# Ex-Post Project Evaluation 2012: Package I-8 (Malawi, Eritrea, Jordan)

**February 2014**


**JAPAN INTERNATIONAL COOPERATION AGENCY**

**Octavia Japan, CO., LTD.**


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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 2010, and Technical Cooperation projects and Grant Aid projects, most of which project cost exceeds 1 billion JPY, that were mainly completed in fiscal year 2009. 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.

February, 2014

Toshitsugu Uesawa
Vice President
Japan International Cooperation Agency (JICA)

Disclaimer

This volume of evaluations, the English translation of the original Japanese version, shows the result of objective ex-post evaluations made by external evaluators. The views and recommendations herein do not necessarily reflect the official views and opinions of JICA. JICA is not responsible for the accuracy of English translation, and the Japanese version shall prevail in the event of any inconsistency with the English version.

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.

Republic of Malawi

**Ex-post Evaluation on Japanese Grant Aid Project**

**The Project for the Rehabilitation of the Bwanje Valley Irrigation System**

**(Phase 1 and Phase 2)**

External Evaluator: Yuko Sugiyama, Octavia Japan Co., Ltd

## 0. Summary

In the Bwanje Valley Irrigation area, the target area of this project (the target area), headworks, irrigation and drainage canals, inspection roads and water supply boreholes were constructed from 1997 to 1999 under Grant Aid from the Government of Japan (GOJ). This grant aid project “Bwanje Valley Irrigation Development Project (the former project)” aimed at the development of irrigation of an area of 800 ha. However, the project's purpose as envisaged was not achieved since the irrigation facilities were damaged due to frequent floods. As a result, this project was implemented with the overall goal of increasing agricultural productivity in the target area. Under this project, rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management were conducted. The objectives of this project were to mitigate the risks against future floods of the irrigation facilities which had been damaged by previous floods, to restore the function of the facilities and to create a stable irrigation water supply to the irrigation area. Both at the time of project appraisal and ex-post evaluation, the project was consistent with the agricultural sector development policies and the needs of the irrigation development of the Republic of Malawi (Malawi). Thus, the relevance of this project was high. As a result of the rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management, the irrigated area reached the target level of 800ha. In addition, compared with the time of project appraisal, rice production increased 3.5 times after project completion. This suggests that the project has contributed to increasing the agricultural productivity in the target area. Furthermore, it is confirmed that farmers in the target area are highly satisfied with the project, according to the beneficiary survey. Therefore, effectiveness and impacts of the project is high. On the other hand, the efficiency of the project is fair, because project period was longer than planned, while the project cost was within the plan. Although no major problems were observed in the institutional aspect of Operation and Maintenance (O&M) carried out by the implementing agency, there were some concerns about the technical aspects of water management and the financial aspects of farmers’ cooperative. Thus, the sustainability of this project is fair.

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

## 1. Project Description


Project Location

Rehabilitated Headworks

### 1.1 Background

In Malawi, agricultural production was low due to droughts and floods and also food shortages were serious caused by decreases in food reserves of the country. As a result, the Government of Malawi (GOM) has often requested emergency food aid from FAO and other donors. In order to cope with such food shortages and to achieve sustainable food productivity through irrigation development, the Ministry of Agriculture and Food Security (MOAFS) of Malawi has prioritized policies such as 'improvement of agricultural productivity through irrigation', 'strengthening of irrigation development programs' and 'rehabilitation and construction of irrigation schemes'.

In the Bwanje Valley Irrigation area, which is the target area of this project, irrigation and drainage canals, inspection roads and water supply boreholes were constructed by the former project. Irrigation services commenced in 2000. However, scouring and erosion of the flood protection dike occurred due to unprecedented floods in January 2002. In addition, the main canal and its operation road were seriously damaged. As part of a follow-up cooperation, GOJ assisted GOM in repairing the damaged dike and the main canal. However, the dike was again damaged by a flood in February 2003, resulting in the purpose of the former project not being achieved. Therefore, it was required to strengthen the irrigation facilities from the view point of disaster protection and to increase the function of the facilities.

### 1.2 Project Outline

This project was implemented at the Bwanje Irrigation Area, located near Mtakataka Trading

Centre, in Dedza District, which is around 80 km east of the capital city Lilongwe. The objective of this project is to mitigate the risks against future floods and to create a stable irrigation water supply by rehabilitating headworks and settling basin, relocating the main canal and levelling the land, thereby contributing to improving agricultural productivity and farmers' incomes, as well as alleviating poverty in the target area.

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| Grant Limit/Actual Grant Amount | 1,033 million yen / 1,031 million yen |
| Exchange of Notes Date (Grant Agreement Date) | November 2005 (Detailed Design) / June 2006 (1st phase) / June 2008 (2nd phase ) |
| Implementing Agency | Ministry of Agriculture and Food Security (MOAFS)<br>Lilongwe Agricultural Development Division (ADD) |
| Project Completion Date | September 2008 ( Phase 1 and Phase 2) |
| Main Contractor | Konoike Construction Co., Ltd. |
| Main Consultant | Nippon Koei Co., Ltd. |
| Basic Design | "Basic design study on the Project for Rehabilitation of the Bwanje Valley Irrigation System in the Republic of Malawi"<br>Japan International Cooperation Agency (JICA),<br>February 2003 – November 2005 |
| Detailed Design | January 2006 – June2006 |
| Related Projects | [Technical Cooperation Projects]<br>■"Development of Smallholder Irrigation Schemes Technical Cooperation Project" (2006-2009)<br>[Grant Aid]<br>■"Bwanje Valley Irrigation Development Project"(1996－1999)<br>■"Follow-up Cooperation for the Bwanje Valley Irrigation Development Project" (2002-2003)"<br>[Other international donors]<br>■"Smallholder Flood Plains Development Programme IFAD[1]" (1998－2006) |

[1] International Fund for Agricultural Development

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Yuko Sugiyama, Octavia Japan Co., Ltd.

### 2.2 Duration of Evaluation Study

Duration of the Study: January – November 2013

Duration of the Field Study: May 19 – June 3 and August 17 – 24, 2013

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

### 3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan

At the time of the project appraisal, agriculture was the main economic sector in Malawi, contributing 40% of GDP (2003), employing 79% of the labour force (2002) and accounting for 83% of total exports (2003). In the national plans, such as "Vision 2020 (1997)", "Malawi Poverty Reduction Paper (2002)" and "Malawi Economic Growth Strategy (2004)", poverty reduction, food security, sustainable economic growth and development were identified as major goals. In these plans, the importance of agriculture and irrigation development was identified.

At the time of ex-post evaluation, GOM recognized irrigation development as one of the key strategies for economic growth, as addressed in "Malawi Growth Development Strategy Ⅱ (2011－2016)", "Malawi Economic Recovery Plan (2012)" and "The Agriculture Sector Wide Approach (2010)". In the "Strategic Plan for Green Belt Initiative" developed in 2011, a target is to increase the country's irrigated area from 90,000ha to 200,000ha in order to improve agricultural productivity and to increase agricultural income by strengthening the sales of agricultural products.

As described above, the need for irrigation development continues to be an important issue for Malawi both at the time of project appraisal and ex-post evaluation. As such, it is confirmed that this project remains consistent with the development policy of Malawi.

3.1.2 Relevance with the Development Needs

With an aim of improving the quality of living of the poor through the development of irrigation, which is the prioritized area, the irrigation facilities were constructed under Grant Aid

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

from GOJ from 1997 to 1999 in the Bwanje Valley Irrigation Area. However, the project effects as envisaged were not achieved, since the irrigation facilities were damaged due to frequent floods after 2001. Under these circumstances, rehabilitation of the irrigation facilities was required urgently in order to strengthen the facilities fundamentally from the viewpoint of disaster protection and to increase the function of the facilities for attaining the project effects as envisaged.

At the time of ex-post evaluation, as agriculture still depends on rainfall in most of the rural part in Malawi, thereby causing unstable agricultural productivity in Malawi, there is still a high need for development of the country's irrigation facilities. Therefore, GOM has been strongly promoting irrigation development by establishing the “Irrigation Act” in 2001 and instituting the process of establishing the National Irrigation Board for sustainable irrigation development. Moreover, GOM plans to construct a dam at the Bwanje Valley Irrigation area to increase the irrigated area from its current 800ha to 2,100ha.

As described above, there continues to be a demand for developing irrigation facilities in Malawi. Therefore, the project is judged consistent with the development needs of Malawi at the time of ex-post evaluation.

3.1.3 Relevance with Japan’s ODA Policy

GNI per capita in Malawi has been low (US$160 in 2005) and the country has frequently been hit by natural disasters such as droughts. Therefore, providing assistance through ODA was significant from the perspective of poverty reduction, which was considered a priority issue in the general framework of ODA (2003). Because GOJ highly evaluated Malawi’s work on economic reform, which prioritized the democratization and poverty reduction, GOJ strongly demonstrated the policy for assisting the country in the area of food aid and poverty reduction of poor farmers mainly by the schemes of grant aid and technical cooperation.

According to the Japanese Country Assistance Policy for Malawi in 2005, GOJ had prioritized ‘food security’ assistance to Malawi. This project is a rehabilitation project with the aim of achieving the effects as envisaged in the former project, which intends to contribute to food security in Malawi. Thus, the consistency with the Japanese assistance policy of this project is considered to be high.

In light of the above, the project has been highly relevant to the country’s development plans and development needs, as well as Japan’s ODA policy; therefore, its relevance is high.

### 3.2 Effectiveness[4] (Rating:③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

1) Direct Effect of the Project (Irrigated area)

In order to mitigate flood risks to the main canal, it was relocated. Accordingly, the area irrigated by the new shifted main canal was changed from 800ha to 590ha. As a result, the target area of this project was considered to be 590ha irrigated by the new main canal. For the remaining 210ha, located between the existing main canal and the new main canal, responsibility of the project execution fell to GOM. However, the purpose of this project was to achieve the expected effects of the former project. In addition, rehabilitation of the headworks and construction of new settling basin were implemented through this project. In view of this, a 210ha area irrigated through the existing main canal was also considered to benefit from this project. Therefore, it should be appropriate to view the entire 800ha as having benefitted from this project[5]. On the other hand, it was estimated that irrigated area in the dry season would be approximately 145ha, as the water volume of the Namikokwe River decreases in the dry season[6]. Table 1 illustrates the irrigated area that was set as an effect indicator of this project.

Table 1: Data on Irrigated Area.[7]

(Before Project Implementation, Target and Actual after Project Completion)

(Unit：ha)

| Indicator | | | Before Project Implementation (2004) | Target after Project Completion (2009) | Actual after Project Completion (At Ex-Post Evaluation in 2013) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2009 | 2010 | 2011 | 2012 |
| Irrigated area[8] | New canal area (590 ha) | Rainy Season | 250 | 590 | 590 | 590 | 590 | 590 |
| | | Dry Season | N/A | N/A | 292 | 250 | 90 | 90 |
| | Existing canal area (210ha) | Rainy Season | N/A | N/A | 210 | 210 | 210 | 210 |
| | | Dry Season | N/A | N/A | 160 | 168 | 60 | 75 |

Source: JICA document and answer on questionnaire.

As can be seen from Table 1, irrigated area during the rainy season achieved 800ha every year

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

[5] At the time of project appraisal, the target level of the irrigated area was set as 590ha which would be irrigated though the new main canal.

[6] In both of the former project and this project, irrigated area in the dry season was estimated 145 ha.

[7] According to the implementing agencies, “irrigated area” refers to an area where water is distributed from the System served by the Namikokwe River. Rainy season：November－April, Dry season：May－October

[8] New canal area refers to the area irrigated by the new main canal. Existing canal area refers to the area irrigated by the existing main canal. Irrigated area in 2004 (250ha) was the irrigated area within the new canal area 590 ha.

following project completion (new canal area: 590ha, existing canal area: 210ha). Meanwhile, during the dry season in 2009 and 2010, as the quantity of rainfall was more than usual, the irrigated area exceeded 400ha. However, in the dry season in 2011 and 2012, the irrigated area decreased to around 150ha, which was estimated at the time of project appraisal

2) Other indicators (Cultivated Area, Collection Ratio of Water User Fee, Average Size of Land per Farmer)

①Indicators concerning agricultural productivity

Table 2 shows the data measuring the improvement of agricultural productivity such as cultivated area, portion of cultivated area, production volume of main agricultural products and those per unit at the time of project appraisal, as well as actual achievement after the project completion.

Table 2：Data concerning the Agricultural Productivity.

(Before Project Implementation and Actual achievements after Project Completion)

| Indicators | 2004 | | 2009 | | 2010 | | 2011 | | 2012 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rainy Season | Dry Season | Rainy Season | Dry Season | Rainy Season | Dry Season | Rainy Season | Dry Season | Rainy Season | Dry Season |
| Cultivated Area (ha)[9] | 612 | 169 | 800 | 407 | 800 | 415 | 800 | 150 | 800 | 165 |
| Portion of cultivated area (%) | 76 | 21 | 100 | 51 | 100 | 52 | 100 | 19 | 100 | 21 |
| Production Volume of main agricultural products (ton/year) | | | | | | | | | | |
| Rice | 1,247 | 0 | 3,720 | 0 | 3,806 | 0 | 4,007 | 0 | 4,322 | 0 |
| Maize | 0 | 248 | 0 | 1,218 | 0 | 1,038 | 0 | 600 | 0 | 600 |
| Production volume per unit (ton/ha) | | | | | | | | | | |
| Rice | 2.0 | 0 | 4.7 | 0 | 4.8 | 0 | 5.0 | 0 | 5.4 | 0 |
| Maize | 0 | 1.5 | 0 | 3.0 | 0 | 2.5 | 0 | 4.0 | 0 | 3.6 |

Source: JICA document and answer on questionnaire.

As can be seen in Table 2, while a portion of cultivated area in the rainy season was 76% at the time of appraisal (2004), it reached 100% every year after project completion. Additionally, comparing production volumes of rice and maize in 2012 with those in 2004, rice production increased 3.5 times and that of maize increased 2.4 times. Furthermore, in terms of production volume per unit, rice increased 2.7 times and maize increased 2.4 times[10]. As described above, it

[9] Cultivated area refers to the cultivated area within the project target area 800ha. 612ha in 2004 includes the area of rain-fed cultivated area.

[10] Increase rates are calculated by dividing the figures of 2012 by those of 2012.

can be said that this project has contributed to promoting efficient water distribution and to improving the agricultural productivity which is shown as increase of cultivated area, production volumes of rice and maize and those per unit, by implementing rehabilitation of the irrigation facilities, land levelling and technical assistance of water management. Regarding the increased rate of production volume and that of cultivated area, rate of production volume was higher than that of the cultivated area. The main reason for this could be that land levelling and equal reallocation of land was conducted in this project which had not been implemented properly in the former project, in addition to the rehabilitation of the facilities. Another reason could be the increase of income from the sales of rice, which made it possible for farmers to use fertilizer.

②Collection Ratio of Water User Fee

Table 3 shows the shifts of data on collection ratio of water user fee.

Table 3：Data on Collection Ratio of Water User Fee.
(Before Project Implementation and Actual after Project Completion)

| Indicator | 2004 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Collection Ratio of Water User Fee (%) | 10-30% | 60-75% | 65-80% | 75-85% | 85-90% |

Source: JICA document and answer on questionnaire.

As shown in Table 3, collection ratio of water user fee largely increased from 10-30% at the time of project appraisal (2004) to 85-90% at the time of ex-post evaluation (2012). According to an interview with Lilongwe Irrigation Services Division (Lilongwe ISD)[11], which is one of the project's implementing agencies[12], the reasons for why the collection ratio had increased year by year were: 1) farmers became able to afford payment of water user fees, since this project contributed to increasing their incomes from rice sales as a result of activating the rice sales business through the technical assistance which is called as the "soft component activities"; 2) the system for collecting water user fees was strengthened by the soft component activities, such as the introduction of PC registration system for farmers, allocation of staff (secretary and responsible personnel), implementation of training concerning water user fee collection and improvement of the accounting system of the farmers' cooperative. In addition, according to an interview with the leaders of the farmers' cooperative, activities of the soft component enhanced the awareness of farmers regarding payment of water user fees. Considering the above, it can be judged this project has contributed significantly to the increase of collection ratio of water user

[11] This division was one of the divisions in Lilongwe ADD at the time of project appraisal.
[12] See "3.5.1 Institutional Aspects of Operation and Maintenance" for details.

fee.

③Indicators concerning land reallocation

In the former project, as the leaders of each village allocated land based on the administration boundaries of villages, the average size of land per farmer was uneven. This triggered dissatisfaction of farmers who had been given smaller sections of land. In addition, this inequality of land created the problem of abandoned land, as farmers who had been given large areas of land could not maintain their land. Table 4 shows the shifts of average size of land per farmer in the target area. As land was reallocated equally to all farmers through this project, the average size of land per farmer became 0.4 ha at the time of project completion[13].

Table 4: Average Size of Land per Farmer in Each Group Village.
(Before Project Implementation and Actual after Project Completion)

(Unit: ha)

| Village group | 2004 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Kafulama | 0.21 | 0.4 | 0.4 | 0.4 | 0.4 |
| Bwanari | 0.20 | 0.4 | 0.4 | 0.4 | 0.4 |
| Mchanja | 0.43 | 0.4 | 0.4 | 0.4 | 0.4 |
| Mthembanji | 0.45 | 0.4 | 0.4 | 0.4 | 0.4 |

Source: JICA document and answer on questionnaire.

### 3.2.2 Qualitative Effects

In this survey, interviews with Lilongwe ISD, the Dedza District Irrigation Office[14] (Dedza DIO), the Agricultural Extension Development Officer (AEDO)[15] and farmers were conducted. In addition, a beneficiary survey[16] was also implemented. Based on the data gathered, analysis of the qualitative effects expected to be achieved through this project was made as follows.

1) Improving stability of irrigation facilities against floods

Although there have been no major floods following the project's completion, it can be examined that relocation of the main canal and rehabilitation of the headworks conducted

[13] See "3.2.2 Qualitative Effects 5）Equal land distribution and improvement of land usage" for details.
[14] It belongs to Lilongwe ISD. Refer to "3.5.1 Institutional Aspects of Operation and Maintenance" for details.
[15] AEDO instructs farmers in farming techniques and general irrigation techniques.
[16] Questionnaire-based interviews were conducted with farmers residing in the Bwanje Valley Irrigation System during the evaluation study. The sample size of the beneficiary survey was 100 from 3 Branch Canals (BC1, BC2 and BC3). 34 were drawn from BC1, 30 from BC2 while 36 from BC3. The survey targeted the farmers who have been cultivating in the Bwanje Valley Irrigation System since before project completion (more than 8 years) and reviewed the change before and after the project.

through this project has contributed to making the irrigation facilities safer and more secure against future flooding. GOM implemented work to change the river channel through the support of a soft component. This also contributed to increasing safety against flooding. Moreover, having received trainings implemented through soft component activities, the farmers' cooperative took actions to decrease the risks of damages by floods. One example of these activities was planting vetiver grasses along the river to protect canal bank against floods. Considering this, it can be inferred that the safety of facilities against floods has been increased.

Picture 1: Relocated main canal

Picture 2: Grasses planted along the main canal, which the farmers' cooperative implemented for the protection of the bank from flood damages

2) Stable water supply

Figure 1 shows farmers' satisfaction levels drawn from the beneficiary survey. The level of satisfaction was generally high among farmers, with the majority (75%) responding that they were either "very satisfied" or "satisfied" with the project. Figure 2 shows the reasons for the satisfaction of those who answered either "very satisfied" or "satisfied". It suggests that the high level of satisfaction can be largely attributed to the rehabilitation of the irrigation facilities and strengthening of water management through soft component by this project, as many respondents mentioned sufficient water supply and efficient water distribution through rehabilitated canals as the reasons for their satisfaction. On the other hand, 23% of the farmers answered "dissatisfied" or "very dissatisfied" with the project. Inefficient water distribution and inadequate water supply were raised as reasons for their dissatisfaction. Considering this, water management such as control of water gates and elimination of sand still needs to be improved in some areas.

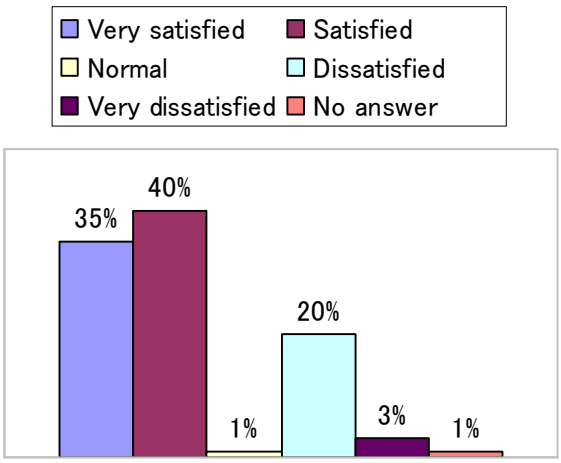



Figure 1: Are you satisfied with the project?

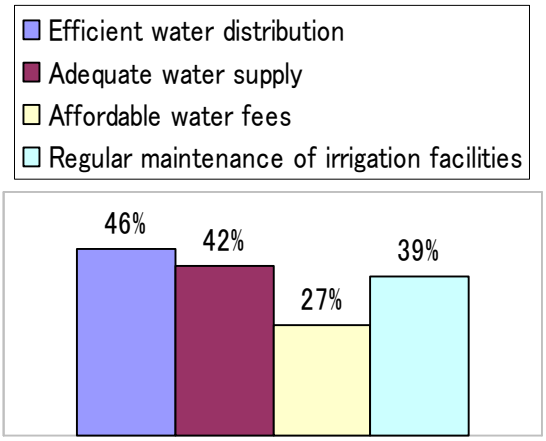



Figure 2: Reasons for satisfaction.

3) Smooth flow of water and alleviation of farmers' burden on sediment removal work

In the previous settling basin, sediment removal work had to be manually carried out without natural flushing by gravity. Because this removal work was not implemented properly, a large amount of sediment was conveyed to the canals. This disturbed smooth flow of water and reduced canal capacity. In the new settling basin constructed by this project, sediment removal work was carried out by natural flushing. This reduced the amount of sediment and increased canal capacity. Additionally, according to interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers, it was confirmed that the farmers' burden on sediment removal had been decreased compared before the project implementation.

