post evaluation, up dramatically from the 159 at the project completion. This is a good example of how BVK is actively utilizing the basic system procured and expanded things in a proactive fashion.

(3) The only piece of equipment that could pose problems with maintenance is the autoclave for water quality inspection equipment. Although the manufacturer has a local distributor, spare parts are quite difficult to obtain. This is because this distributor takes a plenty of time to deliver even a small part. At the time of ex-post evaluation, some parts were seen failing, but stuck together with bond as an emergency measure. Administrators said there were no maintenance problems with other equipment as other local distributors can easily deliver any spare parts to BVK.

A measuring agent is used for measuring the residual chlorine concentration for reservoirs. This agent is a consumable which must be replenished on a regular basis. However, even as domestic procuring process takes time, the stations occasionally run out of the agent. During the ex-post evaluation, they were out of the agent and the equipment was stopped. When the measuring equipment is stopped, station staff members have to visit the reservoir and measure manually. It is a problem stations have to stop due to difficulty to obtain consumables or parts for repairs. This should be taken into consideration in the planning phase.

Monitor of SCADA System

Autoclave with a tentative treatment

From the above, the project maintenance has some light financial issues; therefore, the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

In this project, BVK in the Republic of Serbia was provided with a SCADA system, distribution pumps, control equipment, and water quality testing equipment. The project aimed to provide Belgrade with a safe and stable drinking water supply by these procured system and equipment. This would help Belgrade properly operate and maintain existing city water and sewer facilities while also improving the water supply in regions experiencing water shortages in the city. This project conformed with Belgrade development policy and needs, as well as Japanese ODA policy, and its relevance is high. During the planning phase, Belgrade had issues with citywide droughts in summertime and water shortages due to inefficient water supply in zones 3 and 4 where are at higher altitudes than zone 1 and 2. Because of the contributions from

the project, along with those of other donors and BVK itself, issues are now solved and its effectiveness is high. The project efficiency is fair; although both project cost and period of Japanese side were within the plan, Serbia side did not complete its project component, and the project period significantly exceed the plan. BVK is generally good on the technical front and be able to develop the SCADA system themselves; however, due to Belgrade's inability to install the pumps within the planned budget and its financial vulnerabilities, sustainability of the project effect is fair.

Considering all the elements above, the project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

(1) BVK removed the soft starter procured in the project for PS 1a in order to replace with the rotation speed controller BVK purchased with its own budget. At the time of ex-post evaluation, the removed soft starter was being stored in a warehouse and was not in use. Soft starters are effective equipment which buffer pump damage from rapid pressurization when the pump is started up. Technically, the removed soft starter can be diverted to other pump. There are pump stations in Belgrade still using older pumps, and the soft starters could reduce the load put on pumps at startup if installed. As such, BVK should identify a pump where it can be used and install it as soon as possible.

(2) In PS 23, five pumps, two rotation speed controllers, and three soft starters remain uninstalled yet. If these equipments are installed, it is expected that it enables BVK to monitor water supply in the area around PS 23, and to efficiently supply water to zone 1 and 4 where show a rapid population growth. Moreover, the maintenance become easier than the old modeled pumps currently being used. Due to the continuous discussion of budget implementation between the Belgrade city government and BVK, the government remains undisbursed the allotted budget. Also, mechanical failure may be occurred if the equipment remains unused for a long time. These failures may cause necessity to allocate an additional budget for repair when being installed. BVK should seriously recognize that this project will not be completed unless these equipments are installed. Furthermore, it should be installed as soon as possible to avoid additional cost for repair.

4.2.2 Recommendations to JICA

It should continue to follow up with the equipment that has yet to be completely installed at PS 23. It is expected that completing installation reduce costs by efficiently distributing water, reducing power consumption and decreasing the frequency of failures.

4.3 Lessons Learned

(1) In grant aid projects, the Japanese government and counterpart government divide up the work. However, if the counterpart’s capacities are overestimated, the counterpart may not be able to complete its work as scheduled. In the case of this project, the Serbian government was tasked with installing some equipment, but the required budget for installation at PS 23 comes to 100 million dinars (89 million yen) with electrical system improvements, pipe replacements and other ancillary work. Establishing the counterpart’s scope of responsibility should be a suitable approach to increasing their ownership for the projects, but JICA should review carefully whether the counterpart is financially and technically capable of handling that scope

during the planning phase. Further, JICA should discuss a system maintaining the posture that it will complete the project together with the counterpart. This may involve attempting to occasionally check on progress on the counterpart's obligations throughout the project and sequentially delivering portions of the project as they are completed.

(2) Although "improving water supplies in regions with water supply shortage" was set as the project purpose, this purpose was vague. Improving efficiency of water distribution by applying procured equipment contributed to eliminating regional and seasonal gaps in terms of water distribution. Thus, it is considered that the project purpose was achieved. On the contrary, the implementing agency was rather aware of reducing maintenance cost and electrical consumption by renewing pumps instead of improving the efficiency of water distributions. As a result, the agency did not record relevant indicators being originally set, and thus this constrained to evaluate this project.

When implementing and donor agencies keep the gaps in terms of interpretation of a project purpose, an implementing agency tends to miss the indicators, which a donor agency expects, and it would be an obstacle for evaluations. It is commonly phenomenal that stakeholders have different interpretations on a project purpose. Also, it is significant for an implementing agency to hold indicators to fairly validate project effects. In the future, a project should be implemented with sharing a common understanding of a project purpose among all the stakeholders from a planning phase.