4) Increase of the cultivated area of rice

Land levelling, which was supposed to be conducted by Malawi side after the former project's completion, had not been completed. The level of progress of land leveling was low as only 25% of the entire land-levelling of target area had been implemented in 2004. Due to this delay in land levelling, irrigated area as well as cultivated area remained at a low level. Prior to the project's implementation, cultivated area during the rainy season had been 76% (2004); it reached 100% every year after project completion (see Table 2). According to interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers, the factors for this increase of cultivated area were 1) proper implementation of land leveling, 2) improvement of canal capacity as construction of the new settling basin reduced the amount of sediment.

5) Equal land distribution and improvement of land utilization

As shown in Table 4, 0.4ha of land was reallocated equally to each farmer. Additionally, the

percentage of cultivated area in the rainy season reached 100%, which implies the improvement of land utilization (see Table 2). Figure 3 shows the satisfaction level of farmers that was drawn from the beneficiary survey implemented through this project. The level of satisfaction was generally high among farmers, with the majority (80%) responding that they were either "very satisfied" or "satisfied"[17]. Figure 4 shows whether land reallocation contributed to improving agricultural productivity. Most of the respondents (80%) answered that agricultural productivity was 'largely improved' or 'improved' by this land reallocation. The above results suggest that the land reallocation implemented though this project played an important role in the better utilization of land.

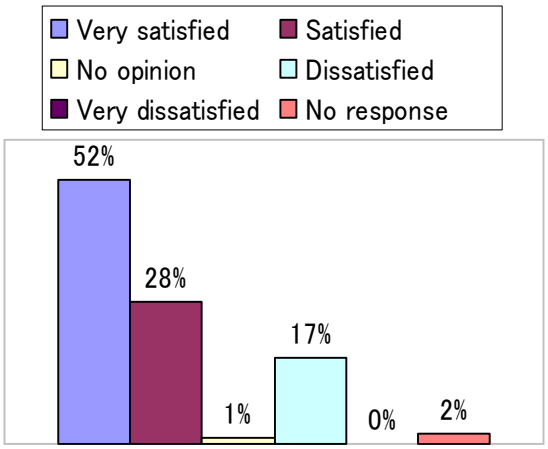



Figure 3: Are you satisfied with the land reallocation implemented through the project?

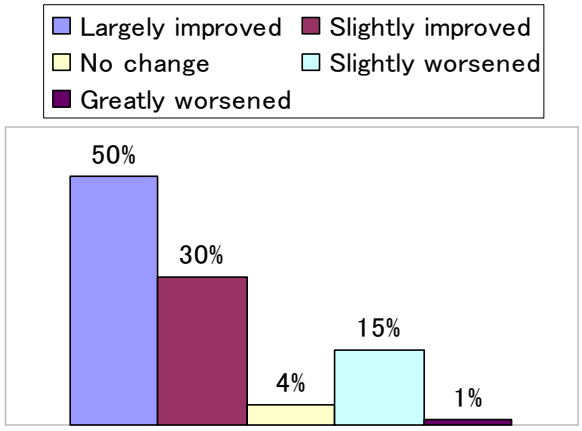



Figure 4: Has the land reallocation program helped to improve agricultural productivity?

【Lessons learned from land reallocation implemented through this project】

In the former project, land allocation was unequal. However, in this project, 0.4ha of land per farmer was reallocated equally. The followings are lessons learned regarding land reallocation, drawn from a review of the ways in which land allocation had been conducted in both the former project and this project.

■Factors of unequal allocation of land in the former project

In the former project, no intervention to land allocation such as activities by soft component was made and land allocation work was entrusted to GOM. As a result, land was allocated unequally to farmers by Traditional Authority (TA) and the leaders of each village using the borders of each village. This could have been one of the major factors of unequal distribution[18] Another factor could

[17] Farmers who answered 'dissatisfied' are mostly those who had received smaller land than before by this land reallocation.

[18] As the project area is customary land, Traditional authority (TA) has the land ownership. TA transfers its authority of cultivation to Group Village Head (GVH) and VH (Village Head).

be that cadastre was not well prepared and accurate data and documents of each farmer were not available at the time.

■Factors of equal land reallocation in this project

1) Promoting the understanding and effective involvement of Traditional Authority (TA)

At the beginning of the soft component activities, explanation to the TA regarding the importance of land reallocation was conducted to better promote their understanding of the importance. As a result of the discussions, equal land reallocation was agreed on without considering the borders of the villages and cooperation of the TA to the project was strengthened. For example, with the help of the TA, the farmers who were not willing to accept land reallocation accepted it.

2) Cumulative participatory workshops with farmers

Through soft component activities, participatory workshops with farmers were repeatedly conducted and discussions on the importance of land reallocation were made on several occasions. These cumulative workshops, as well as the TA's persuasion, enabled securing an agreement from those farmers who had initially disagreed to land reallocation.

3) Accurate data collection and management

Through soft component activities, a new computer-based data management of farmers' information was introduced. This new system enabled managing data accurately and thus avoiding the duplication of land allocation.

4) Collaboration between the hardware side (land levelling) and the software side (land reallocation)

Since farmers would not have agreed to land reallocation without confirming that their distributed land was adequately levelled, land levelling work and land reallocation were implemented together. Finally, each agreement was made by the endorsement of farmers after confirming the levelled land in the presence of a Japanese supervisory consultant. This procedure was conducted for the entire target area (800ha). This suggests that land levelling played an important role in equal land reallocation.

6) Achievement of equal water distribution by improvement of water management capabilities

Prior to this project, the water management system had not been functioning very well and water was not being distributed equally. Through soft component activities, a water management committee (one of the organizations under farmers' cooperative) was established and had implemented proper water management taken along their plans after the project completion. Through interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers, it is confirmed that the water management capacity of the farmers' cooperative had been improved

through trainings as well as the water management manual provided by the soft component activities. On the other hand, the beneficiary survey showed that some farmers were not satisfied with water management in their areas. Therefore, regular and continuous monitoring, as well as capacity building of water management of the concerned parties need to be continued.

7) Continuous utilization of the existing main canal

As Tables 1 and 2 show, the irrigated area as well as the cultivated area of the existing main canal (210ha) reached 100%; therefore, continuous utilization of the existing main canal is confirmed.

### 3.3 Impact

3.3.1 Intended Impacts

At the time of project appraisal, impacts on improvement of agricultural productivity, increase of agricultural income and poverty reduction were intended to be achieved by this project. Based on the data taken from the interviews with Lilongwe ISD, Dedza DIO, AEDO and farmers as well as the beneficiary survey, the intended impacts of this project were analyzed as follows.

1) Stable agricultural productions and improvement of production volume

Prior to project implementation, most farmers had conducted agriculture without using fertilizer or pesticide. After project completion, production volume of rice increasing along with farmers' incomes enabled them to purchase certified seeds and fertilizer. According to the interview with Lilongwe ISD, almost 90% of farmers in the target area now use fertilizers. Additionally, prior to the project, cultivation timing had not been unified across the entire target area, mainly due to the lack of irrigated water and disunion of cultivated breeds. To that end, instruction on cultivation was implemented to farmers through soft component activities. Results of the beneficiary survey show that most of the farmers (88%) responded that the timing of cultivation has now become regular. In addition, several interviewees of Lilongwe ISD, Dedza DIO and AEDO commented that water distribution became equal and stable, as a uniform cultivation period enabled the implementation of systematic irrigation.

As described above, water supply has become stable and production volume of rice and maize and those per unit have been increasing every year following project completion. Thus, it can be judged that this project has largely contributed to increasing the agricultural productivity in the target area.

2) Contribution to farmers' incomes and poverty reduction

Table 5 shows the average household income in the Bwanje Valley Irrigation Area prior to project implementation and actual income after project completion.

Table 5: Average household income in the Bwanje Valley Irrigation Area.
(Before Project Implementation and Actual after Project Completion)

Unit：MK

| | 2004 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Farmers' household income | 50,000 | 120,000 | 165,000 | 204,000 | 300,000 |

Source: JICA document and answer on questionnaire.

As shown in Table 5, farmers' income increased 6 times from 2004 to 2012. Since almost 70% of farmers' incomes in the target area come from rice sales, it can be said that this increase was largely attributed to the increased income from rice sales. In addition, according to the beneficiary survey, many of the respondents raised "stable water supply", "good quality of land" and "equal distribution of land" as reasons for the increase in incomes. This suggests that the land levelling, equal land reallocation and appropriate technical assistance on water management achieved by this project largely contributed to increase of farmers' incomes in the target area. Moreover, through the soft component activities, rice sales business was activated in order to fill the lack of income from water user fee. Furthermore, cooperation with OVOP[19] (for example, expansion of sales channel) was promoted and the construction of a rice mill was supported through the soft component activities. At the time of ex-post evaluation, rice produced in the target area was sold at 8 markets in major cities such as Lilongwe and Blantyre. This shows that new markets have been successfully explored following project completion. In addition, as part of the rice sales promotion activities to find potential customers, the farmers' cooperative made presentations at the OVOP regional exhibition in Lilongwe (2012) and the International Trade Fair in Blantyre (2013) with the assistance of OVOP. Thus, it can be stated that the activities promoted by the soft component have been continuously implemented following project completion. Moreover, as a result of assessing the market situation accurately through the support of soft component activities, production of Kilombelo, which has high market value, increased and as a result, the income from rice sales increased[20].

Figure 5 shows whether the project contributed to improving the living environment of the

[19] "One Village One Product" supported by JICA

[20] Main blends of rice produced in the Bwanje irrigation at the project appraisal time were Faya and Kilombelo. However, Faya was less popular in the market and the seeds of Faya remained unsold.

farmers, as drawn from the beneficiary survey. As seen in Figure 5, 83% of beneficiaries answered that the living standard had been improved by this project. How their living standards had been improved is shown in Figure 6. Many of the respondents and the interviewees pointed out 1) the securement of enough food, 2) purchasing of vehicles (for example, motorbikes, bicycle and oxcart) and other livingware (for examples, mattress, clothes and mobile phones) 3) improvement of housing (for example, using of iron roof), 4) better education for children and 5) an increase in livestock, as examples of improvement of living environment.

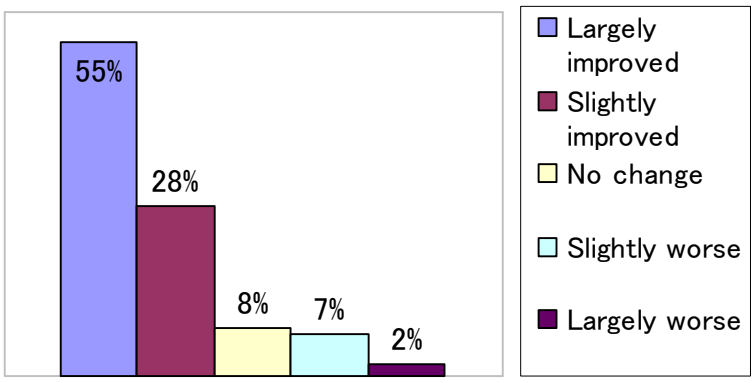



Figure 5: Has the project changed the living environment?

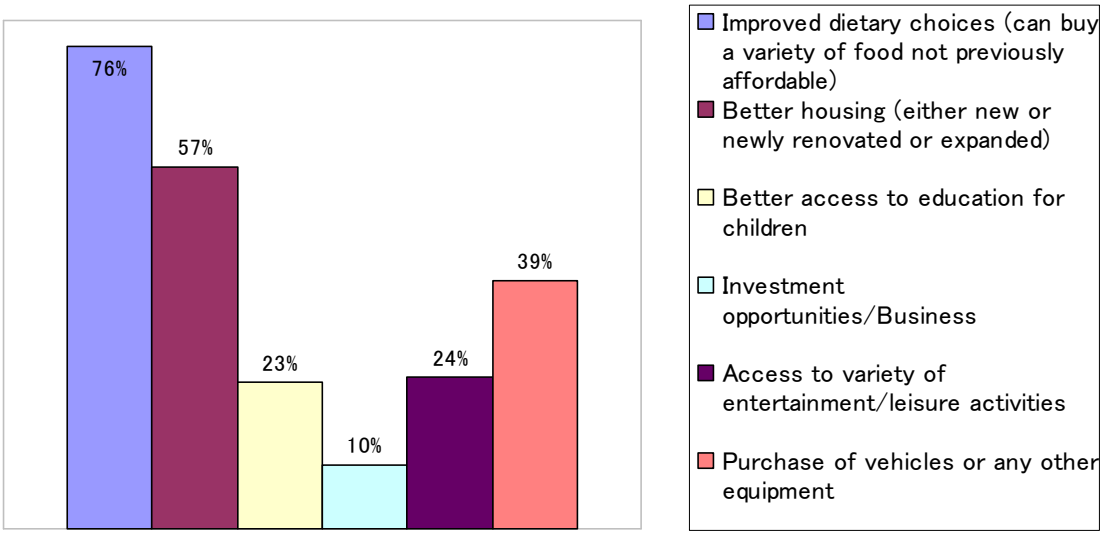



Figure 6: Reason(s) for answering "yes" to the question in Figure 9 (multiple answers allowed).

The above results suggest that the project has played an important role in the betterment of farmers' lives in the Bwanje irrigation area.

3.3.2 Other Impacts

1) Impacts on the Natural Environment

The District Environment Office of the Dedza District Council is in charge of monitoring the target area. Monitoring plans are prepared annually and a district meeting is held monthly in which monitoring results are shared with AEDO and engineers from Dedza DIO. According to the environmental assessment report submitted by the District Environmental Office after the project completion and site visits, no negative impact on the environment by this project was found. However, some interviewees commented that deforestation caused by farmers upstream of Namikokwe River has been progressing and has been increasing the inflow of sand, which brings a further lack of water to the irrigation facilities in the dry season. According to the Lilongwe ISD, the Ministry of Environment and Climate Change and MOAFS have been taking some actions. For example, tree planting has been conducted in order to stop deforestation. Also, building a protection wall made by some plants and changing the ridge upstream of the Namikokwe River have been implemented in order to reduce the inflow of sand to the irrigation facilities caused by the deforestation.

2) Land Acquisition and Resettlement

No land acquisition or resettlement occurred for this project, which was confirmed through

the interviews with Lilongwe ISD and site visits during the evaluation study.

(Conclusion on Effectiveness and Impact)

After the project completion, the entire Bwanje Valley Irrigation area (800ha) benefitted from the rehabilitation of the irrigation facilities by this project as planned. Also, several project effects such as an increase of production volume and production units of rice and maize and an increase of collection rate in water user fee have been confirmed. In addition, owing to the betterment of water distribution, equal land reallocation and completion of land levelling, positive impacts such as the improvement of agricultural productivity, farmers' incomes and environmental standards were seen. In view 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

Table 6 shows the planned and actual outputs of the project. Concerning table 6, the project outputs, both those contributed by Japan and by Malawi were generally achieved as planned.

It was confirmed that all land levelling of 597ha (Japanese side: 419ha out of 590ha, Malawi side: 178ha out of 210ha) had been completed. Also, as described previously, the cultivated area reached 100% after the project completion, which shows that the problem of non-cultivation was solved (see Table 2).

According to an interview with the implementing agencies and the Japanese supervisory consultant, inputs by the Malawi side were implemented as planned.

Table 6: Planned and Actual Project Outputs

| Planned Outputs (At Appraisal) | Actual Outputs (At Ex-Post Evaluation) |
|---|---|
| 【Contribution of the Japanese Side】<br>1) Rehabilitation of Headworks<br>Rehabilitation of the following parts:<br>①River Slope/Bed Protection Works below the Downstream Apron<br>②Operation Bridge<br>③Sluiceway Gate<br>④Intake<br>⑤Conducting Wall at the Upstream Sluiceway<br>2) Rehabilitation of Settling Basin<br>①Demolishment of the existing settling Basin<br>②Construction of the new Settling Basin | 【Contribution of the Japanese Side】<br>All the outputs were achieved as per the plan, although there were some minor design changes.<br><br>The following changes were made at the time of Detailed Design (D/D) Survey from the initial design of the Basic Design (B/D):<br>(1) River Slope of Headworks below Downstream Apron<br>B/D：Width 50.0m×Length 25.0m<br>Area 1,250 m²<br>D/D：Width50.0m×Length37.0m<br>Area 1,850 m² |

| | |
|---|---|
| Sediment Conduit：Length: 31.0 m, Width: 1.5m x 3 nos., Slope:<br>Discharge Pipe：Length: 35.0 m, Width x Height: 1.0m x 1.0m, Slope: 1/38<br>Flush Gate ：1.0m x 1.0m x 3 nos.<br>Control Gate ：1.2m x 0.5m x 3 nos.<br>Spillway Gate ：1.0m x 1.25m x 1 no.<br>3) Relocation of Main Canal<br>It was planned that the main canal, which was in parallel to the Namikokwe River, be relocated to the mountain ridge.<br>Main Canal： Length: 5.8km, Design Discharge: 1.14 ~0.53 $m^3$/s<br>Branch Canal： Length: 3.0km, Design Discharge: 0.33 ~0.18 $m^3$/s<br>Tertiary Canal： Length: 0.8km<br>Raising Existing Canal Height： Length: 10.2km, Raising Height:10cm~20cm<br>Drainage Canal：Length: 4.0km, Design Discharge: 0.04~0.37 m3/s<br>Canal Related Structure：<br>Gate Structure, Bifurcation, Turnout, Drop, Culvert, Drainage Culvert,<br>Footbridge, Washing Basin, Field Inlet, Division Box<br>Inspection Road： Length: 5.8km, Width: 5.0m (Width of Pavement 3.0m) | (2) River Bed Protection area of Headworks<br>B/D：4,100 m²<br>D/D：3,100 m²<br>(3) Rehabilitation of Bank Protection at the Downstream<br>B/D：3,000 m²<br>D/D：2,400 m²<br><br>During rehabilitation work of the headworks in the first phase, the temporary canal was excavated largely by the floods. Because of this, the backfilling volume of the temporary canal became 40,000$m^3$, while the original plan was for 5,500$m^3$. As a result, the backfilling work of remaining 34,500$m^3$ was done at the second phase. |
| 4)Land Levelling<br>①Responsible area under Japanese assistance：590ha<br>②Levelling grade：±7.5cm<br>5) Soft component Program<br>①Land Re-Allocation Assistance<br>・ Preparation of the detailed implementation plan and standards for land re-allocation<br>・ Assistance on implementation of land re-allocation and preparation of land registration list and cadastral maps<br>②Water Management Strengthening Assistance<br>・ Re-organization of the present water management organization<br>・ Capacity building of water management and O&M of facilities<br>・ Establishment of new water fee collection system<br>③Flood Damage Mitigation and Repair Measures Assistance<br>・ Assistance for construction of bypass canal with road of the existing main canal, river protection works and spur dike<br>・ On-the-job training for flood damage mitigation and repair measures | 4) Land Levelling<br>Land levelling of the entire area of 419ha (within the Japanese side of 590ha) was completed.<br>5) Soft component Program<br>①Land Re-Allocation Assistance: planned activities were implemented<br>②Water Management Strengthening Assistance:<br>In order to make sure that the O&M system functioned appropriately after project completion, improvement of the management of farmers' cooperative was considered to be necessary. Therefore, the following activities were implemented additionally.<br>・ Improvement of accounting system of farmers' cooperative as one of the supports for collection of water user fees<br>・ Activation of rice marketing business to compensate for the shortfall of income from water user fees<br>・ Construction of rice mill and commencing rice mill business to compensate for the shortfall of income from water user fees<br>・ Introduction of maize mill machine to compensate for the shortfall of income |

| | |
|---|---|
| ・ Preparation of manual for flood damage mitigation and repair measures<br><br>6)Temporary works (site office, accommodation, temporary yard) and construction and dismantling of temporary access road<br><br>【Contribution of the Malawi Side】<br>1)Land acquisition for construction<br>2)Personnel and budget for land reallocation, acquisition of agreement from farmers on land re-allocation, implementation of land re-allocation<br>3)Personnel for implementation of the capacity building of water management for the farmers' cooperative<br>4)Personnel and budget for implementation of the Flood Damage Mitigation and Repair of the existing main canal | from water user fees<br>③Flood Damage Mitigation and Repair Measures Assistance:<br>Planned activities were implemented. Staff of the farmers' cooperative was added as targets of the technical assistance.<br><br>Total input for the above mentioned soft component activities was 12.8M/M.<br><br>【Contribution of the Malawi Side】<br>Planned activities were implemented. Land levelling of all 178ha of the Malawi side (210ha) was completed. |

### 3.4.2. Project Inputs

#### 3.4.2.1 Project Cost

The planned project cost was 1,038 million yen (1,033 million yen was the E/N ceiling and 5 million yen was to be supplied by the Malawi side), whereas the actual project cost was approximately 1,035 million yen (1,031 million yen was contributed by Japan and 4.37 million yen was contributed by Malawi). Thus, actual project cost was delivered mostly as planned (99% of the planned cost).

#### 3.4.2.2 Project Period

The project period was planned to be from November 2004 to February 2008 (27 months). The actual project period of Japanese side was from November 2004 to September 2008 (34 months) and that of Malawi side was from April 2006 to March 2008, which was longer than planned (126% of the planned period). According to interview with the Japanese supervisory consultant, the reasons for this delay were as follows: 1) during construction, the temporary canal was damaged by flooding; 2) procedure for importing building materials was not smoothly effected by the Ministry of Finance of Malawi; 3) spare parts for the construction plant and equipment were not available within the country, and took time to import when needed; 4) cement happened to be unavailable within the country during the construction period.

Although the project cost was within the plan, the project period was slightly exceeded; therefore, efficiency of the project was fair.

Picture 3 : Newly Constructed Settling Basin

Picture 4: Leveled land

**3.5 Sustainability (Rating: ②)**

3.5.1 Institutional Aspects of Operation and Maintenance

Due to the reorganization of government ministries in 2009, the ministries in charge of O&M of this irrigation facilities at the time of ex-post evaluation were the Ministry of Water Development and Irrigation (MOWDI) and MOAFS. However, since most of the staff who had been involved in this project moved from MOAFS to MOWDI, MOWDI was the main executing agency[21]. Lilongwe ISD under MOWDI was mainly in charge of O&M of the irrigation facilities. Instructed by Lilongwe ISD, engineers in Dedza DIO conducted regular monitoring of the irrigation facilities and technical assistance. A new Assistant Irrigation Officer, who is specifically in charge of the Bwanje Valley Irrigation area and surrounding area, was allocated in Dedza DIO in May 2013. It is confirmed that this officer often visits and monitors the irrigation facilities.

Dedza DADO, under MOAFS, allocated one project manager and three AEDO at the Project Office after the project's completion. These staff have instructed farmers in general agricultural and irrigation techniques. However, two AEDO positions were vacant at the time of ex-post evaluation. As vacancy of AEDO positions was not only a problem in this target area but one throughout the country[22], MOAFS introduced the “Lead Farmers System” in which potential farmers who might be able to take a role of AEDO are selected from each village and trained with the purpose of providing services which, ordinarily, are provided by the AEDO. This

[21] Irrigation Service Division of Lilongwe ADD which was under the original executing agency (MOAFS) was separated from MOAFS and moved to MOWDI. Therefore, the department itself became Lilongwe ISD under MOWDI and the staff was not changed.

[22] Almost 40% of AEDO is vacant at the time of ex-post evaluation all over the country.

system also aims to improve the ownership of farmers concerning O&M of their irrigation systems. In the target area, this “Lead Farmers System” is planned to be introduced in the near future and is expected to create farmers who can contribute to filling in the services which is not delivered because of two AEDO vacancies. Additionally, according to the interviews with implementing agencies and AEDO, farmers in the target area were well trained by AEDO and improved their ability of O&M. Therefore, they insisted that the AEDO vacancy was currently not a major problem. However, considering that there were 2,067 cooperative members in the target area, there might be the possibility that the current 2 AEDO cannot take full responsibility for continuous assistance for improvement of O&M, water management and agricultural productions. Therefore, it is desirable for GOM to assist this “Lead Farmers System” function well and promote strong cooperation between AEDO and the engineers of Dedza DIO.

Following project completion, routine maintenance of the irrigation facilities was implemented by the farmers’ cooperative under the direction of the Project Office and Dedza DIO. The total number of the farmers’ cooperative members was 2,067 at the time of ex-post evaluation. Leaders of the farmers’ cooperative drew up a monthly O&M plan and monitored the facilities three times a month.

GOM has been promoting a reorganization of institutional arrangement in irrigation systems all over the country by separating the farmers’ cooperative to two organizations: "Water Users Association (WUA)” and the “farmers’ cooperative”. WUA is in charge of the O&M of irrigation facilities and water management, whereas the farmers’ cooperative specializes in selling agricultural products. These two organizations are separated in terms of financial aspects (see Table 7). The purpose of this separation is 1) enhancing the transparency of operations by making an apparent role division between O&M of the irrigation system and the sales of agricultural products; 2) enhancing the efficiency of O&M and improving the collection ratio of water user fees and annual fees by establishing an organization which specializes in the O&M of the irrigation facilities.

At the target area, the above mentioned reorganization of institutional arrangement has been implemented since 2011 and the new system was established after the official election conducted in May 2013. Prior to this reorganization of institutional arrangement, sixty-five representatives from the farmers’ cooperative had been received trainings (such as operational and financial roles related to the WUA and the farmers’ cooperative) implemented by GOM. After receiving this training, the representatives conducted trainings to pass on the information they attained to the farmers at each village. Approximately 1,600 farmers (75% of all the farmers in the target area) have already received training. Regarding the management of WUA,

some interviewees from implementing agencies and AEDO commented that there should not be any problems concerning this, as 36 representatives selected through the election in May 2013 had already taken the above mentioned training by GOM. The interviewees also mentioned that the trainings conducted at each village have promoted the understanding of farmers about reorganization of institutional arrangement. Regarding the farmers' cooperative, it belongs to the Ministry of Industry and Trade (MOIT), which monitors and supervises the farmers' cooperative through the Dedza OVOP District Office.

Table 7: Roles and financial sources of WUA and Farmers' cooperative.

| | WUA | Farmers' cooperative |
|---|---|---|
| Role | O&M of irrigation system and assistance for water management techniques | General operations for selling agricultural productions[23] |
| Financial source | Water user fees, annual fees and penalties, etc. | Income from selling fertilizer[24]/rice, rice and maize milling and share, etc. |
| Use | Cost for implementation of O&M (repair cost, labour cost, etc.) | Costs for selling agricultural products (transportation fees and sales promotion fees, etc.) |
| Sub-organ | MOWDI | MOIT |

According to the reorganization of institutional arrangements, multiple Ministries (MOWDI, MOAFS and MOIT) are involved in the operation of the irrigation system. Regular information sharing was being implemented among the agencies concerned at the time of ex-post evaluation. However, this information sharing is limited to the actions to be taken when problems arose; cooperative planning and monitoring of this irrigation system among the concerning agencies are not being conducted. Considering that this irrigation system is the largest irrigation system in Malawi and that the new organizations (WUA & the farmers' cooperative) have only just been established, active involvement and cooperation of the concerning agencies is considered important for the strengthening of an efficient O&M structure.

[23] Farmers sell the agricultural products to the farmers' cooperative and farmers' cooperative sell those products to the market.
[24] Farmers' cooperative purchase fertilizer wholesale and sell them to farmers.

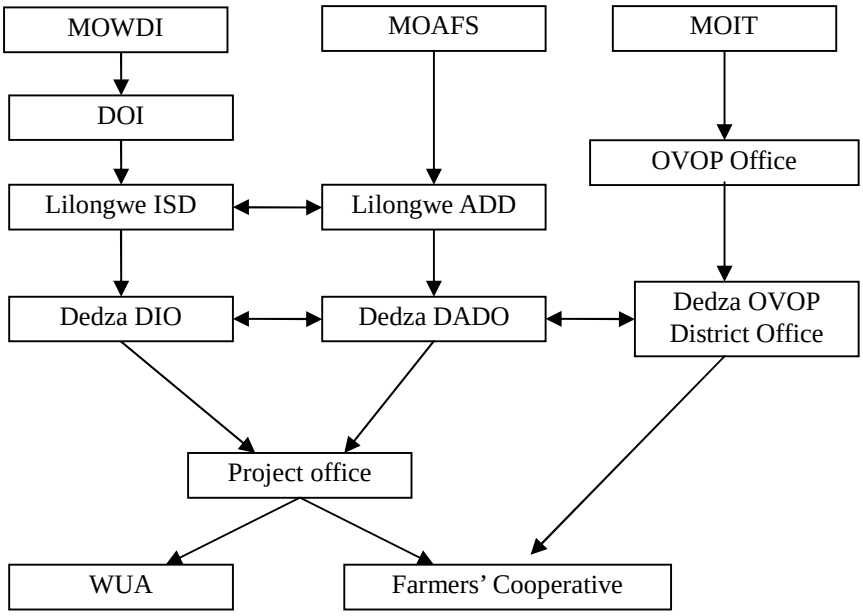



Figure 7: Agencies involved and O&M structure of the irrigation system

3.5.2 Technical Aspects of Operation and Maintenance

According to interviews with leaders of the farmers' cooperative and the beneficiary survey, the trainings concerning O&M, water management, water user fee collection and mitigation of flood damage implemented through soft component activities improved farmers' capacity for the above mentioned areas. Additionally, even after project completion, many trainings regarding irrigation techniques, O&M, farming and organizational management were conducted for the farmers' cooperative. Twenty training sessions (5 categories) were conducted for the farmers' cooperative from project completion to the time of ex-post evaluation and a total of 204 individuals participated in these trainings. In addition, as part of the soft component assistance, a rice market survey was conducted. Based on this survey, farmers were instructed to crop mainly Kilombelo, which has high demand in the market. This increased the production volume of Kilombelo in the target area. Moreover, as a result of promoting cooperation between the farmers' cooperative and OVOP through soft component activities, the farmers' cooperative also explored new markets and participated in trade fairs with assistance from OVOP following project completion. Thus, markets for rice have been broadened. As described above, it is confirmed that capacity of the farmers' cooperative regarding the rice production and sales was improved. Furthermore, staff of the implementing agencies participated in the trainings on irrigation management system, farmer organization on water management, O&M of irrigation facilities (all presented by JICA, 2012) and trainings on community based irrigation management were conducted by grass roots technical cooperation of the Miyagi prefecture

(2011 and 2012). According to the interviews with MOWDI and Lilongwe ISD, these trainings have contributed to improving irrigation and water management ability and raising awareness of the importance of O&M of the facilities.

Dedza DIO and leaders of the farmers' cooperative mentioned that the latter is able to conduct basic repair of the canal through soft component activities. They also commented that the manuals on water management and O&M provided by the soft component are being efficiently used. However, as mentioned previously, results of the beneficiary survey shows that water management is still not adequately implemented in some areas in the target area. Therefore, continuous monitoring by Dedza DIO and AEDO is necessary. Additionally, strengthening WUA's water management ability is considered to be important for the future.

### 3.5.3 Financial Aspects of Operation and Maintenance

Table 8 shows the O&M budgets of the Project Office and the farmers' cooperative for the past four years.

Table 8: O&M budgets of the Project Office and the farmers' cooperative.

(Unit : MK)

| | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Project office | 330,000 | 360,000 | 360,000 | 400,000 |
| Farmers' Cooperative | 40,100 | 315,210 | N/A | 284,720 |

Source: Answer on questionnaire.

O&M budget of the Project Office was allocated from Dedza DADO and used for technical assistance and monitoring of farmers. On the other hand, financial sources for O&M budget of the farmers' cooperative were water user fees, annual fees, penalties from cooperative members and income from rice sales and milling. These were used for 1) O&M of the facilities; 2) salaries for a secretary, water guards and rice mill operators who farmers' cooperative employ; 3) fuel and light expenses of the rice mill, etc. Major repairs, which the farmers' cooperative is not able to handle itself, is supposed to be conducted by GOM.

According to the leaders of the farmers' cooperative and AEDO, O&M budget of the farmers' cooperative is currently not lacking resources. Under the new O&M system, the main financial resources for O&M budgets will come only from water user fees, annual fees and penalties from members. However, the collection ratio of water user fees has been increasing year by year upto 90% currently (see Table 3). Also, both the prices of water user fees and annual fees were increased in 2013, as the market price of rice doubled. In addition, WUA specializes in collecting water user fees and annual fees; as such, collection of these fees is expected to be

strengthened. Henceforth, it is necessary that WUA pays more attention to increasing the collection ratio of water user fees and annual fees so as to secure O&M budgets for the irrigation facilities.

On the other hand, regarding farmers' cooperative management, cooperative now purchases rice only from 50 % of farmers due to the lack of cash. If the rice sales business becomes more activated, positive impacts such as increase of farmers' income as well as improvement of collection ratio of water user fees could be expected. One business manager was allocated by assistance of NGO[25] in May 2013 at the project office and was supposed to instruct the farmers' cooperative. However, the concerned persons[26] do not fully understand the roles of this business manager. Therefore, it is considered to be important that staff of the concerning agencies as well as the cooperative members share common understanding on the role of this manager clearly. It is also desirable for MOIT to instruct farmers' cooperative for the effective management and assist it from the financial aspects.

3.5.4 Current Status of Operation and Maintenance

No problems were observed through the field study in the status of maintenance of the headworks, settling basin, main and branch canals and drainage canal. The facilities are being utilized properly. Concerning the maintenance of headworks and settling basin, water guards employed by the farmers' cooperative are in charge of controlling the gate of the headworks, checking and controlling water level, flushing out sediments, removing debris under the supervision of farmers' cooperative. With regard to the new main canal and branch canals, two representatives from each branch canal are in charge of checking water level, cleaning the canal and repairing breaches. For the tertiary canal and drainage canal, each farmer has been allocated an area to clean and the farmer's name is marked on the side of the canal (see Picture 5)

Some problems have been observed in terms of the technical aspects of water management and the financial aspect of the farmers' cooperative; therefore, sustainability of the project's effect is fair.

[25] Interchurch Organization for Development Cooperation
[26] MOIWD, Lilongwe ISD, Dedza DOI, AEDO etc.

Picture 5 : Tertiary canal in which each farmer's name is marked

Picture 6 : Water guard controlling the gate of settling basin

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

In the Bwanje Valley Irrigation area, the target area of this project (the target area), headworks, irrigation and drainage canals, inspection roads and water supply boreholes were constructed from 1997 to 1999 under Grant Aid from the Government of Japan (GOJ). This grant aid project "Bwanje Valley Irrigation Development Project (the former project)" aimed at the development of irrigation of an area of 800 ha. However, the project's purpose as envisaged was not achieved since the irrigation facilities were damaged due to frequent floods. As a result, this project was implemented with the overall goal of increasing agricultural productivity in the target area. Under this project, rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management were conducted. The objectives of this project were to mitigate the risks against future floods in the target area which had been damaged by previous floods, to restore the function of the irrigation facilities damaged by floods and to create a stable irrigation water supply to this system. Both at the time of project appraisal and ex-post evaluation, the project was consistent with the agricultural sector development policies and the needs of the irrigation development of the Republic of Malawi (Malawi). Thus, the relevance of this project was high. As a result of the rehabilitation of the irrigation facilities, land levelling, land re-allocation and technical assistance for water management, the irrigated area reached the target level of 800ha. In addition, compared with the time of project appraisal, rice production increased 3.5 times after project completion. This suggests that the project has contributed to increasing the agricultural productivity in the target area. Furthermore, it is confirmed that farmers in the target area are highly satisfied with the project, according to the beneficiary survey. Therefore, effectiveness and impacts of the project is high. On the other hand, the efficiency of the project is fair, because project period was longer

than planned, while the project cost was within the plan. Although no major problems were observed in the institutional aspect of Operation and Maintenance (O&M) carried out by the implementing agency, there were some concerns about the technical aspects of water management and the financial aspects of farmers' cooperative. Thus, the sustainability of this project is fair.

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

**4.2** Recommendations

4.2.1 Recommendations to the Implementing Agencies

■ As three ministries (MOWDI, MOAFS, MOIT) are involved in the irrigation facilities, it is desirable to promote more active information sharing, to clarify the roles of each ministry, and thus to strengthen cooperation among the agencies concerned in order for the new management system to function effectively.

■ No major problems regarding the reorganization of institutional arrangement have been found since WUA and the farmers' cooperative have just started to function. However, it is important to establish a strong relationship between these two organizations so as to achieve effective and efficient utilization of the irrigation facilities. In addition, although quite a lot of farmers (75% of total members) received trainings on reorganization of institutional arrangement, it is desired that the implementing agencies promote further understanding of farmers by utilizing the opportunities of village meetings.

■Vacancy of AEDO positions has not been a major problem to date, because farmers received adequate technical assistance and acquired adequate skills. However, in order to continuously instruct and monitor 2,067 farmers in farming and irrigation, it is important to introduce the "Lead Farmers System" as soon as possible. Also, once this has been introduced, the implementing agencies need to regularly monitor to make it function well.

■According to interviews with some concerning parties as well as results of the beneficiary survey, it was found that water management and daily maintenance was not conducted adequately in some areas. Therefore, it could be necessary to implement regular monitoring and training continuously. In addition, the water management ability of WUA and farmers should be continued to be improved. Moreover, awareness raising on the importance of regular and daily maintenance is required to be implemented in order to maintain the irrigation facilities as long as possible.

■The main financial sources of WUA are water user fees, annual fees and penalties. Therefore, it should be necessary to improve the collection ratio of water user fees further and strengthen

planning and management skills of the O&M budget. The implementing agencies have indicated a plan to conduct training to strengthen these skills in WUA. It is suggested that this training be implemented as soon as possible in order for WUA to function efficiently. Monitoring and follow-up after training should also be implemented.

■ In order for the farmers' cooperative to function more actively, it is desirable to clarify the role of the business manager to the concerning parties as well as to farmers. MOIT also needs to instruct and support the farmers' cooperative more actively to improve efficient management.

■ As deforestation upstream of Namikokwe River is a concern in terms of serious damage it may bring to the irrigation facilities, activities to protect the irrigation facilities from these damages should be continued. In addition, raising awareness among farmers who cut down the trees is important.

### 4.3 Lessons Learned

In this project, both irrigation area and cultivated area achieved the targeted level. The project showed high impacts in terms of improvement of agricultural productivity and farmers' incomes. The following factors were considered to contribute to this success. Firstly, this project was carefully planned, based on the accurate survey of factors that prevented the intended effects in the former project. Secondly, based on the above mentioned analysis, sufficient consideration of land levelling and land reallocation was given in addition to the rehabilitation of facilities, in other words, an efficient integration of software and hardware components was made. One of the factors which made these both components function well is that adequate explanation of the project to farmers increased the transparency of this project. Another factor is that close communication between the implementing agencies and the Japanese supervisory consultant promoted active involvement of the implementing agencies. To sum up, lessons learnt through this project were: implementation of accurate pre-survey; comprehensive assistance from hardware and software angles; promotion of understanding among farmers as well as the involvement of the implementing agencies.

The State of Eritrea

**Ex-Post Evaluation of Japanese Grant Aid Project**
**The Project for Urban Water Supply in Debub Region**

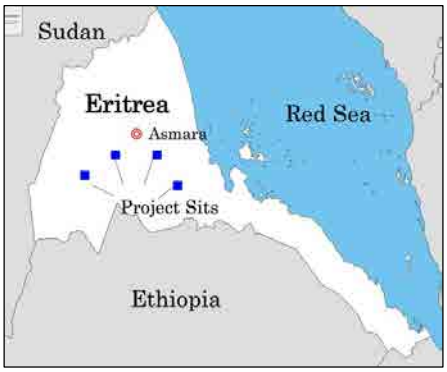
External Evaluator: Kenichi Inazawa, Miyuki Koga, Octavia Japan Co., Ltd.

## 0. Summary

The objective of this project was to increase water supply volume and to provide safe drinking water, by constructing water supply facilities (deep wells, pumping facilities, transmission pipes, reservoirs, distribution pipes and public fountains, etc) in four towns of Debub Region (Debarwa, Dekemhare, May-Dima and Adi Keyih). At the time of the ex-post evaluation, this project is consistent with the policy of Eritrea, such as the "National Water Supply Action Plan," with the development needs for improving water supply facilities in rural towns, and with Japan's ODA policy; thus relevance of the project is high. Due to problems, such as difficulty in procuring parts necessary for house connection work, staff shortage at the water supply service unit of each town and underutilization of well and pumping facilities, the actual average water supply volume per day, which indicates the quantitative effects, has shown limited achievement at the time of the ex-post evaluation; however, the number of people served with safe water and the percent of population with access to safe water have reached certain levels. Hence, the effectiveness and impact of the project is fair. Given that the project period and project cost were within the plan, efficiency of the project is high. On the other hand, major problems have been observed in that the target towns cannot neither assign sufficient number of staff nor conduct training programs due to budget shortage. Similarly, it is difficult to procure spare parts necessary for the connection work. In addition, the target towns have difficulties in addressing various problems that arise. Therefore, sustainability of the project effects is low.

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

## 1. Project Description




Project Location

Constructed Reservoir (May-Dima)

### 1.1 Background

In the State of Eritrea (hereinafter referred to as "Eritrea"), the country's average water supply service rate[1] was very low at approximately 30% for the regions with regional urban centers and rural areas combined before the commencement of this project (2004). Roughly 80% of the country's population lived in regional urban centers and rural areas, relying on unsanitary water from hand-dug shallow wells or rivers and springs. Droughts also occurred from time and time, and the country faced water shortage frequently. In addition, the border conflict with the neighboring country, Ethiopia (1998-2000), increased the number of internally displaced people who migrated from the border areas to the regional centers. This increased water demands dramatically, which led to the deterioration of the water supply service. It was an urgent issue to promote the development of water sources, the increase in water supply volume and the provision of safe water[2] in regional towns. In particular, in the four towns of Debub Region (Debarwa, Dekemhare, May-Dima and Adi Keyih), the water supply service was poor due to the shortage of water sources (The water supply rates were 24.9%, 32.8%, 14.8%, and 14.2%, respectively[3]). Therefore, the government of Eritrea requested Japan to support this project.

### 1.2 Project Outline

The objective of this project was to increase water supply volume and to provide safe

[1] The main water source is groundwater from wells.
[2] At the time of the basic design study (2006), the level of water supply volume was extremely low at 4.9-13.5 liter per day per head in the four targeted towns. Additionally, as coli-forms and bacteria were detected from the groundwater in the studied area, there was a need for chlorination treatment.
[3] According to JICA' survey conducted in December 2005

drinking water by constructing water supply facilities (deep deep-wells, pumping facilities, transmission pipes, reservoirs, distribution pipes and public fountains, etc.) in four towns of Debub Region (Debarwa, Dekemhare, May-Dima and Adi Keyih).

| | |
|---|---|
| Grant Limit / Actual Grant Amount | 1,575 million yen / 1,500 million yen |
| Exchange of Notes Date (/Grant Agreement Date) | Detailed Design: September 2006<br>Construction Work: May 2007 |
| Implementing Agency | The Water Resource Department (WRD) of the Ministry of Land, Water, and Environment (MoLWE) |
| Project Completion Date | February 2010 |
| Main Contractor(s) | Dai Nippon Construction |
| Main Consultant(s) | Nippon Koei Co., Ltd. |
| Basic Design | July 2006 |
| Related Projects (if any) | JICA: "Study on Groundwater Development and Water Supply for Seven Towns in Southern Region of Eritrea" (August 1997-March 1998) |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenichi Inazawa and Miyuki Koga, Octavia Japan Co., Ltd.

### 2.2 Duration of Evaluation Study

Evaluation Study: January 2013-December 2013

Field Study: June 7-21, 2013, August 25-31, 2013

### 2.3 Constraints during the Evaluation Study

Because the monitoring by the concerned regional administrations and Water Supply Services of four towns, to which this project was handed over after project completion, has not been sufficient, only limited data could be obtained through this evaluation study; and the evaluator had no other alternative but to rely on the answers to the questionnaire and the interviews with the related agencies in many aspects.

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

### 3.1 Relevance (Rating: ③[5])

3.1.1 Relevance to the Development Plan of Eritrea

At the time of the project planning, the government of Eritrea developed the "National Water Policy (draft)" in 2004. While indicating the direction of utilizing the available water resources effectively, fairly and optimally for sustainable social and economic development, this policy proposed basic policies for water supply, sanitation and irrigation among others. In addition, the government of Eritrea formulated the "Urgent Action Plan for National Water Supply and Sanitation" (2004-2007) which focused particularly on water shortage in the regions, with the goal of "supplying safe water to 60% of the rural population by 2015" in line with the Millennium Development Goal.

At the time of the ex-post evaluation, the government of Eritrea developed the "Eritrea Water Resource Policy" in 2008, which advocates for the maximum utilization of the potential water resources and for the broad water distribution to the Eritrean citizens thereby contributing to the socio-economic development. In addition, the government has formulated the "Action Plan for Integrated Water Resource Management" since 2009. The plan aims to promote efficient water resource allocation and management in order to respond to the increase in water demand associated with the high population rate[6], thereby contributing to the economic growth and poverty reduction. Building on this action plan, the government developed the "National Water Supply Action Plan" (2013-2017) in 2013. While the problem of water shortage is prevalent in the country, this new action plan aims to supply sufficient and safe water to the people by developing well and other water supply facilities (1,400 places in total) to address water shortage problems in the regions.

In view of the above, concerning the water sector in Eritrea, this project is consistent with the policy, such as national and sectoral plan, at the time of the project planning and also at the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of Eritrea

Before the commencement of the project, the percent of population with access to safe water in regional urban centers was approximately 50% on average, while the national average, including the regional urban centers and rural areas, was very low at approximately 30%. This is

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[5] ③: High, ② Fair, ① Low
[6] It is 3.0% according to the World Bank's 2010 data.

because the water source development technology and the water supply facilities were underdeveloped. According to JICA's Study on Groundwater Development and Water Supply for Seven Towns in Southern Region of Eritrea" (1997-98), it was confirmed that the average daily water supply volume was extremely low at 4.9-13.5 liters per person due to old facilities in three out of the four towns targeted by this project, except for May-Dima. Therefore, there was a great need for stable water supply through the development of water supply facilities. In addition, measures were also needed to address the issue of unaccounted for water and to improve the project planning capacities.

At the time of the ex-post evaluation, the understanding of the provincial government of Debub is that there is not enough number of water supply facilities, such as wells, relative to the population in the four towns targeted by this project. The government also mentioned that the water demand has been increasing year after year along with the increase in population in each town; thus there continues to be a need to promote the development of water sources and the construction of water supply facilities.

Based on above, the consistency is confirmed with the development needs before the commencement of the project and also with the development needs at the time of the ex-post evaluation.

### 3.1.3 Relevance to Japan's ODA Policy

Before the commencement of this project, infrastructures were destroyed in Eritrea due to the border conflict with its neighboring country, Ethiopia. In addition, droughts occurred repeatedly. Based on this situation, the government of Japan considered that supporting the reconstruction efforts of Eritrea through the Official Development Assistance (ODA) would be meaningful as it was in line with the ODA Charter which placed an emphasis on "poverty reduction" and "peace building." Because conflicts and natural disasters, such as droughts, are direct threats to people, providing assistance to fight against these threats was also viewed important from the perspective of "human security." In addition, following the peace agreement signed between Eritrea and Ethiopia in December 2000, the governments of Japan and Eritrea affirmed that Japan's assistance should focus on basic human needs, such as health/sanitation, water supply and education, as well as on the restoration and development of infrastructures at the economic cooperation policy meeting in May 2001. Considering such a background, it can be said that providing water supply assistance such as this project to Eritrea is consistent with the assistance policy of the government of Japan.

In view of the above, this project is relevant to Eritrea's development policy and needs as well as to Japan's ODA policy; therefore, its relevance is high.

### 3.2 Effectiveness[7] (Rating: ②)

3.2.1 Quantitative Effects

Table 1 shows the baselines (2005), targets (2015) and assumed values at the time of the ex-post evaluation (2012) for average daily water supply volume, number of people served with safe water, percent of population with access to safe water and unaccounted for water rate, before the implementation of this project. Table 2 shows the actuals for the three consecutive years after the project completion.

At the time of the project design, average daily water supply volume in 2015 was set as a target. On the other hand, in this ex-post evaluation there was a need to calculate the targets as of 2012 for the sake of before and after comparison[8]. With respect to the average daily water supply volume, the assumption was made that the volume would have started to increase from the time of project completion (2010)[9]. Applying the rate of increase of the target from 2010 to 2015, what the target value should have been for 2012 was estimated, which was then compared with the actual for 2012. On the other hand, concerning the number of people served by safe water and the percent of population with access to safe water[10], because the population inflow (including the influx of internally displaced people) is increasing in Debarwa and Dekemhare as it will be described later, we estimated the target value for 2012 by calculating the rate of increase from 2005 actual to 2015, which was then compared with the actual for 2012.

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

[8] Target had not been set clearly through the soft component training, which will be described in "3.5.2 Technical Aspects of the Operation and Maintenance" under Sustainability.

[9] The assumption was made that the water supply would increase starting from the completion of the project because the development of the reservoirs and the water distribution networks were planned to be completed in each town by April 2010.

[10] The percent of population with access to safe water is (the number of people served by safe water divided by the total population of each town) x100.

Table 1: Data on Quantitative Indicators of this Project (Before Project Commencement)

| Indicator | Target Area | Baseline (2005) | Target (2015) | Assumed Target at the Time of the Ex-Post Evaluation (2012) |
|---|---|---|---|---|
| 1) Average daily water supply volume ($m^3$/day) | 4 towns (total) | N/A | 8,389 | N/A[11] |
| | Debarwa | 155 | 1,942 | 1,072 |
| | Dekemhare | 467 | 2,743 | 1,366 |
| | May-Dima | N/A | 675 | N/A |
| | Adi Keyih | 193 | 3,029 | 1,702 |
| 2) Number of people served with safe water (person) | 4 towns (total) | 20,403 | 150,901 | 111,752 |
| | Debarwa | 4,311 | 30,497 | 22,641 |
| | Dekemhare | 9,319 | 47,983 | 36,384 |
| | May-Dima | 2,537 | 25,962 | 18,935 |
| | Adi Keyih | 4,236 | 46,459 | 33,792 |
| 3) Percent of population with access to safe water (%) | 4 towns (average) | 22.1 | 100.0 | 76.5 |
| | Debarwa | 24.9 | 100.0 | 77.5 |
| | Dekemhare | 32.8 | 100.0 | 79.8 |
| | May-Dima | 14.8 | 100.0 | 74.4 |
| | Adi Keyih | 14.2 | 100.0 | 74.3 |
| 4) Unaccounted for water (%) | 4 towns (average) | N/A[12] | 15.0 | N/A |
| | Debarwa | N/A | 15.0 | N/A |
| | Dekemhare | N/A | 15.0 | N/A |
| | May-Dima | N/A | 15.0 | N/A |
| | Adi Keyih | N/A | 15.0 | N/A |

Source: Document provided by JICA

Table 2: Data on Quantitative Indicators of this Project (After Project Completion)

| Indicator | Target Area | Actual after the Project Completion | | | |
|---|---|---|---|---|---|
| | | 2010 | 2011 | 2012 | Achievement Rate* |
| 1) Average daily | 4 towns (total) | N/A | N/A | 2,380 | N/A |

[11] In May-Dima, no baseline data was set in 2005; similarly no data was collected after 2005. Therefore, it was not possible to calculate the assumed target for 2012 in the case of May-Dima. In terms of average daily water supply volume in other three towns, it was calculated by applying the rate of increase of the target from 2010 to 2015, based on the assumption that the water supply would start to increase from the time of project completion (2010).

[12] With respect to unaccounted for water rate before the commencement of the project, it was not possible to calculate the rate because no concrete data was available.

| | | | | | |
|---|---|---|---|---|---|
| water supply volume ($m^3$/day) | Debarwa | 279 | 347 | 370 | 34.5% |
| | Dekemhare | 1,231 | 1,235 | 1,265 | 92.6% |
| | May-Dima | N/A | N/A | 130 | N/A |
| | Adi Keyih | 465 | 558 | 615 | 36.1% |
| 2) Number of people served with safe water (person) | 4 towns (total) | 75,924 | 81,668 | 87,886 | 58.2% |
| | Debarwa | 9,900 | 11,006 | 13,216 | 58.4% |
| | Dekemhare | 21,410 | 22,160 | 22,660 | 47.2% |
| | May-Dima | 14,614 | 15,152 | 15,690 | 60.4% |
| | Adi Keyih | 30,000 | 33,350 | 36,320 | 78.2% |
| 3) Percent of population with access to safe water (%) | 4 towns (average) | N/A | N/A | 67.8 | 88.6% |
| | Debarwa | 55.0 | 59.0 | 69.7 | 89.9% |
| | Dekemhare | N/A | N/A | 58.4 | 73.2% |
| | May-Dima | 80.0 | 73.0 | 65.0 | 87.4% |
| | Adi Keyih | 65.0 | 72.0 | 78.0 | 104.9% |
| 4) Unaccounted for water (%) | 4 towns (average) | N/A | N/A | N/A | N/A |
| | Debarwa | N/A | N/A | N/A | N/A |
| | Dekemhare | N/A | N/A | N/A | N/A |
| | May-Dima | N/A | N/A | N/A | N/A |
| | Adi Keyih | N/A | N/A | N/A | N/A |

Source: Answers on questionnaire and data provided by the Water Supply Service (WSS) of each town
*Note: Achievement rates were calculated by comparing the assumed target at the time of the ex-post evaluation in Table 1 (2012) with the actual (2012) shown in this table.

1) Average Daily Water Supply Volume[13]

The achievement rates of four towns for 2012, calculated based on the data shown in Table 1 and Table 2, are low at 49.4% on average for the four towns: 34.5% for Debarwa; 92.6% for Dekemhare; N/A for May-Dima; and 36.1% for Adi Keyih; thus the average achievement rate for the four towns is N/A. For reference, if the target for 2015 (675$m^3$/day[14]) is used as an alternative for the 2012 assumed target at the time of the ex-post evaluation for May-Dima, the achievement rate would be 19.3%; hence the average achievement rate for the four towns would

[13] The calculation method is slightly different from town to town. (e.g., for some towns per day data was available while for others weekly data was divided by seven days)
[14] For the purpose of calculating the assumed target at the time of the ex-post evaluation (2012) for all four towns, target for 2015 (675 $m^3$/day) was used of May-Dima (＝1,072+1,366+675+1,702 $m^3$/day). As a supplementary note, unlike other three towns, piped water or water from tankers was not available in May-Dima; people relied on shallow wells and public fountains. While it can be presumed that average daily water supply volume of May-Dima was less than the other towns, the actual situation is not clear.

be 49.4%.

The situations of the towns except for Dekemhare are as follows[15]. In Debarwa, according to Debarwa's Water Supply Service (hereinafter referred to as "Debarwa WSS"), while there is a high demand of residents for water service, (1) there is a shortage of parts necessary for connecting each house to the water distributing pipe (mainly snap taps with saddles), as a result of which residents' water demand is not sufficiently met (it will be described in more details in the section of "Sustainability"), and (2) the volume of water intake from the wells is less than what was initially expected[16]. As for May-Dima, according to staff assigned to water supply of the town[17], (1) the volume of water intake is less than what was initially expected because seven out of the ten wells and pumping facilities constructed by this project are not operational[18], and (2) the groundwater availability is on the decrease around the well also for the three operational facilities[19]. In the case of Adi Keyih, according to the Water Supply Service (hereinafter referred to as "Adi Keyih WSS"), (1) the volume of water intake is less than what was initially expected because the groundwater level is on the decrease, and (2) sufficient volume of water is not provided to the residents because the water distribution network is old and causing high leakage and low water pressure while there are no major problems with the operational status of the facilities constructed by this project.

2) Number of People Served with Safe Water and 3) Percent of Population with Access to Safe Water

It can be observed from Table 2 that the achievements are relatively high for the number of people served with safe water and the percent of population with access to safe water, as compared to the performance in terms of average daily water supply volume. Evidently, as the number of residents increases year after year in the residential plots[20] for which the WSS of the three towns except for May-Dima is providing water connection, a situation is arising where certain amount of water is being shared by a large number of residents (i.e., a situation in which many people are sharing the small total). This explains why the rate of increase from the

[15] No data was provided by the Eritrean side concerning water intake volumes and decreasing amount of underground water in each town.
[16] Details will be explained in the Output section under Efficiency.
[17] As it will be explained in the institutional aspects of the operation and maintenance under Sustainability, Water Supply Service (WSS) does not exist in May-Dima unlike the other towns. Staffs of other units are in charge of water supply concurrently; thus these staffs were interviewed for the purpose of collecting necessary information.
[18] Details will be explained in the Output section under Efficiency.
[19] Details will be explained in the Output section under Efficiency.
[20] Since the commencement of the project, the number of live births has been increasing throughout Eritrea. In particular, there is an increasing population inflow into towns closer to the capital, Asmara (especially Debarwa and Dekemhare).

baseline to target is higher for the number of people served with safe water and the percent of population with access to safe water than for the average daily water supply volume. As it will be described later as part of the beneficiary survey results (Figure 6: Answers on Water Supply Frequency Before and After Project Implementation), residents receive water supply less frequently after the project implementation than before the project implementation. This finding reaffirms the earlier presumption that a limited water supply is being shared by an increasing number of residents[21]. In May-Dima the number of residents with access to safe water has increased as a result of the construction of the public fountains by this project[22].

4) Unaccounted for Water Rate

As shown in Table 2, unaccounted for water rate was not calculated in all four towns. The following reasons were provided for this: (1) The employees assigned to water supply in each town either do not measure or cannot measure[23]; (2) In the case of Dekemhare mainly, a flowmeter (digital type, see Figure 2) installed inside the pumping facilities does not function because the embedded battery outlived its usefulness. While Dekemhare WSS does not have any spare, it is not possible to procure it domestically, either, due to budget shortage and others; thus it is not possible to measure accurate flow data.

Figure 1: Pumping Facilities (May-Dima)

Figure 2: Non-Operating Flowmeter (Dekemhare)

[21] It should be noted that the respondents of the beneficiary survey are referring to all water supply facilities that are available in the target area, including the ones constructed by this project; thus the application of the survey results is not limited to this project.

[22] As a side note, many residents in May-Dima used to fetch water from hand-dug shallow wells, rivers and springs before the project commencement.

[23] When these staffs were interviewed, they made comments, such as “We do not calculate the rate. We do not know any method to calculate the rate.”

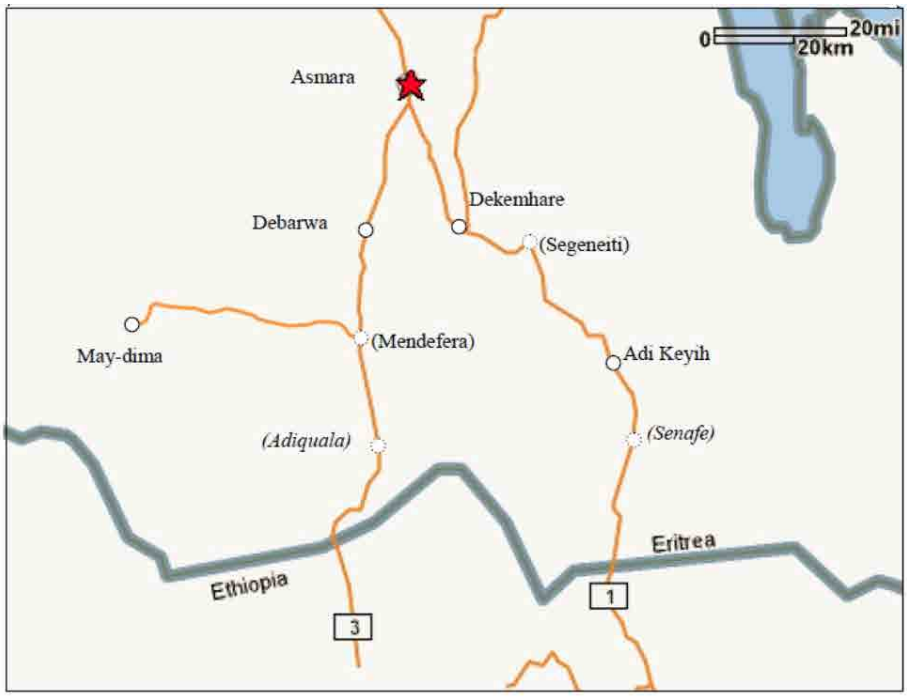



Figure 3: Locations of Project Sites[24]

(Reference Data) Number of House/Yard Connections in Each Town

This section will review target and actual numbers of house/yard connections in each town except for May-Dima[25]. As shown in Table 3 below, there are more connections in 2010 and onwards than in 2005 in the case of Debarwa although no data is available concerning targets. The number of connections is not increasing significantly because of the shortage of parts necessary for the connection work (mainly snap taps with saddles and flowmeters) as described earlier. In Dekemhare, although the number of connections is on the increase from 2010 to 2012 on an actual basis, the number of connections is less than the 2005 baseline. According to Dekemhare WSS, this is because of the following: (1) The 2005 baseline (737 connections) included the connections that had been completed but not yet in use, which suggests that the actual connections that were operational were less than what was stated as the baseline in reality; (2) After the commencement of the project a construction was carried out in the town to expand roads in the downtown area. The existing water distribution network was partly affected by this construction, as a result of which the number of house/yard connections decreased temporarily. While the work is being undertaken to establish new connections thereafter, the total number of connections has not yet reached the previous level; and (3) Dekemhare WSS is

[24] Source is document provided by JICA.
[25] The number of connection is zero in May-Dima because water distribution network does not exist there and water is only supplied with public fountains.

facing staff shortage as described earlier. As for Adi Keyih, it can be judged that the achievement is almost as per the target.

Table 3: Baseline, Target and Actual for Number of House/Yard Connections in Each Town

(Unit: Number of connections)

| Target Area | 2005 | 2010 | 2011 | 2012 | 2015 |
|---|---|---|---|---|---|
| | (Baseline) | (Target) | | | |
| Debarwa | 142 | N/A | N/A | N/A | N/A |
| Dekemhare | 737 | 1,200 | 1,400 | 1,600 | 2,000 |
| Adi Keyih | 919 | 1,578 | 1,728 | 1,888 | N/A |
| Target Area | | 2010 | 2011 | 2012 | |
| | | (Actual) | | | |
| Debarwa | | 897 | 976 | 1,179 | |
| Dekemhare | | 451 | 513 | 710 | |
| Adi Keyih | | 1,543 | 1,709 | 1,876 | |

Source: Data for 2005 (baseline) is from documents provided by JICA, and data for 2010 and onward (baseline, target and actual) is from answers on questionnaire and the ex-post evaluation survey.
Note: The numbers are shown on a cumulative basis.

### 3.3 Impact

#### 3.3.1 Intended Impacts

##### 3.3.1.1 Contribution to Improving Living Conditions of Residents

A beneficiary survey was conducted targeting "residents who are already receiving water supply service (residents who are receiving water through house connections and public fountains)" in the four target towns concerning the level of satisfaction with this project as well as changes in their living and sanitary conditions[26]. With regard to the level of satisfaction with this project shown in Figure 4, many of the residents are either "very satisfied" or "satisfied" in the target towns except for Adi Keyih. This is presumably because the water situation has improved through the development of water supply facilities by this project compared to before the project commencement when rural residents used to fetch water from hand-dug shallow wells, rivers and springs while urban residents were faced with unstable water pressure. In the case of Adi Keyih, while the water supply facilities have been developed by this project, it is thought that a part of the dissatisfaction comes from the leakage in the distribution pipe caused

[26] Samples were drawn with random sampling method, and it took the form of questionnaire. The sample size is 100 in total. The compositions of the respondents are as follows: (1) By town: 25 samples from each of Debarwa, Dekemhare, May-Dima and Adi Keyih town; (2) Sex: Debarwa had 4 male samples and 21 female samples, Dekemhare had 10 male samples and 15 female samples, May-Dima had 8 male samples and 17 female samples, Adi Keyih had 4 male samples and 17 female samples; 3) Age: 35 samples in 20-29 years old, 27 samples in 30-39 years old, 20 samples in 40-49 years old, 7 samples in 50-59 years old, and 11 samples in the 60s or above.

by the old water distribution network that exists in the town as described earlier. According to the interviews with the respondents of this town, comments such as “water volume is not stable” were given. With regard to the question related to the level of satisfaction with water supply volume shown in Figure 5, it is presumably for the same reason that relatively many respondents selected “no” in Adi Keyih. Figure 6 is a question concerning water supply frequency before the project commencement and after the project completion. In Debarwa, Dekemhare and Adi Keyih it can be observed that the water supply frequency is less after the project completion than before the commencement[27]. This is due to the situation described earlier in which an increasing number of residents are sharing the limited volume of supplied water as a result of the population growth[28]. In May-Dima where a higher proportion of residents used to go to the rivers and springs to fetch water than the other towns before the commencement of the project, the responses show the trend that residents are able to access water from the constructed public fountains after the project completion.

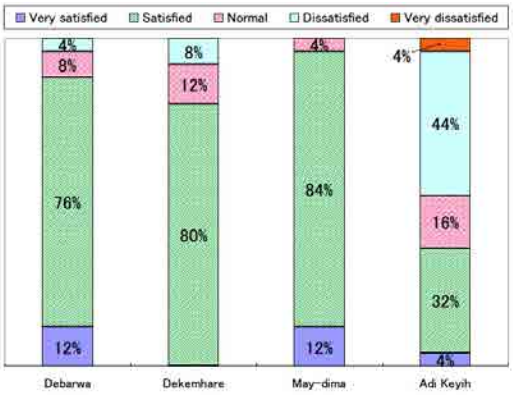



Figure 4: Are you satisfied with this project?

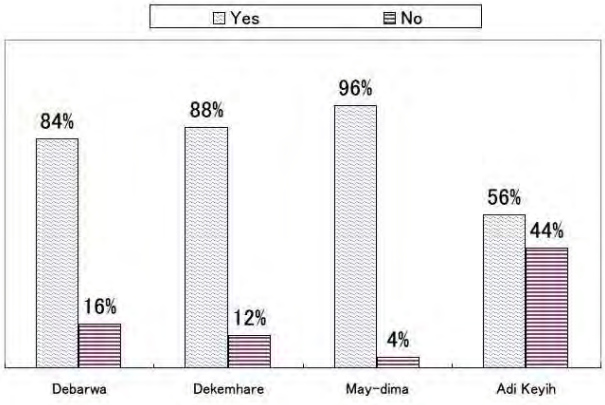



Figure 5: Do you think the volume of supplied water is sufficient?

[27] While the situation differs from town to town, there were some residents who used to receive water supply through the existing water distribution pipe, in addition to the residents who used to fetch water from shallow wells before the commencement of the project. It was thus judged relevant to do a before-and-after comparison and review the results. Although there may be external factors such as population growth caused by influx of internally displaced people in the case of Debarwa, Dekemhare and Adi Key, it is not taken into consideration in this analysis.

[28] In other words, although people have gained access to water supply facilities, they are not necessarily receiving sufficient amount of water.

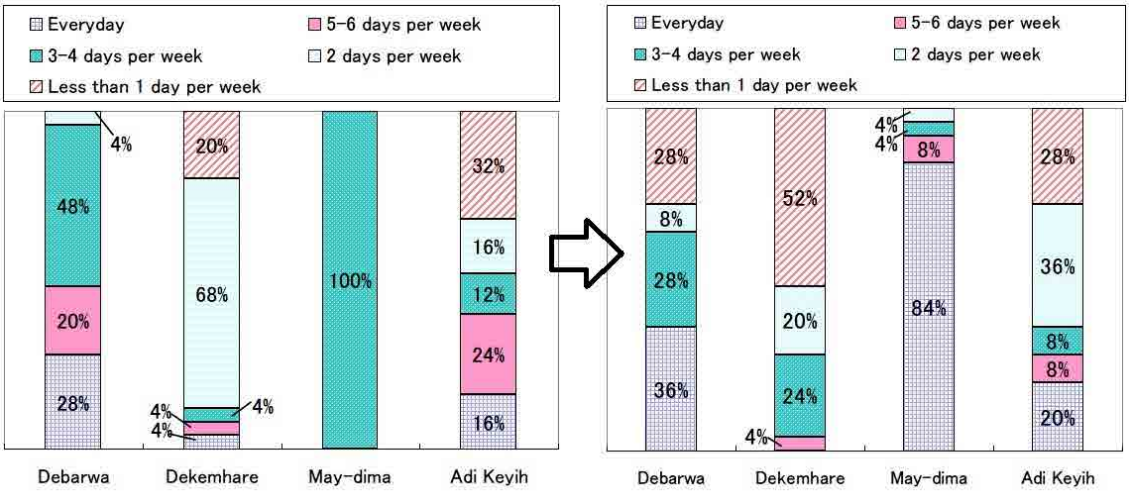



Figure 6: How frequent was/is water supplied before the commencement of the project and after the completion of the project?
(Left: Before project commencement, Right: After project completion)

### 3.3.2 Other Impacts

#### 3.3.2.1 Impacts on the Natural Environment

Before the commencement of the project it was presumed that the implementation of this project would have little negative impact on the social environment of the four target towns. However, it was cautioned that noise and vibration should be minimized while constructing the distribution pipes, giving consideration to residents in the neighborhood. Through the questionnaire and the interviews conducted during this ex-post evaluation, it has been confirmed that there was no negative impact on natural environment, noise or vibration associated with the construction of the facilities in the four target towns during the project implementation.

In Adi Keyih, on the other hand, a chlorine injector (see Figure 8), which has been installed at one of the transmission pumping facilities constructed by this project (1 site), is not in use at all. The original plan was that water would be chlorinated at the water transmission facilities after being collected from the wells[29]. However, the actual practice was confirmed that Adi Keyih WSS staff members pour chlorine at a rough estimate (with buckets and others) at a reservoir located in the suburb. In other words, there is a possibility that appropriate quantity of chlorine is not being injected[30]. When some residents were interviewed during the beneficiary survey, they commented, "The supplied water has a strong chlorine smell. It may be because the

[29] It was planned that accurate amount of chlorine would be injected automatically with the injector.
[30] No information or data was available for how long and why they have been pouring chlorine at a rough estimate. Data was also not available concerning the results of the water quality tests that are conducted periodically.

injected amount is too much. Some abnormal change is observed in the clothes after the laundry. We are afraid that there may be some health risk to our children."

As for the other towns, it has been confirmed through site visits and interviews that there are no major problems on the natural environment attributed to the constructed well and pumping facilities and reservoirs.

Concerning the institutional aspects of environmental monitoring, water quality is checked at water sources such as wells in all of the four towns. The Water Resource Department (WRD) sends inspectors to conduct unannounced water quality monitoring and tests[31]. These inspectors take samples, examine the water quality and give admonitions the towns as needed. In Debarwa and Dekemhare sanitarians (one person each) conduct water quality tests and monitoring during water supply. According to Debarwa WSS, there are no major problems with the water quality. According to Dekemhare WSS, they cannot conduct water tests in a satisfactory manner because they do not have any water quality measuring instrument[32]. Similarly, in May-Dima and Adi Keyih water quality is not checked or analyzed during water supply as human and financial resources are limited; thus water quality test and analysis is thought to be an issue which needs to be addressed in the future. According to both towns, they would like to carry out water tests in the future with consideration for the health of the residents.

3.3.2.2 Land Acquisition and Resettlement

There was no resettlement in this project. On the other hand, land had to be acquired for the construction of reservoirs, well and pumping facilities and public fountains. According to the provincial government of Debub, the land which had to be acquired was owned by the provincial government from the beginning and that there were no problems with the procedure associated with the acquisition. It has been confirmed that approximately 800$m^2$ of land was acquired totally in Debarwa, approximately 4,110 $m^2$ in Dekemhare, approximately 580 $m^2$ in May-Dima, and approximately 2,570 $m^2$ in Adi Keyih.

[31] WRD conducts water quality test at intervals. According to each town, it is carried out once every half-a-year on average although it is sometimes conducted irregularly.

[32] According to them, it cannot be acquired easily because it is an imported product. No water quality data for Debarwa and Dekemhare was available although it was requested.

Figure 7: Adi Key Town

Figure 8: Chlorine Injector

【Conclusion on Effectiveness and Impact】

With regard to effectiveness, when assumed targets for 2012 were compared with the actuals at the time of the ex-post evaluation using indicators set at the time of the planning, such as (1) number of people served with safe water, (2) percent of population with access to safe water, and (3) average daily water supply volume, the average achievement rates for the four towns are 58.2%, 88.6% and N/A respectively. In addition, with respect to impact, the project had a certain level of contribution toward the improvement in the living conditions of the residents according to the results of the beneficiary survey which targeted those who are already receiving the water supply service. On the other hand, it is observed that the frequency of water supply is decreasing in the towns other than May-Dima.

In light of the above, this project has somewhat achieved its objectives; therefore, its effectiveness and impact is fair.

### 3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Table 4 is the planned and actual outputs of this project.

Table 4: Planned and Actual Outputs of This Project

| Plan (At Appraisal) | Actual (At Ex-Post Evaluation) |
|---|---|
| 【Planned Outputs from the Japanese Side】<br>■ Construction and expansion of piping-system water supply facilities for four towns (e.g., deep well water intake facilities, | 【Actual Outputs from the Japanese Side】<br>■ They are as follows: |

| | |
|---|---|
| transmission pipes, distribution pipes and water fountains)<br>1) Debarwa<br>a) Deep-well and pumping facilities: 14<br>b) Transmission pipe: 25km<br>c) Reservoirs: 2 (500$m^3$, 50 $m^3$)<br>d) Distribution pipe: 9km<br>e)Public fountains: 9<br><br>2) Dekemhare<br>a) Deep-well and pumping facilities (including replacement of the existing pumps): 8<br>b) Transmission pipe: 24km<br>c) Reservoirs: 1 (1,100$m^3$)<br>d) Distribution pipe: 14km<br>e) Public fountains: 16<br><br>3) May-Dima<br>a) Deep-well and pumping facilities (including replacement of the existing pumps): 15<br>b) Transmission pipe: 15km<br>c) Reservoirs: 1 (300$m^3$)<br>d) Distribution pipe: 4km<br>e) Public fountains: 9<br><br>4) Adi Keyih<br>a) Deep-well and pumping facilities : 11<br>b) Booster Pump: 1<br>c) Transmission pipe: 20km<br>d) Reservoirs: 2 (700$m^3$ and 50$m^3$)<br>e) Public fountains: 10<br><br>■ Soft component (technical assistance) to strengthen the institutional aspects of the operation and maintenance by the Water Supply Service of each town for smooth operation and maintenance of the above outputs[33]<br><br>【Planned Inputs from the Eritrean Side】<br>a) Securing and providing land<br>b) Facilitation for obtaining construction permits | 1) Debarwa<br>a) Deep-well and pumping facilities: 16<br>b) Transmission pipe: 14.886km, 35 valve chamber elevations<br>c) Reservoirs: 2 (500$m^3$, 50 $m^3$)<br>d) Distribution pipe: 9.834km<br>e) Public fountains: 4<br><br>2) Dekemhare<br>a) Deep-well and pumping facilities: 8<br>b) Transmission pipe: 23.040km, 55 valve chamber elevations<br>c) Reservoirs: 1 (1,100$m^3$)<br>d) Distribution pipe: 13.809km, 25 valve chamber elevations<br>e) Public fountains: 8, 2 water towers, 1 pressure reducing valve<br><br>3) May-Dima<br>a) Deep-well and pumping facilities: 19<br>b) Transmission pipe: 12.412km, 16 valve chamber elevations<br>c) Reservoirs: 1 (300$m^3$)<br>d) Distribution pipe: 5.681km, 4 valve chamber elevations<br>e) Public fountains: 9<br><br>4) Adi Keyih<br>a) Deep-well and pumping facilities : 15<br>b) Booster Pump: 2<br>c) Transmission pipe: 19.790km, 18 valve chamber elevations<br>d) Reservoirs: 2 (700$m^3$ and 50$m^3$)<br>e) Distribution pipe: 1.091km<br>f) Public fountains: 6<br><br>■ It was implemented as planned.<br><br>【Actual Inputs from the Eritrean Side】<br>a), b) and c) were implemented as planned except that the connection work (c)) is on-going at present as it will be explained in |

[33] The details will be explained in "Technical Aspects of the Operation and Maintenance" under Sustainability.

| | |
|---|---|
| c) Construction work for the house/yard connection[34] | the section of project period under Efficiency. |

With respect to the outputs by the Japanese side, there are some differences between the plan before project commencement and the actual at the time of the ex-post evaluation. According to the interviews with the main consultant who was in charge of construction management of this project, the provincial government of Debub and the four target towns, the main reasons are as follows: (1) Changes were made to the construction method during the detailed design and the construction based on the conditions of the project sites; (2) The expense was not allowed to exceed the planned financial input of the Japanese side (given the nature of Japan's grant aid projects); thus outputs had to be delivered within the budget limit. What was done in practice is that design changes were made to the necessary outputs of high-priority that were within the planned budget, while outputs perceived to be of relatively low-priority were either downscaled or excluded as a result of the design change.

With regard to the soft component, there was a need before the commencement of the project to address the problem of the old water distributing pipe and water supply facilities caused by insufficient maintenance in each town. In response to such a situation, a technology transfer was implemented by this project with the aim of improving capabilities to manage leakage and operate based on business plans as soft component training for staff engaged in the water supply service. More specifically, the following topics were covered: examples and detection of leakage; how to renew old pipes and fix leakage as well as required equipment; establishing customer ledgers (identification of water supply systems and status of equipment use, such as pipe diameters and flowmeters); periodic patrol plans; record keeping (distributed water volume/supplied water volume, recording repairs of facilities, recording meter reading and recording leakage control, etc.); and on-the-job training.

(Outputs with Issues Observed at the Time of the Ex-Post Evaluation)

Through this ex-post evaluation, operational problems and risks were observed in some parts of the constructed outputs. The major ones are listed below:

■ In Dekemhare well and pumping facilities (3 places in total) are not operational. More

[34] In May-Dima out of the four target towns, it was planned that water would be supplied with public fountains considering the availability of groundwater potential and the town size. Thus there is no water distribution network or house connection.

specifically, (1) one pumping facility is not being used, although it has no operational problem, because soil erosion, which occurred in one of the water transmission routes, has left a transmission pipe unfixed and interrupted (see Figure 9) (1 place); and (2) operation of one pumping facility is suspended due to an electric system failure (2 places)[35].

■ In Dekemhare a site of the constructed reservoir is at a risk for ground (terrace) collapse (see Figure 10). Generally this town has many places with sandy soil, and soil erosion is likely to occur when there is heavy rain. In particular, erosion has been expanding in the slopes since the completion of the project; some grounds are found to be fragile. Recently, erosion is progressing in the entire slope[36]. No repair work has been done up to the point of this ex-post evaluation[37].

■ Seven out of the ten well and pumping facilities constructed in May-Dima are not operational[38]. According to the provincial government of Debub and May-Dima town, this is because groundwater has been decreasing year after year (with the groundwater level becoming lower), as a result of which water intake has become impossible in some areas[39]. At the time of the ex-post evaluation, water intake volume from these wells is found to be almost none obviously in the dry season and even in the rainy season. According to the provincial government and May-Dima town, they are aware that water intake volume is on the decrease even for the remaining three well and pumping facilities that are operational at the time of the ex-post evaluation[40]. Therefore, a possibility cannot be denied that the remaining three facilities may also stop operating in the near future in May-Dima.

■ The foundation parts and doors of some well and pumping facilities were designed and constructed at low elevations in Debarwa, Dekemhare and Adi Keyih[41], as a result of which these facilities get flooded in the case of heavy rain. Pumping equipment installed inside the facilities has to be stopped during the flood; and it cannot be operated for water intake until

[35] With regard to one of two places, although an exact reason remains unknown, the lightening arrester was not activated when the lightening hit according to the WSS staff. However, it could be the case that this happened because the arrester (embedded part, consumable) was not replaced, while it was pointed out during the inspection that arresters would need replacement.

[36] The focal point of the provincial government of Debub at the time commented in an interview, "Actually, we could observe that ground was fragile at the design stage of this project. Thus we requested the Japanese side to change the site for the reservoir construction. However, it was denied because budget and time were limited for the design study."

[37] According to the interview with the town and the provincial government of Debub, it is due to budget shortage.

[38] Concrete information was not available as to how long they have been non-operational.

[39] However each town targeted by this project is not measuring the data. Therefore, no accurate data is available.

[40] As discussed earlier, the target towns of this project are not currently measuring the data. Therefore, no accurate data is available.

[41] Knowing the climate and situations during heavy rains around the sites where well and pumping facilities were constructed, the provincial government requested the Japanese side to elevate the foundations and the doors at the time of the design and also during the project implementation. However, such request was denied because the budget and time were limited for the design study.

floodwater recedes. According to the provincial government of Debub, from April 2010 up to the time of the ex-post evaluation, the facilities got flooded four times in Debarwa, five times in Dekemhare, and six times in Adi Keyih. They also commented that although there has not been any failure of pumping equipment thus far, equipment is apparently becoming worn fairly quickly because they had been under water.

Figure 9: Interrupted Water Transmission Pipe Due to Soil Erosion[42] (Dekemhare)

Figure 10: Constructed Reservoir (Dekemhare)

Figure 11: Non-Operational Well and Pumping Facility Due to Electrical System Failure Caused by Lightning (Dekemhare)

Figure 12: Well and Pumping Facility in Debarwa (it gets flooded in the case of heavy rain as the foundation and the door are built at too low an elevation)

### 3.4.2 Project Inputs

#### 3.4.2.1 Project Cost

The total project cost was initially planned to be approximately 1,581 million yen (the grant limit stated in the Exchange of Notes was 1,524 million yen for the construction and 51 million yen for the detailed design from the Japanese side, and approximately 6 million yen from the

[42] The poles seen in the center of the photo had been installed to support the transmission main. As seen in the picture, no transmission main has been installed due to soil erosion.

Eritrean side), whereas the actual cost was approximately 1,509 million yen (regarding the actual cost of the Japanese side, the construction was 1,449 million yen and the detailed design was 51 million yen, while the Eritrean side was approximately 9 million yen), which was mostly as planned (approximately 95% of the plan).

3.4.2.2 Project Period

The project period was planned to be 3 years and 7 months (43 months) from September 2006 to April 2010. The procurement and installation work by the Japanese side took 3 years and 5 months (41 months) from September 2006 to February 2010, which is within the plan. On the other hand, concerning the work implemented by the Eritrean side, the house/yard connection work is on-going in the three towns except in May-Dima at the time of the ex-post evaluation. According to the document provided by JICA and interviews conducted during the fieldwork of this evaluation study, it was the initial plan of the Eritrean side that the connection work be continued up to 2015. Therefore, it is deemed inevitable that the work has not been completed at the time of the ex-post evaluation. Therefore, the completion of the construction and the procurement of equipment and materials by the Japanese side would be considered as the timing of the completion of this project. (Thus the actual project period is 95% of the plan.)

In view of the above, both project cost and project period were mostly as planned; therefore, efficiency of the project is high.

## 3.5 Sustainability (Rating: ①)

### 3.5.1 Institutional Aspects of Operation and Maintenance

The implementing agency of this project is the Water Resource Department (WRD), which is one of the departments of the Ministry of Land, Water, and Environment (MoLWE). However, WRD is responsible for the coordination and processing of new projects and planning of water supply programs; thus substantively they are not involved in this project at the time of the ex-post evaluation. The operation and maintenance of the facilities constructed by this project is the responsibility of the water supply units within the municipality offices of Debarwa, Dekemhare, May-Dima and Adi Keyih, which are under the provincial government of Debub. However, in the case of May-Dima, there is no unit specialized in water supply because the size of the population and the municipality office is small; the staff of the municipalities who also

have other duties carry out the operation and maintenance work[43]. In the three towns except May-Dima, water supply units are called the Water Supply Services (WSS). The provincial government of Debub supervises and monitors this project by coordinating and liaising with each town.

Table 5 shows the number of staff assigned to the water supply service in the four target towns before project commencement and at the time of the ex-post evaluation. The number of staff increased in all towns compared to before the commencement of the project. This is mainly because the work requirement increased as the number of water connections increased compared to before project commencement. In Dekemhare, however, the number of staff is not necessarily sufficient given the increasing population and number of connections; thus the operation and maintenance structure is not sufficient. According to Dekemhare WSS, they cannot assign sufficient number of personnel for the operation and maintenance because their budget is limited and also because there is no prospect of receiving budget support from the provincial government of Debub. At present, they are faced with staff shortage and lack of training, and they cannot even carry out even the connection work in a satisfactory manner. Therefore, it can be said that there are some problems in the institutional aspects of the operation and maintenance of this project.

Table 5: Number of Staff Assigned to Water Supply Service in Four Target Towns

(Unit: person)

| Position | Before Project Commencement | | | | At the Time of Ex-Post Evaluation | | | |
|---|---|---|---|---|---|---|---|---|
| | Debarwa | Dekemhare | May-Dima | Adi Keyih | Debarwa | Dekemhare | May-Dima | Adi Keyih |
| Water Supply Head | 1 | 1 | - | 1 | 1 | 1 | (1) | 1 |
| Office/ Clerk Staff | 1 | 2 | - | 6 | 13 | 3 | (10) | 15 |
| Technical Staff | 4 | 10 | 4 | 5 | 6 | 18 | (6) | 17 |
| Support Staff | 9 | 14 | 5 | 9 | 4 | 10 | - | 13 |
| Total | 15 | 27 | 9 | 21 | 24 | 32 | (17) | 46 |

Source: JICA document (before project commencement) and answers on questionnaire (at the time of the ex-post evaluation)

Note: Numbers in brackets are the numbers of staff who also have other duties.

### 3.5.2 Technical Aspects of Operation and Maintenance

[43] For example, a general administrative staff is checking the pumping facilities, while a driver is assigned to do the piping work. According to May-Dima town, they would like to establish a unit dedicated to water supply in the future, like WSS in other towns.

It has been confirmed through the interviews with WSS of three towns and municipality staff assigned to water supply in May-Dima that they have a certain level of technical standard just enough to carry out the needed operation and maintenance. This is thought to be owing to the soft-component training conducted during the implementation of the project as explained in the Output section under Efficiency. Some employees who had participated in the training were interviewed during the evaluation study; and they commented, “Although the training was short, I think it was the kind of training necessary for us. We are utilizing what we learned through the practical maintenance for our day-to-day tasks today.” Based on such a comment, it can be considered that the soft component training has produced results, fulfilling the technical standard necessary for the maintenance work.

While it has been confirmed that on-the-job training is provided for newly recruited staff in all target towns, no training (e.g., training on connecting suction pipes to distributing pipes, and leakage check and repair) has been offered to staff other than the newly recruited since the completion of this project; there is no plan or policy for such training, either. This is because each town does not have sufficient training budget. There is no budgetary support from the provincial government of Debub or WRD. The towns commented, “While we feel that there is a need for training, we do not know what to do exactly. We do have some topics that we want to learn, but we do not know what to do.” In addition, there is not enough number of staff in Dekemhare for the increasing population and demand for the connection service as described earlier. Moreover, even if staff is newly recruited, they do not have the opportunity to receive the training needed to carry out the water connection work and others. Furthermore, Adi Keyih WSS staff is pouring chlorine at a rough estimate without using the chlorine injector as described earlier. Given that full-time staff at a transmission pumping facility did not know how to use the injector and that the injector was left unattended (1 site), it can be concluded that there are some problems in the technical aspects of the operation and maintenance.

### 3.5.3 Financial Aspects of Operation and Maintenance

Table 6 shows the income and expenditure in relation to the water supply service of four towns (last 3 years). The “income” shown in the table is mostly from water sales. On the other hand, the “expenditure” refers to a cost needed for operating the water service; it is the operation and maintenance cost, such as costs of fuel and electricity necessary for operating water pumps during water intake and staff salaries.

Table 6: Income and Expenditure of Water Supply Service in Four Target Towns

(Unit: 1000 nakfa)

| 【Debarwa】 | 2010 | 2011 | 2012 |
|---|---|---|---|
| Income | 1,226 | 1,553 | 1,533 |
| Expenditure | 326 | 328 | 326 |
| (Income – Expenditure) | 900 | 1,225 | 1,207 |
| 【Dekemhare】 | 2010 | 2011 | 2012 |
| Income | 2,234 | 1,712 | 2,133 |
| Expenditure | 2,561 | 3,034 | 2,879 |
| (Income – Expenditure) | -327 | -1,322 | -746 |
| 【May-Dima】 | 2010 | 2011 | 2012 |
| Income | 129 | 452 | 449 |
| Expenditure | 113 | 493 | 562 |
| (Income – Expenditure) | 16 | -41 | -113 |
| 【Adi Keyih】 | 2010 | 2011 | 2012 |
| Income | 1,890 | 3,403 | 3,519 |
| Expenditure | 1,278 | 1,321 | 1,675 |
| (Income – Expenditure) | 612 | 2,082 | 1,844 |

Source: Answers on questionnaire

Note: The exchange rate is 6.73 yen for 1 nakfa[44] as of June 2013

In Dekemhare and May-Dima expenditure exceeds income, ending in the red. This is because WSS has not been able to increase water sales of residents as they have not been able to respond to the high water demand due to staff shortage as described earlier. In the case of May-Dima, expenditure exceeds income because the cost of fuel needed to operate pumps is substantial, while income from water sales has not increased as much due to the limited water intake volume at the well and pumping facilities as explained earlier. The deficit of WSS is covered by the respective municipality office. According to WSS of three towns and the municipality of May-Dima, a small amount of subsidy is also allocated by the provincial government of Debub to compensate for the loss[45].

In Debarwa and Adi Keyih income exceeds expenditure, generating profits. In the case of Debarwa, they have been able to secure income which is larger than expenditure because there are relatively more commercial-scale utility customers (e.g., companies and factories). In Adi Keyih, on the other hand, their water sales are increasing because in recent years the number of construction companies that are commercial-scale utility customers has increased in the town.

The main municipality office manages cash for water services in all towns; WSS of the three

[44] The official exchange rate is 15 nakfa for 1 USD as of June 2013.

[45] However, data on the exact amount of the subsidies could not be obtained.

towns do not have any authority to manage income or expenditure. In other words, even though WSS generates profits, like in the case of Debarwa and Adi Keyih, the surplus is not returned to WSS (other unit in the case of May-Dima) as WSS does not have any authority to deal with budget. The actual practice is that WSS prepares an operational plan for the following year including budget and submits it to the municipality office. However, budget is not necessarily approved as per the request. There are some cases where budget is increased based on the performance of the previous year in the case of running in the black; however, it is not to such an extent that WSS can recruit new staff or plan and organize training on its own.

The operation and maintenance cost of this project in incorporated in the expenditure shown in Table 6. According to the interviews with WSS staff of Debarwa, Dekemhare and Adi Keyih and May-Dima's staff in charge of water supply and others, they commented such as this: "Although we believe that the minimum level of budget is secured, we cannot say it is sufficient given the recent increase in the cost of fuel necessary for operating the pumping facilities. The budget is limited for purchasing parts necessary for the water connection work. There is little budget for training, either. The cost of transporting fuel and spare parts is high (although it is only in May-Dima) as the town is located in the mountainous area." Taking account of the above situation concerning the discretion of budget allocation and execution as well as the comments of staff members, it can be said that there is a problem in the financial aspects of the operation and maintenance of this project at the time of the ex-post evaluation[46]. Therefore, it is thought necessary that the municipality office should make available sufficient operation and maintenance budget for the local units, such as WSS, including the review of budget allocation system[47].

### 3.5.4 Current Status of Operation and Maintenance

While no major maintenance works are carried out for the wells constructed by this project as they are in the ground, it is suggested that the common maintenance of boreholes to be carried out periodically. The pumping facilities established near the wells are periodically checked and cleaned. In case there is a problem with pumping equipment, specialized operators based in Asmara will be asked to do the repair because the maintenance staff of each town do not have the repairing skills. As for the transmission and distribution pipes, the maintenance staff of each

[46] According to WRD, water tariff will be reviewed soon, jointly by WRD and four WSSs.

[47] According to each town, there is no problem with the payment for electricity needed to operate the pumps; and there has not been any case of late payment. Additionally, as for the purchase of liquid chlorine necessary for chlorine injection, the Debub region purchase in bulk altogether and distribute it to each town. As far as chlorine is concerned, no major problems were observed in financing its purchasing cost and its procurement system.

town patrol in the town and do the repair as they find any breakage and leakage. Additionally, they visit the site to address any breakage or leakage as soon as it is reported by residents. As for the reservoirs, no major maintenance work is required; the maintenance staff eliminate weeds and clean the premises. With regard to the public fountains, the maintenance staff of each town clean a few times a week. They replace broken faucets if needed.

On the other hand, as it was discussed in the effectiveness section, problems were observed in some of the outputs at the time of the ex-post evaluation, three years after the completion of this project. More specifically, some of the well and pumping facilities are not operational in Dekemhare (transmission line is interrupted due to land erosion, and electric system failure at pumping facilities); the reservoir in Dekemhare is facing a risk of land slide; the well and pumping facilities are not operational in May-Dima (decreasing intake water volume); and some of the well and pumping facilities had been flooded in Debarwa, Dekemhare and Adi Keyih. The WSS of each town is not well-positioned to address these problems.

In addition, there is a serious concern about the procurement and securing of parts. According to Debarwa WSS, Dekemhare WSS and Adi Keyih WSS that are in need of the distribution pipe connection parts (e.g., snap taps with saddles), it is difficult for WSS to purchase from domestic suppliers. This is because suppliers are not willing to sell products to small organizations with little financial capacity and credit, such as WSS. In addition, although three towns are requesting support from the provincial government of Debub in this regard, the provincial government is also in such a financial difficulty chronically that they cannot respond to the matter sufficiently. Additionally, although the provincial government of Debub is requesting the central government (WRD) to smoothen the handling of the procurement of parts at the national level so that parts are distributed to each town, WRD does not have the authority or authorization right over internationally procured goods; thus WRD is not well-placed to resolve the issue. While WRD has consulted the Ministry of the National Development and the Ministry of Finance with the said authority about the matter a few times, it has not been solved up until the time of the ex-post evaluation. Therefore, it is deemed necessary that this matter should be addressed through dialogues among concerned parties in a prompt manner. As a side note, Eritrea has been imposed sanctions by the United Nations since December 2009. As a result, the national finances worsened and it has become difficult to obtain some industrial parts, which is thought to be related to this issue in no small part.

【Conclusion on Sustainability】

In view of the above, there are problems in the institutional, technical and financial aspects of the operation and maintenance of this project. Additionally, there is a serious problem in the current status of the operation and maintenance[48]. Therefore, sustainability of the project effect is low.

Figure 13: Downtown of Dekemhare

Figure 14: May-Dima Town

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

The objective of this project was to increase water supply volume and to provide safe drinking water, by constructing water supply facilities (deep wells, pumping facilities, transmission pipes, reservoirs, distribution pipes and public fountains, etc.) in four towns of Debub Region (Debarwa, Dekemhare, May-Dima and Adi Keyih). At the time of the ex-post evaluation, this project is consistent with the policy of Eritrea, such as the "National Water Supply Action Plan," with the development needs for improving water supply facilities in rural towns, and with Japan's ODA policy; thus relevance of the project is high. Due to problems, such as difficulty in procuring parts necessary for house connection work, staff shortage at the water supply service unit of each town and underutilization of well and pumping facilities, the actual average water supply volume per day, which indicates the quantitative effects, has shown limited achievement in some towns. However, the number of people served with safe water and the percent of population with access to safe water have reached certain levels. Hence, the effectiveness and impact of the project is fair. On the other hand, major problems have been observed in that the target towns cannot assign sufficient number of staff and conduct training

[48] However, it is not likely that any concrete measures can be taken at present.

programs due to budget shortage. In addition, the target towns are not well-positioned to address these problems; therefore, sustainability of the project effects is low.

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

### 4.2 Recommendations

#### 4.2.1 Recommendations to the Implementing Agency

・No training has been offered to the staff members engaged in the water supply service in each town since the completion of the project. Especially in Dekemhare, a shortage of WSS staff is prominent, and the town is confronted with the challenge of not being able to carry out the water connection work in a satisfactory manner. As a result, the town is not sufficiently meeting the demand of residents for water supply service. Therefore, the municipality office of each town is recommended to secure budget necessary for the allocation and training of personnel and also for the operation and maintenance work by requesting support from the provincial government of Debub to the extent possible.

・There is a difficulty in obtaining and procuring connection parts (e.g., snap taps with saddles, etc.) that are necessary for supplying water. It is recommended that the central government, WRD, the provincial government of Debub and each municipality office should thoroughly discuss the procurement arrangement and establish a system whereby parts can be procured smoothly.

・In Dekemhare, a terrace on which a reservoir has been constructed has a risk of collapsing due to soil erosion. The municipality office is recommended to allocate budgets necessary for the slope repair work as quickly as possible and to proceed with the work, thereby making efforts toward eliminating the risk.

・In Adi Keyih, a chlorine injector installed at a transmission pumping station (1 site) is not in use. Adi Keyih WSS is advised to assign staff who can properly handle chlorine injector and chlorination, thereby making efforts for safe water supply.

#### 4.2.2 Recommendations to JICA

・It is recommended that JICA should request and advise the government of Eritrea as needed to facilitate the smooth procurement of parts needed for the water supply service in each town.

### 4.3 Lessons Learned

・Verification of Expected Number of Water Connections at the Time of Planning and Effective

Utilization of Monitoring for Achieving Objectives

The direction or the plan for the house/yard connection, which was to be borne by the Eritrean side, was not necessarily clear at the design stage. It would have been necessary to verify the number of future connections expected after the completion of the project and monitor the progress with a view to achieving project objectives. In particular, while the average daily water supply volume expected to be achieved by 2015 was indicated, it would have been meaningful to monitor the progress of this project while tracking the actual average daily water supply volume, considering it as a water supply project up to the current year. Therefore, it is thought that future similar projects (groundwater/well construction projects) need to carry out surveys, and design works and monitoring by considering such aspect.

The Hashemite Kingdom of Jordan

**Ex-Post Evaluation of Japanese Grant Aid Project**
**The Project for Improvement of the Water Supply for the Zarqa District (Phase II)**

External Evaluator: Kenichi Inazawa, Miyuki Koga, Octavia Japan Co., Ltd.

## 0. Summary

This project constructed water supply facilities and provided technical assistance for strengthening water distribution management technologies with an aim to reduce the leakage ratio and to increase the number of water supply hours per week and water consumption per head per day in the northern part of Zarqa Municipality, Hashemeyeh Municipality, and Sukhna Municipality, located northeast of the capital city, Amman. At the time of the ex-post evaluation, this project is consistent with the policy, such as the 'Jordan Water Strategy,' and with the development needs for improving water supply facilities; thus the relevance is rated high. Through this project, the water supply rate has improved, the number of water supply hours has increased, the water pressure has improved, the water consumption per head per day has increased, and the leakage ratio has reduced mostly as planned. Additionally, the results of the beneficiary survey show positive responses about water pressure and water supply volume, as well as positive impacts of the project, such as reduced time and labor burden in accessing water. Thus, effectiveness and impacts are rated high. The project period and project cost were mostly as planned, therefore the effectiveness is rated high. On the other hand, sustainability is rated fair because financially the Implementing Agency has recorded deficits for many years, although no major problems are observed in the institutional and technical aspects of the operation and maintenance carried out by the Implementing Agency.

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

## 1. Project Description


Project Location


Batrawi Reservoir

### 1.1 Background

In the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") deserts and waste land comprise 80% of the national land, and the rainfall is also low. The per capita water resource potential[1] is extremely low at 160m$^3$ as compared to the world average of 7,700m$^3$ [2]. In addition, because the country accepted refugees from neighboring countries as a result of the Gulf War and other regional conflicts, water demands rapidly increased before the commencement of this project, adding stress on the water resources. Both in the urban and rural areas people relied on public water supply with the national service ratio exceeding 95% on average. However, water supply could not keep up with the demand, as a result of which planned water restrictions were implemented a few days a week. Water shortage was particularly serious in Zarqa Governance located northeast of the capital, Amman. Per capita water consumption in the project target area (northern part of Zarqa Municipality, Hashemeyeh Municipality and Sukhna Municipality) was particularly low at 84 L per day, which was far short of the national goal at that time, 150 L per day. In some areas residents only had water supply 12-72 hours per week. Therefore, it was essential to increase the amount of supplied water in the project area, thereby supplying water in a stable manner.

### 1.2 Project Outline

This project aims to reduce the leakage ratio, to increase the number of water supply hours per week, and to increase water consumption per head per day by improving water supply facilities (i.e., construction of service reservoir, laying of transmission mains, and renewing pumping facilities, etc) and providing technical assistance for the enhancement of water distribution management technology, thereby contributing to the improvement in the living environment for the residents in the northern part of Zarqa Municipality, Hashemeyeh Municipality and Sukhna Municipality located northeast of the capital, Amman.

| | |
|---|---|
| Grant Limit / Actual Grant Amount | 【Grant Limit】2,371 million yen in total (the first term: 511 million yen, the second term: 668 million yen, the third term: 1,192 million yen)<br>【Actual Grant Amount】2,261 million yen in total (the first |

[1] In general, the term, resource potential, refers to a total amount of some resource based on theoretical calculation.
[2] 2002 data

| | |
|---|---|
| | term: 489 million yen, the second term: 666 million yen, the third term: 1,105 million yen) |
| Exchange of Notes Date (/Grant Agreement Date) | The first term: July 2006<br>The second term: July 2007<br>The third term: August 2008 |
| Implementing Agency | Water Authority of Jordan (WAJ) |
| Project Completion Date | March 2010<br>(the first term: February 2008, the second term: February 2009, the third term: March 2010) |
| Main Contractor(s) | Dai Nippon Construction |
| Main Consultant(s) | Tokyo Engineering Consultants Co., Ltd. |
| Basic Design | October 2005 – May 2006 |
| Detailed Design | (The first term) July 2006 – March 2008<br>(The second term) August 2007 – March 2009<br>(The third term) November 2008 – March 2010 |
| Related Projects (if any) | [Technical Cooperation ]<br>■ "The Study on the Improvement of the Water Supply System for the Zarqa District in the Hashemite Kingdom of Jordan" (1994-1996), JICA<br>■ "Capacity Development Project for Non-Revenue Water Reduction in Jordan (Phase 1)" (2005-2008)<br>■ "Capacity Development Project for Non-Revenue Water Reduction in Jordan (Phase 2)" (2009-2011)<br>■ Dispatching of Experts (Non-Revenue Water Reduction Experts and Water Supply Improvement Experts, 4 persons, 1999-2006)<br>■ Training of counterparts in Japan (Water supply and non-revenue water management, 1 person, 2001)<br>[Grant Aid]<br>■ "The Project for Improvement of the Water Supply for the Zarqa District[3]" (2002-2005, 1,721 million yen) |

[3] It improved the water conveyance and distribution facilities in Ruseifa Municipality and Awajan area in Zarqa Municipality.

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenichi Inazawa & Miyuki Koga, Octavia Japan Co., Ltd.

### 2.2 Duration of Evaluation Study

Evaluation Study: January 2013 – December 2013

Field Study: 24 May – 6 June 2013 & 2 – 8 September, 2013

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

### 3.1 Relevance (Rating: ③[5])

3.1.1 Relevance to the Development Plan of Jordan

Before the commencement of this project, the government of Jordan showed its direction toward pursuing optimum utilization of limited water resources by managing and conserving water resources and improving institutional systems concerning water supply operations, based on the National Water Strategy, which had been in effect since 1977. In addition, the government was developing the National Three-Year Socioeconomic Plan (2004-2006) at that time, in which water-sector objectives were laid out, including the development of new water sources, reduction in non-revenue water tariff rates, and financial improvement concerning water and sewerage facilities.

At the time of the ex-post evaluation, the government has developed a new national development plan, the "National Agenda (2006-2015)." Among the water-sector issues stipulated in this national plan are shortage of renewable water resources, depletion of underground water, inefficient water tariff rate structure, and limited market opportunities for the private sector. In addition, the government has developed the "Jordan's Water Strategy" (2008-2022), which lists objectives for the time being, such as supply of safe drinking water, promotion of non-revenue water reduction, effective utilization of the existing water resources, and increasing water supply capacity with the introduction of new technologies.

In view of the above, this project is consistent with the policy concerning the water sector in Jordan, such as the national and sectoral plans, both at the times of before project commencement and the ex-post evaluation.

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

[5] ③: High, ② Fair, ① Low

3.1.2 Relevance to the Development Needs of Jordan

The Zarqa Governorate, located northeast of the capital, Amman, was one of the regions in Jordan that faced serious water shortage before the commencement of this project. The volume of supplied water was insufficient, and the leakage ratio in the distribution network was high. In the project area (northern part of Zarqa Municipality, Hashemeyeh Municipality and Sukhna Municipality) water consumption per head was 84 L per day, which was far below the national goal of 150 L per day. Additionally, as the project area has hilly topography, water was mainly conveyed using pump pressure. No planned measures were in place to control the water leakage. It was difficult to say that supplied water was safe because water pressure in the pipes could drop to zero or negative due to intermittent water supply with chlorination being insufficient. Although water service ratio was as high as 98% in the target area at that time, water supply hours were restricted. Some areas only received 12-72 hours of water supply weekly, which had major impacts on daily lives of the residents. Considering these circumstances, there was a great demand to improve water supply facilities, which would enable stable and safe water supply in the project area.

At the time of the ex-post evaluation, per capita water consumption has reached 116 L per day[6] in the target area through the implementation of this project. However, it still falls short of 150 L per day, the national goal before the commencement of this project. Also, there still remain old water distribution pipes in the downtown area of Zarqa Municipality, and the Implementing Agency of this project (hereinafter referred to as "WAJ") is planning to stabilize water supply by replacing the existing distribution pipes, by improving water distribution network systems, and by reducing non-revenue water tariff rate[7].

In view of the above, there continues to be a plan and needs to improve water distribution network systems in the project area at the time of the ex-post evaluation. Therefore, it can be judged that this project is consistent with the development needs both at the times of the ex-ante and ex-post evaluations.

3.1.3 Relevance to Japan's ODA Policy

In Japan's Country Assistance Policy for Jordan (formulated in 1996), water supply was

[6] It will be explained in the Quantitative Effects section under Effectiveness.

[7] New projects planned for the next few years include the Millennium Challenge Water Supply Project supported by the government of the United States, which will begin in October 2013. It will renew the existing water distribution networks mainly in downtown Zarqa Municipality with the project budget of 275 million USD according to WAJ. In addition, there is a plan to improve and renew the pumping facilities and equipment in Awajan, Abu Al Zaigan and Sarrout areas.

identified as one of the priority issues concerning the improvement of basic living conditions. In particular, it highlighted the securing of water for domestic use and irrigation. In addition, the Jordan Country Assistance Plan (FY2005) developed by JICA aims to improve water supply capacity while paying attention to effective and efficient water utilization under a priority sector: "improvement in basic living conditions." Specifically, the plan lays out JICA's direction to assist the improvement of water supply facilities and measures to reduce non-revenue water. This project supports Jordan's water sector with a view to supplying safe water to the people; therefore, it can be said that the project is consistent with the development assistance policy of Japan.

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

### 3.2 Effectiveness[8] (Rating: ③)

3.2.1 Quantitative Effects

Before the commencement of this project, population growth was prominent in the project areas[9], causing serious water shortage. In addition to the shortage of water supply volume, leakage ratio was also high. As a result, water consumption per head was as little as 84 L, which could not reach the national goal of 150 L per day. In addition, not enough measures were in place to address the leakage problem. Table 1 shows data on various indicators (actual before commencement and target after completion) of the project area (northern part of Zarqa Municipality, Hashemeyeh Municipality and Sukhna Municipality) before project commencement as well as actuals for the three years after the completion of the project.

Table 1: Effectiveness and Quantitative Data of This Project

(Actual Before Project Commencement and Target After Project Completion)

| Indicator | Actual Before Commencement (2005) | Target Before Commencement (2010) | Actual After Completion | | |
|---|---|---|---|---|---|
| | | | 2010 | 2011 | 2012 |
| (1) Water service ratio | 98% | 100% | 100% | 100% | 100% |
| (2) Estimated | 329,540 | 373,711 | 382,000 | 390,000 | 400,000 |

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

[9] The population growth rate is 2.2% per annum (source: World Bank's 2011 data). Particularly, many people, such as workers, are migrating from rural areas to downtown Zarqa these days.

| | | | | | |
|---|---|---|---|---|---|
| population served with clean water | people | people | people | people | people |
| (3) Estimated population un-served with clean water | 6,725 people | 0 | 0 | 0 | 0 |
| (4) Weekly water supply hours | 12-72 hours/week | 72 or more hours/week | 72 hours/week | 72 hours/week | 72 hours/week |
| (5) Leakage ratio | 31% | 25% | 23.5% | 25.0% | 24.5% |
| (6) Water consumption per head per day (daily average) | 84 L /head/day | 113[10] L /head/day | 126 L /head /day | 128 L /head/day | 116 L /head/day[11] |
| (7) Water pressure | 0-10 bar | 1-7 bar | 1.5-5.5 bar | 1.5-5.5 bar | 1.5-5.5 bar |

Source: JICA document (actual and target before project commencement), answers on questionnaire (actual after project completion)

With regard to (1) water service ratio, it has reached 100% in the project area as the water supply rate improved through mainly the implementation of this project. This means that all residents in the project area have become able to receive WAJ's water supply service. The (2) estimated population served with clean water has increased as compared to 2005, which is attributed to the high population growth rate mentioned earlier. Regarding (3) estimated population un-served with clean water, while there were a few areas in which residents did not have access to water supply service and had to purchase domestic water from private sellers, the number of such residents became zero after the completion of this project[12]. Concerning (4) weekly water supply hours, while WAJ Zarqa targeted to supply water 72 or more hours per week after the completion of this project, they have achieved 72 hours since 2010. It is mainly because the reservoirs and water distribution network systems developed by this project enabled the water distribution to switch from the pumping system to a gravity system (which will be elaborated in the "Qualitative Effects" section), realizing efficient water distribution[13]. With respect to 5) leakage ratio, it has become 25% or less after the completion of the project as certain improvement was made to the distribution networks through this project. However, there still remain old distribution pipes particularly in the northern part of Zarqa Municipality at the time of the ex-post evaluation, and leakage continues to be a problem in some areas. Therefore,

[10] On the other hand, it was projected to be 104 L/head/day if the project was not to be implemented.
[11] It decreased from 2011. According to WAJ Zarqa, water supply situation temporarily worsened in Ruseifa area next to Zarqa Municipality (outside the project area), which forced them to temporarily allocate some of the water meant for the project areas to Ruseifa. Besides, because WAJ Zarqa does not keep track of daily water consumption, daily consumption was calculated by dividing the weekly consumption by seven days.
[12] As a result, service ratio has reached 100% as seen in (1).
[13] WAJ Zarqa divides the project area into three groups and assign scheduled water supply hours to each group. On the other hand, residents who receive water supply service have water tanks at home to store water.

WAJ Zarqa is continuing its effort to reduce leakage ratio through new projects, including the new project such as "Millennium Challenge Water Supply Project" mentioned earlier. Regarding 6) water consumption per head per day (daily average), owing to the development of water distribution networks and the improvement in leakage ratio, it has exceeded the initial target (113 L/head/day). As for 7) water pressure[14], it was unstable (0-10bar) before the commencement of this project. In some areas residents complained about low water pressure (e.g., 1 bar or less) whereas in others water was distributed at pressures as high as 10 bar. In some cases distribution pipes were seriously damaged. At the time of the ex-post evaluation, WAJ Zarqa is keeping the water pressures within the range of 1.5-5.5 bar, realizing more stable water distribution as compared to before the commencement of the project. According to WAJ Zarqa, the main reason is that the reservoirs and distribution network systems developed by this project have made the management of water distribution more efficient. It has also suggested that stable water pressures indirectly contribute to increasing water supply hours and reducing water leakage.

In view of the above, it can be judged that this project has improved water pressure, reduced leakage ratio, increased weekly water supply hours and water consumption per head per day, and thus mostly achieved the initial targets.

Photo 1: Sukhna Reservoir

Photo 2: Northern Zarqa Reservoir

[14] The unit used to measure water pressure, 1 bar, represents a water pressure level which can directly supply water to a place 10 meter upward from the ground.

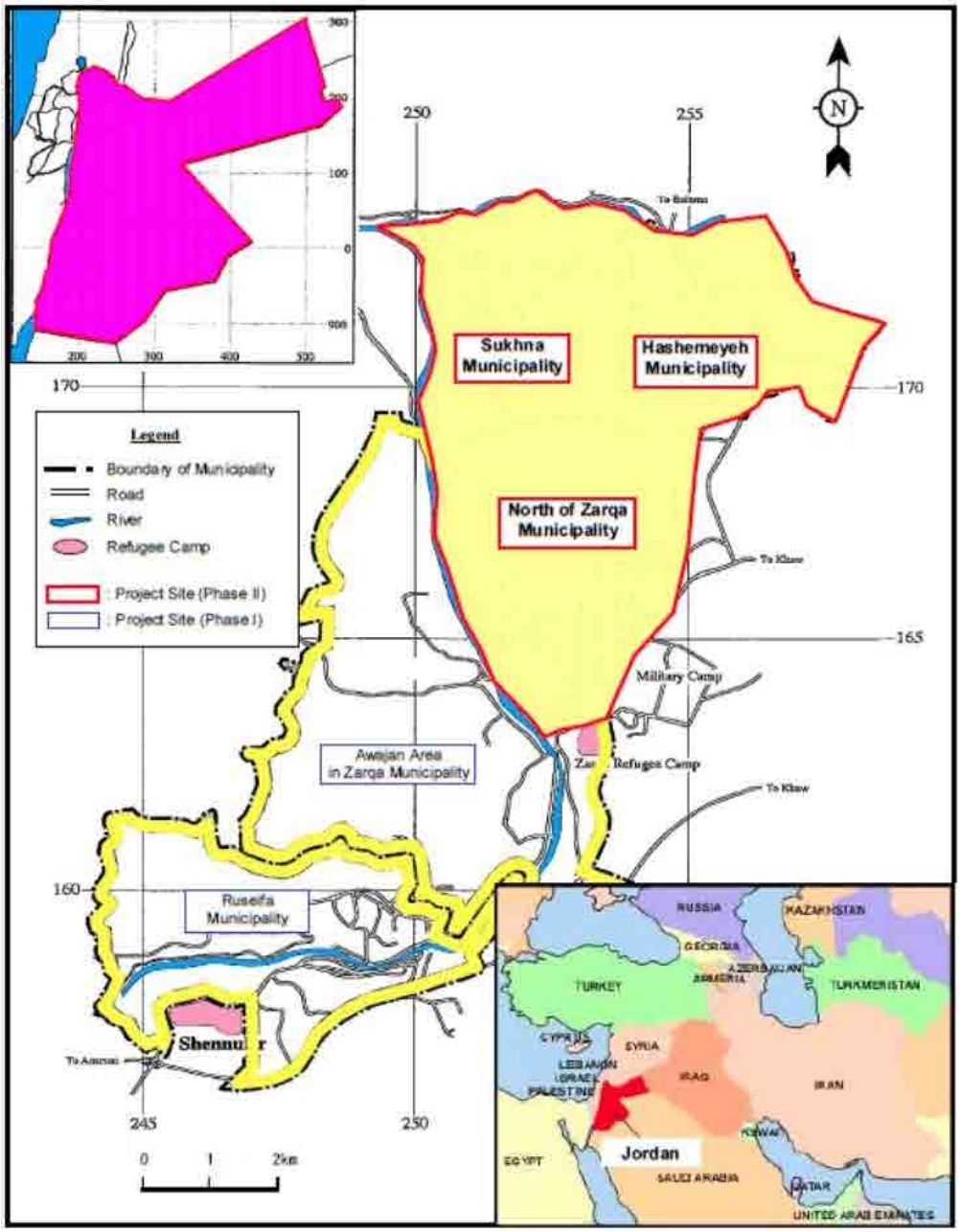
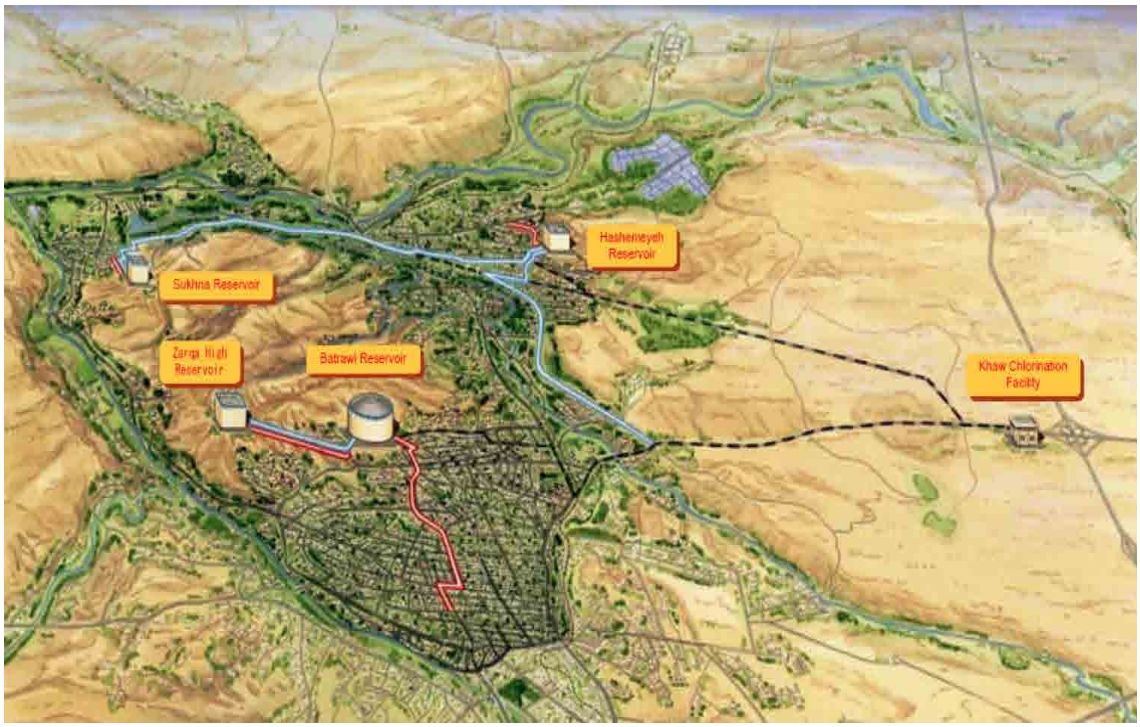



Figure 1: Locations of the Project Sites




Source: JICA document

Figure 2: Locations of the Project Sites

3.2.2 Qualitative Effects (Realizing Efficient Water Distribution with Gravity System and Strengthening Chlorination System)

With the construction of water reservoirs and distribution networks by this project, the pumping water system which was used before the commencement of this project switched to a gravity system in the project area. This shift to the gravity-based water distribution has equalized water pressure, making water distribution efficient. In addition, it has become possible to distribute sufficient volume of water to farther places inside the project area as compared to before the commencement of the project.

With the aim of strengthening the chlorination system, chlorination equipment was procured and installed inside the Khaw Pumping Station located in the eastern part of Zarqa Municipality (see Photo 6). Combined with the chlorination equipment installed at the Azraq wells and pumping station[15], which is the intake source of the project area, it has reinforced the chlorination systems for the water conveyance to the area. More specifically, through this project, a system has been established whereby the chlorination equipment of the Khaw Pumping Station is operative even when the chlorination equipment of the Azraq well and

[15] It is located in the desert area about 100km east of the capital city, Amman.

pumping station stops operating due to power outages and accidents; thus there is no problem with the chlorination system in the project area.

## 3.3 Impact

### 3.3.1 Intended Impacts

#### 3.3.1.1 Contribution to Improvement in Living Conditions of Residents

Targeting residents of the project areas (the northern part of Zarqa Municipality, Hashemeyeh Municipality, and Sukhna Municipality), a beneficiary survey was conducted concerning the level of satisfaction with this project and improvement of the living conditions. A random sampling method[16] was used, and it was carried out in the form of a questionnaire. Below are the review and analysis of the survey results.

With regard to Figure 3, which is the level of satisfaction with this project, approximately 50% of the respondents answered they were either “very satisfied” or “satisfied.” On the other hand, “normal” and “dissatisfied” also account for approximately 50% of the responses. The main reason for this seems to be that residents are discontent with the water supply situations, such as leakage and water pressure, as there still remain many old existing water pipes in the northern part of Zarqa Municipality where residential houses are concentrated compared to Hashemeyeh and Sukhna Municipalities[17]. This also explains why the same percentages of the respondents answered “good” and “deteriorated” to a question about water pressures in Figure 4. On the other hand, regarding a question about supplied water volume in Figure 5, more than 75% of the respondents answered “yes" (increased).” This is presumably because the water distribution switched from the pumping system to the gravity system. In addition, as shown in Figure 6, 70% of the respondents said that water had no odor. This could be owing to the reinforcement of the chlorination system through the procurement and installation of chlorination equipment by this project as explained above. Figure 7 is a question about physical and time burden involved in drawing and transporting water; a high percentage of the respondents answered “yes (reduced)”. Many of those who answered “yes” are residents of Hashemeyeh and Sukhna Municipalities where water supply service was worse relative to the northern part of Zarqa Municipality. Figure 8 is a question about the level of confidence in water; more than 70% of the residents answered “yes (water has become safe and secure),”

[16] The total sample size for all three areas was 102. (35 samples from the northern part of Zarqa Municipality, 34 samples from Hashemeyeh Municipality, and 33 samples from Sukhna Municipality.)
[17] It was confirmed during the resident interviews conducted in the beneficiary survey.

indicating that the level of confidence is generally high. Additionally, Figure 9 and 10 are questions about illness, such as diarrhea, and improvement in sanitary conditions. Although it is difficult to prove that these results have direct linkages to this project, it seems that the project is making a certain contribution to the improvement in health and sanitation of the residents in the target area as the responses were generally positive.

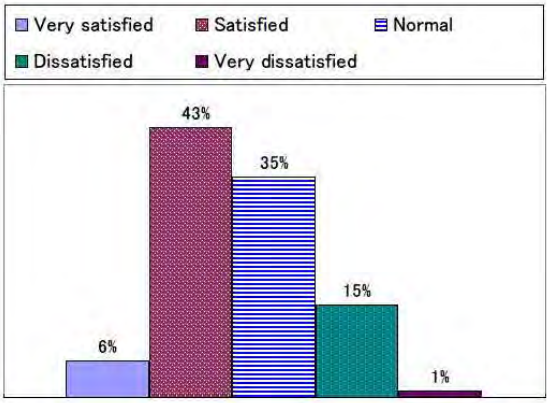



Figure 3: Are you satisfied with this project?

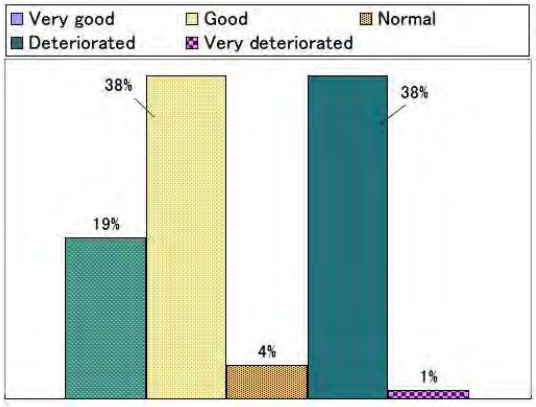



Figure 4: What do you think of the current water pressure?

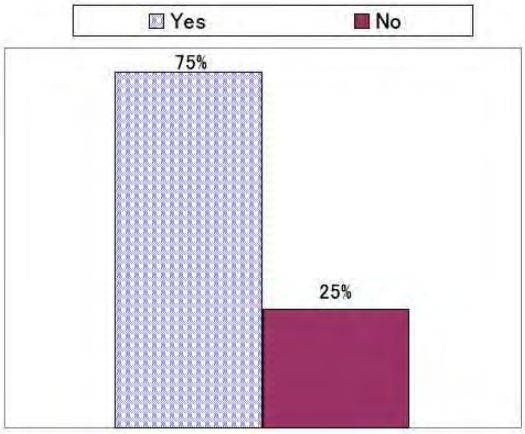



Figure 5: Do you think the volume of supplied water has increased?

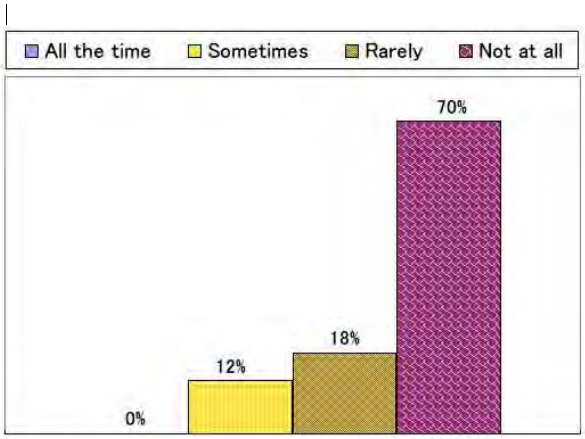



Figure 6: Do you feel that the supplied water has any unpleasant odor?

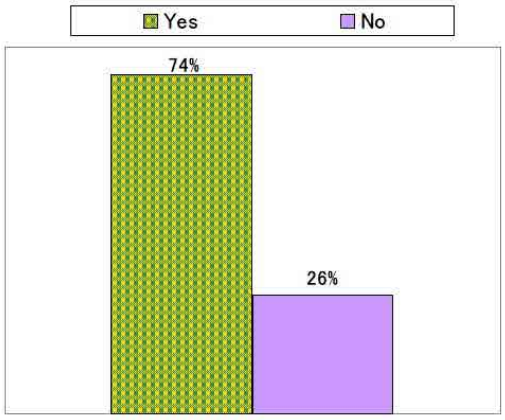



Figure 7: Do you think the physical and time burden involved in drawing and carrying water reduced after the completion of this project as compared to before the project?

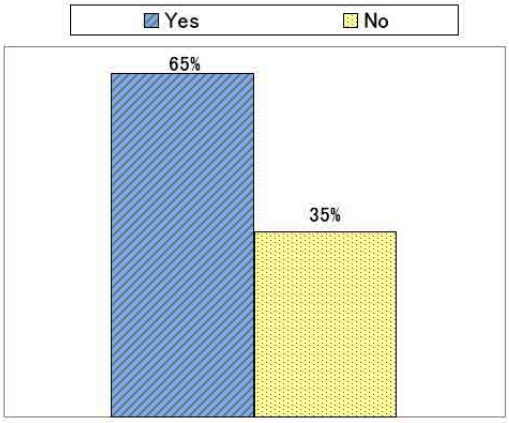



Figure 8: Do you think the supplied water has become safe and secure after the completion of this project? (a question related to levels of confidence in water)

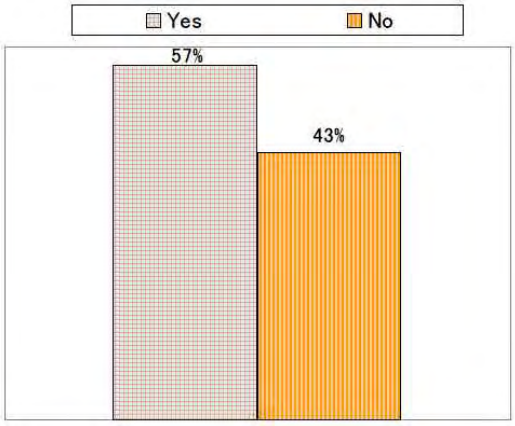



Figure 9: Do you think diarrhea and typhoid cases reduced around you after the completion of this project?

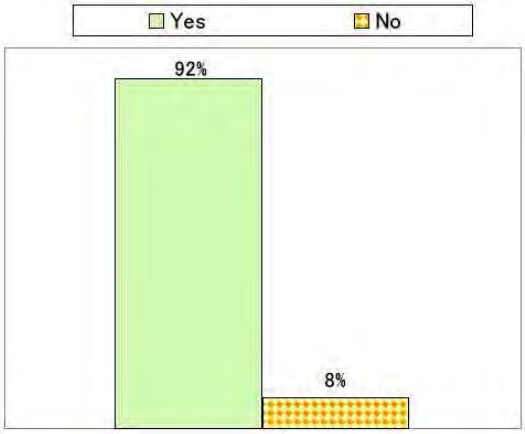



Figure 10: Do you think sanitary conditions improved around you after the completion of this project?

### 3.3.2 Other Impacts

#### 3.3.2.1 Impacts on the Natural Environment

Initially, the Ministry of Environment of Jordan deemed that an Environmental Impact Assessment (EIA) was necessary for this project because it was an infrastructure development project. Before the commencement of this project (February 2006), however, the Ministry decided that the EIA was not necessary because the main focus of this project was to rehabilitate and improve the existing facilities and also because the impacts of this project on natural environment were expected to be minimum.

With regard to the environmental issues (air pollution, noise, odor, and so on) inside the

project sites at the time of the ex-post evaluation, it was confirmed through the interviews with WAJ Zarqa staff and others that there were no major problems in this regard[18]. Additionally, during the site inspections, no major problems were observed in and around each project site in terms of the impacts on natural environment.

3.3.2.2 Land Acquisition and Resettlement

This project did not require any resettlement. On the other hand, land was acquired for the construction of the reservoirs: 7,638m$^2$ for Sukhna Reservoir; 11,661m$^2$ for Hashemeyeh Reservoir; 13,600m$^2$ for Batrawi Reservoir; and 4,273 m$^2$ for Zarqa North Reservoir. There was no monetary compensation involved because all the acquired lands were owned by the government of Jordan (national land) before the commencement of the project. In addition, WAJ already completed all the necessary procedures before the commencement of the project.

Photo 3: Northern Part of Zarqa Municipality (photo was taken from the developed reservoir)

Photo 4: Sukhna Municipality

Conclusion on Effectiveness and Impacts

Through this project, the water supply rate has improved, the number of water supply hours has increased, the water pressure has improved, the water consumption per head per day has increased, and the leakage ratio has reduced mostly as planned. Additionally, the results of the beneficiary survey show positive responses about water pressure and water supply volume, as well as positive impacts of the project, such as reduced time and labor burden in accessing water.

This project has largely achieved its objectives, therefore its effectiveness is high.

[18] It is the "Environment and Reuse Department" that is responsible for environmental monitoring of WAJ. The main tasks of this department are to conduct environmental studies concerning water supply projects and to carry out periodical environmental monitoring. The department is mandated to address any issue concerning negative impacts on natural environment as soon as it arises.

### 3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Table 2 shows the planned and actual outputs of this project.

Table 2: Planned and Actual Outputs of the Project

| Plan (Before Project Commencement) | Actual (At the Time of Ex-Post Evaluation) |
|---|---|
| 【Planned Inputs from Japanese Side】<br>■Construction of Service Reservoirs:<br>・Zarqa North Reservoir (2,500$m^3$)<br>・Hashemeyeh Reservoir (1,500$m^3$)<br>・Sukhna Reservoir (1,000 $m^3$)<br>・Batrawi Reservoir (Expansion (14,000$m^3$) of the existing part, which is 4,000 $m^3$)<br>■Laying of Transmission Mains:<br>・Batrawi Pumping Station – Zarqa North Reservoir (300mm x 2,072m)<br>・Khaw Junction – Hashemeyeh Reservoir (300mm x 6,141m)<br>・ Hashemeyeh Reservoir – Sukhna Reservoir (300mm x 7,798m)<br>■Laying of Distribution Connection Mains:<br>・Zarqa North Reservoir to the existing distribution mains (300mm x 1,572m)<br>・Hashemeyeh Reservoir to the existing distribution mains (300mm x 1,338m)<br>・Sukhna Reservoir to existing distribution mains (200mm x 722m)<br>・ Batrawi Reservoir to the existing distribution mains (600mm x 3,080m、400 mm x 480m)<br>■ Renewing Pumping Facilities (Batrawi Pumping Station)<br>・Pump capacity: 5$m^3$/min x 90m head x 132 kW x 2 units (1 unit as a spare)<br>・Electricity equipment and metering units<br>■Chlorination Facility:<br>・Dosing equipment (16kg/h x 2 units)<br>・Concrete building (L 12m x W 10m x H 6.3m)<br>■Separating Distribution Zones and Changing the Existing Distribution Pipes to Transmission Pipes:<br>・Sluice valves: 6 places (materials to be | 【Actual Inputs from Japanese Side】<br>The outputs shown in the left column were implemented mostly as planned. |

| | |
|---|---|
| procured by the Jordanian side)<br><br>■ Transfer of Water Distribution Management Technologies to Enable Smooth Operation And Maintenance of the Above (soft component) (*For more details, refer to "Technical Aspects of Operation and Maintenance" under the Sustainability section.)<br><br>【Planned Inputs from Jordanian side】<br>① Allocation of required water resources amount for the project area<br>② Procurement of sluice valves and other required materials for installing sluice valves<br>③ Provision of the construction sites for water distribution reservoir<br>④ Development of the reservoir site by construction of access road, fence, green area, light and overflow pipe<br>⑤ Appropriate operation and maintenance of the constructed water supply system and provision of equipment and facility to implement the soft component | 【Actual Inputs from Jordanian side】<br>The outputs shown in the left column were implemented mostly as planned. |

Source: JICA document (before project commencement), Answers on questionnaire (at time of ex-post evaluation)

As shown in Table 2, the outputs, which were planned before the project implementation to be contributed by the Japanese and the Jordanian sides, were implemented mostly as planned. It has also been confirmed through the questionnaire and interviews that the project did not have any additional output.

Photo 5: Renewed Pumping Facility (Batrawi Pumping Station)

Photo 6: Procured and Installed Chlorination Equipment (Khaw Pumping Station)

3.4.2 Project Inputs

3.4.2.1 Project Cost

The total project cost was planned to be 2,485 million yen (grant limit of 2,371 million yen,

roughly 114 million yen to be borne by the Jordanian side). The actual total cost was around 2,416 million yen (2,261 million yen was contributed by the Japanese side, and roughly 155 million yen was contributed by the Jordanian side), which was mostly as planned (97% of the plan).

3.4.2.2 Project Period

The planned project period was 3 years and 9 months (45 months) from July 2006 to March 2010. While the procurement and installation work by the Japanese side was implemented as planned from July 2006 to March 2010, the construction work by the Jordanian side was executed from March 2007 to May 2010, which was a delay of about two months. More specifically, out of the outputs to be contributed by the Jordanian side, the construction of fences and gates and the site paving were delayed (by about two months) because the Cabinet was reshuffled in October 2009, which caused a delay in the approval of the FY2010 budget, affecting the budget allocation for this project as well as for others. However, considering that the fence construction by the Jordanian side is not something that severely affects the attainment of the project effects, it is appropriate to consider that the project outputs were achieved when the procurement and installation work by the Japanese side was completed. (Therefore, the project period is considered 100% of the plan.)

In view of the above, both project cost and project period were mostly as planned; therefore, efficiency of the project is high.

**3.5 Sustainability (Rating:②)**

3.5.1 Institutional Aspects of Operation and Maintenance

The Implementing Agency of this project is Water Authority of Jordan (WAJ). WAJ is mandated to operate water supply and sewerage services in Jordan under the supervision of the Ministry of Water and Irrigation (MWI). Regarding the organizational structure of WAJ, it has 8 divisions (Water Supply Division, Sewerage Division, Laboratory and Water Quality Division, Northern Region Division, Central Region Division, Southern Region Division, Finance Division, and Administration Division). There were totally about 7,000 employees working for WAJ before the commencement of the project, which is down to around 4,000 employees at the time of the ex-post evaluation. The reasons, as explained by WAJ, are: (1) WAJ reduced the

number of staff with the aim of improving its finance; and (2) With the introduction of IT and other new technologies, some positions became unnecessary and were cut[19].

It is WAJ Zarqa that is responsible for the operation and maintenance of this project. It consists of Administration Department, Technical Department, Water Supply Department, Sewer Department, Client Relation Department, Non-Revenue Water Department and Russeifa Water Department. There are totally 649 employees: 18 engineers; 347 technically skilled workers; and 284 other staff. Before the commencement of the project, on the other hand, the total number of employees was 615. According to WAJ Zarqa, as the number of staff slightly increased because with the expansion of the area covered by water distribution networks, there was a need to increase the number of staff engaged in water supply and guards who would be stationed at the reservoirs. The Water Department (273 employees), which is the largest in WAJ Zarqa, manages pumping stations and wells inside Zarqa Municipality. For the operation and maintenance of the facilities developed by this project (e.g., opening and shutting of water distribution valves, patrol and inspection of the water distribution networks, responding to the breakage and fixing/repairing, opening and shutting of reservoir valves, and cleaning of the facilities), 21 staff members are assigned to Zarqa area and 5 staff members each to Hashemeyeh and Sukhna areas. When interviewed about the number of operation and maintenance staff, WAJ Zarqa commented, “We consider that each department is fully staffed, handling just the right amount of work.” As stated above, it can be judged that the staffing level is sufficient at WAJ Zarqa. Taking account also of the comment of the staff member, it can be considered that there are no major problems in the institutional aspects of the operation and maintenance of this project.

### 3.5.2 Technical Aspects of Operation and Maintenance

As a soft component training, training covering water distribution network mapping program and water distribution data management program was given to WAJ Zarqa staff (totally 11 participants); GIS training was given to WAJ Headquarters staff (totally 6 participants); training on water distribution network analysis program was given to WAJ Zarqa staff (totally 13 participants); and training on EPANET (network analysis software) was given to WAJ Headquarters staff (totally 7 participants) during the implementation of this project. In addition, a seminar was held on a water distribution network analysis model for many of the WAJ Zarqa

[19] The introduction of PCs and other terminals enabled WAJ to work more efficiently while improving the performance of maintenance equipment, such as leakage detectors. Therefore, WAJ was able to reduce the number of staff from what was previously required in some parts.

staff (totally 50 participants). Through such soft-component training, staff members have become able to capture a status of a water distribution network more easily and utilize water distribution data properly. Furthermore, a water distribution network analysis model has been established, enabling staff members to run water distribution network simulations and also to understand hydraulic situations of the network. Staff members who took part in the above mentioned training commented when being interviewed, "We are utilizing what we learned in the training for our day-to-day tasks as needed."

The examples of training held after the completion of this project include technical training for staff (e.g., practical training on service pipe connection for household connections), which is organized regularly at a training facility owned by WAJ[20]. In addition, WAJ Zarqa holds its own training for staff members. The examples include technical and practical training on how to use equipment to detect leakage in distribution pipes. Additionally, On-the-Job Training (OJT) is provided to newly recruited staff as needed.

The operation and maintenance staff assigned to Zarqa North, Hashemeyeh and Sukhna areas are generally well-experienced. (On average they have more than 8 years of experience. The oldest person has 20 years of experience.) According to the interviews with the management of WAJ Headquarters and WAJ Zarqa, they commented, "The levels of staff's experience are sufficient to carry out the day-to-day operation and maintenance work."

Based on the above, WAJ Zarqa staff members not only have sufficient training experiences but also have rich working experience, demonstrating sufficient technical capacities to carry out the periodic and day-to-day operation and maintenance. Therefore, it can be said that no major problems are found in the technical aspects of the operation and maintenance.

### 3.5.3 Financial Aspects of Operation and Maintenance

WAJ group's profit and loss statements for the past three years[21] are shown in Table 3, WAJ group's balance sheets are shown in Table 4, and WAJ Zarqa's profit and loss statements are shown in Table 5. With regard to WAJ group's profit and loss statements, current term net profit or loss has been in the red for the past three years. Total operation revenue exceeds total operation expense, leaving some surplus and enabling cost recovery. However, once the other expenses, such as depreciation, bad loans and financial charges (interests paid), are taken into account, current term net balance shows large deficits, demonstrating how these expenses weigh

[20] It is located in the capital city, Amman.
[21] Although the evaluation team attempted to obtain the most recent FY2012 data, it was not made publicly available because WAJ was going through an external audit.

on WAJ. In fact, WAJ has been creating new borrowings to repay its debt since before the commencement of this project[22]. At the time of the ex-post evaluation, WAJ is exploring an organizational strategy, including profitability, income structures and restructuring. However, they have not explicitly indicated the policy of moving toward an independent accounting system. It is deemed necessary that WAJ make further efforts to improve its finances while considering to revise the water tariff rates[23].

Table 3: WAJ Group's Profit and Loss Statement (Consolidated)

(Unit: Jordanian Dinar: JD)

| | FY2009 | FY2010 | FY2011 |
|---|---|---|---|
| ①Water supply revenues | 92,485,791 | 99,316,792 | 112,618,189 |
| ②Sewerage revenues | 32,821,043 | 33,344,713 | 39,133,884 |
| ③Subscription and connection fees | 14,832,486 | 16,289,186 | 17,669,668 |
| ④Stations and meters maintenance income | 1,464,801 | 472,812 | 334,919 |
| ⑤Other operating income | 797,137 | 817,063 | 313,254 |
| Total Operating Revenue (A) | 142,401,258 | 150,240,566 | 170,069,914 |
| ①Water purchase cost | 0 | 1,505,547 | 3,361,507 |
| ②Salaries, wages and employees benefit | 42,822,754 | 43,002,758 | 49,237,853 |
| ③Operating expenses | 87,090,497 | 85,934,465 | 98,334,438 |
| ④Administration expenses | 4,285,420 | 4,748,652 | 5,170,739 |
| Total Operating Expense (B) | 134,198,671 | 135,191,422 | 156,104,537 |
| Cost Recovery Ratio (A)/(B) | 106% | 111% | 109% |
| ①Total Operating Revenue (A) – Total Operating Expense (B) | 8,202,587 | 15,049,144 | 13,965,377 |
| ②Other revenue | 6,241,988 | 3,955,134 | 8,440,362 |
| ③Amortization of deferred revenue | 0 | 1,198,224 | 1,197,984 |
| ④Contribution to a waster water treatment project (Al-Sarma Wastewater Treatment Project) | -22,543,533 | -13,398,752 | -3,621,213 |
| ⑤Depreciation | -74,183,432 | -77,163,901 | -78,663,326 |
| ⑥Doubtful debts allowance | -3,017,189 | -1,000,000 | -5,598,805 |
| Sum of ①–⑦ | -85,299,579 | -71,360,151 | -64,279,621 |
| Gains (losses) on foreign loan revaluation | -9,335,762 | 15,818,037 | 4,880,714 |

[22] Regarding the financial data for FY2004 which is before the commencement of this project, total operating revenue was roughly 107 million JD while total operating expense was roughly 81 million JD; thus the difference (surplus) was around 26 million JD. However, after taking account of depreciation, interests paid and other expenses, which are about 76 million JD, the balance shows a deficit of around 50 million JD.

[23] According to a study by USAID, water charge accounts for 1-1.5% of the household's budget, which is relatively small. In addition, results from a socioeconomic survey indicate that costs of purchasing water to make up for the water shortage place more financial burden on households than the water charges. At the time of the ex-post evaluation, WAJ does not have a well-established system of collecting water charges according to the user's ability to pay. It is therefore considered necessary to revise the price setting system and rate levels.

| | | | |
|---|---|---|---|
| Finance cost | -21,637,189 | -24,117,242 | -30,479,265 |
| Deficit before tax | -116,272,530 | -79,659,356 | -89,878,172 |
| Income tax | -410,432 | -372,462 | -317,759 |
| Current term net profit or loss | -116,682,962 | -80,031,818 | -90,195,931 |

Source: WAJ Headquarters
Remark: 1 Jordanian Dinar = around 143 Japanese yen (at the exchange rate of June 2013)

With respect to WAJ group's balance sheets shown in Table 4, total asset is on the increase from FY2009 to FY2011. However, accumulated deficit is also on the increase (FY2009: -1,121,746,589JD → FY2010: -1,202,845,559JD → FY2011: -1,293,814,184JD). Additionally, capital-to-asset ratio (net assets divided by total assets) is on the decrease from FY2009 to FY2011 (FY2009: 0.54 → FY2010: 0.49 → FY2011: 0.43). This is not a favorable trend because low capital-to-asset ratios generally indicate that interests paid are putting pressure on profit, representing higher risks of not being able to repay debts. Furthermore, comparing non-current assets and capital, the former is larger than the latter for FY2009 through FY2011, and the difference between the two is expanding year by year. Ideally, capital should be large enough to cover the fixed assets (land and buildings); thus it is not a favorable trend, either. In addition, comparing current assets to current liabilities, while current assets exceed current liabilities in FY2009, current liabilities exceed current assets in FY2010 and FY2011. Also, the difference between the two has been increasing ((current assets – current liabilities), FY2009: 26,882,383 JD → FY2010: -6,534,811 JD → FY2011: -130,553,294 JD). This means that it is increasing difficulty for current assets to cover liabilities that are due within one year, depicting WAJ's serious cash-flow problem. Another concern is that the investment in the development of new water sources (e.g., DISI Conveyance Project) keeps increasing even though WAJ continues to end in the red.

Table 4: WAJ Group's Balance Sheet (Recent 3 Years)

(Unit: Jordanian Dinar: JD)

| Assets | 2009 | 2010 | 2011 |
|---|---|---|---|
| **Current Assets** | **201,422,657** | **173,822,510** | **160,284,751** |
| Current account and deposits at banks | 11,821,113 | 22,724,213 | 17,556,935 |
| Receivables and other debit balances | 55,981,663 | 65,236,199 | 74,872,206 |
| Warehouses | 27,219,911 | 25,547,160 | 28,691,789 |
| Restricted escrow account | 106,399,970 | 60,314,938 | 39,163,821 |
| **Non-Current Assets** | **1,234,114,360** | **1,438,119,201** | **1,507,085,613** |
| Property, plant and equipment | 1,234,114,360 | 1,365,789,201 | 1,429,672,047 |
| Disi Water Conveyance Project | 0 | 72,330,000 | 77,413,566 |
| **Total Assets** | **1,435,537,017** | **1,611,941,711** | **1,667,370,364** |

| Liabilities | 2009 | 2010 | 2011 |
|---|---|---|---|
| **Current Liabilities** | **174,540,274** | **180,357,321** | **290,838,045** |
| Payables and other credit balance | 10,323,960 | 8,448,740 | 26,971,632 |
| Electric companies payable | 7,877,461 | 3,924,612 | 11,877,588 |
| Disi Water Conveyance Deposit | 35,500,000 | 60,314,938 | 39,163,821 |
| Due to others | 14,625,550 | 9,899,232 | 10,545,321 |
| Due to banks | 27,644,784 | 31,006,431 | 41,356,394 |
| Foreign loans payable current portion | 14,782,485 | 15,792,421 | 19,934,439 |
| Public treasury bonds -current portion | 62,000,000 | 48,500,000 | 138,500,000 |
| Unearned revenue current portion | 1,347,262 | 1,852,315 | 1,745,238 |
| Current liabilities provision for income tax | 438,772 | 618,632 | 743,612 |
| **Non-Current Liabilities** | **489,564,295** | **648,277,360** | **654,401,691** |
| Foreign loan payable | 216,235,638 | 212,580,798 | 213,717,590 |
| Public bond | 234,500,000 | 387,480,000 | 392,980,000 |
| Long term deposit payable | 19,352,644 | 20,811,610 | 21,384,438 |
| Unearned revenues | 19,476,013 | 27,404,952 | 26,319,663 |
| **Total Liabilities** | **664,104,569** | **828,634,681** | **945,239,736** |

| Equity | 2009 | 2010 | 2011 |
|---|---|---|---|
| Capital | 1,883,336,470 | 1,975,677,595 | 2,004,697,124 |
| Statutory Reserve | 1,341,212 | 1,501,905 | 1,687,066 |
| Voluntary Reserve | 3,142,159 | 3,437,616 | 3,807,938 |
| Accumulated deficit | -1,121,746,589 | -1,202,845,559 | -1,293,814,184 |
| Non-controlling interest right | 5,359,196 | 5,535,473 | 5,752,684 |
| **Total Equity** | **771,432,448** | **783,307,030** | **722,130,628** |
| **Total Liabilities and Equity** | **1,435,537,017** | **1,611,941,711** | **1,667,370,364** |

On the other hand, WAJ Zarqa has also been ending in the red for the past three years as shown in Table 5, WAJ Zarqa's profit and loss statements[24]. Given that it does not show a trend toward improvement, it can be said that there are concerns about the financial aspects of the

[24] In fact, WAJ Zarqa's operation and maintenance budget is centrally managed by WAJ Headquarters who compensates for the deficit.

operation and maintenance of this project.

Table 5: WAJ Zarqa's Profit and Loss Statement

(Unit: Jordanian Dinar: JD)

| | FY2009 | FY2010 | FY2011 |
|---|---|---|---|
| Water sales | 6,047,400 | 6,036,371 | 6,487,649 |
| Subscription, application and connection fees | 1,185,661 | 1,152,439 | 642,557 |
| Sewerage and drainage fees | 1,479,504 | 1,152,301 | 1,681,181 |
| Sewerage tax | 1,142,710 | 362,553 | 474,734 |
| Miscellaneous revenues | 192,058 | 137,880 | 134,517 |
| Water meters maintenance fees | 107,152 | 127,629 | 137,216 |
| Water exported to other governorates | 1,966,983 | 1,885,776 | 1,846,388 |
| Water sales by tankers | 7,635 | 17,604 | 6,710 |
| Total Operational Revenue (A) | 12,129,103 | 10,872,554 | 11,410,952 |
| Salaries and wages | 2,695,309 | 2,695,404 | 2,870,305 |
| Vehicles maintenance | 168,963 | 172,332 | 167,271 |
| Meters maintenance | 246,675 | 168,458 | 119,524 |
| Maintenance stations | 313,684 | 241,259 | 493,624 |
| Electricity | 5,587,118 | 5,590,281 | 5,917,371 |
| Equipment maintenance | 136,652 | 29,160 | 20,217 |
| Telecommunication | 17,430 | 16,814 | 14,083 |
| Fuel | 212,311 | 233,648 | 259,987 |
| New connections | 384,412 | 194,742 | 356,985 |
| Maintenance of networks | 593,860 | 6,578 | 34,591 |
| Stationery | 62,319 | 11,041 | 13,365 |
| Insurance | 60,464 | 32,041 | 35,000 |
| Building maintenance | 35,297 | 13,920 | 37,063 |
| Chemicals | 52,882 | 14,102 | 50,119 |
| Rent expenditure | 19,646 | 19,646 | 19,646 |
| Other expenditure | 11,810 | 28,736 | 56,468 |
| Desalination | 286,000 | 226,905 | 674,547 |
| Water treatment fees | 1,778,152 | 3,617,120 | 1,154,961 |
| Total Operating Expense (B) | 12,662,984 | 13,312,187 | 12,295,127 |
| Net Loss Before Tax | -533,881 | -2,439,633 | -884,175 |

Source: WAJ Zarqa

### 3.5.4 Current Status of Operation and Maintenance

There are no major problems in the status of operation and maintenance carried out by WAJ Zarqa staff in charge of the areas targeted by this project. They patrol the areas to check the existing and installed water distribution networks a few times a week. When breakage or leakage is found, they carry out repair work immediately[25]. Also, they receive phone calls from

[25] WAJ Zarqa is focusing on measures against water thefts. Special investigation teams are formed to patrol the areas targeted by this project periodically (5-7 vehicles are going around). The minute somebody is found stealing water, he/she is charged the water fee immediately. For malicious cases, they urge offenders to pay penalty charges on top of

residents regarding leakage, to which they respond by going to the site if needed. For the pumping equipment procured and installed near the Batrawi Reservoir, they change internal oil and carry out inspection and cleaning. Regarding the four reservoirs developed in Batrawi, Zarqa North, Hashemeyeh and Sukhna, they open and shut distribution valves as well as maintain and clean the facilities. WAJ Zarqa has an in-house maintenance workshop at which overhaul and repair works are carried out when there is a problem with the pumping facilities.

There is no problem with spare parts procurement institutionally and financially. According to WAJ Zarqa's staff, if everything goes smoothly, it takes only one day to procure spare parts domestically. WAJ Zarqa submits a request to the headquarters for the cost of purchasing spare parts. Thus far, the headquarters have paid to WAJ Zarqa for the purchasing of spare parts without any problems.

There are guard houses for all the reservoirs developed by this project. Normally, security guards only work in the night for 12 hours from 6pm to 6am the next morning, patrolling the surrounding areas. Among these reservoirs, Zarqa North, being the crowded residential area, has frequent problems such that children from the neighborhood break into the premises passed the protective fence (at times they even break the fence) to scribble and play football during the day[26]. It is therefore deemed necessary to enforce the protection of the facilities and the premises by assigning daytime guards.

Conclusion on Sustainability

No major problems are observed in the institutional and technical aspects of the operation and maintenance carried out by WAJ Zarqa at the time of the ex-post evaluation. However, considering that both WAJ group and WAJ Zarqa have been recording deficits for many years with little prospect of improving their finances in the near future, there is a concern in terms of financial sustainability. Therefore, sustainability of the project effect is fair.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

This project constructed water supply facilities and provided technical assistance for strengthening water distribution management technologies with an aim to reduce the leakage ratio and to increase the number of water supply hours per week and water consumption per head per day in the northern part of Zarqa Municipality, Hashemeyeh Municipality, and Sukhna

water fees.

[26] The protective fence of this reservoir was broken three times in the first half of 2013 alone.

Municipality, located northeast of the capital city, Amman. At the time of the ex-post evaluation, this project is consistent with the policy, such as the 'Jordan Water Strategy,' and with the development needs for improving water supply facilities; thus the relevance is rated high. Through this project, the water supply rate has improved, the number of water supply hours has increased, the water pressure has improved, the water consumption per head per day has increased, and the leakage ratio has reduced mostly as planned. Additionally, the results of beneficiary survey show positive responses about water pressure and water supply volume, as well as positive impacts of the project, such as reduced time and labor burden in accessing water. Thus, effectiveness and impacts are rated high. The project period and project cost were mostly as planned, therefore the effectiveness is rated high. On the other hand, sustainability is rated fair because financially the Implementing Agency has recorded deficits for many years, although no major problems are observed in the institutional and technical aspects of the operation and maintenance carried out by the Implementing Agency.

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

### 4.2 Recommendations

#### 4.2.1 Recommendations to the Implementing Agency

(Enforcing Safety Management in and around the Facilities)

It is preferable that Zarqa North Reservoir is guarded 24 hours a day. As the reservoir is located in a crowded residential area relative to the other sites, it has been reported that children from the neighborhood would enter into the premises by passing the protective fence constructed by this project (by breaking the fence) during the day. Children would then scribble on the facilities and play football inside the premises. Although WAJ Zarqa currently have security guards only in the night, it is deemed necessary to assign security guards also during the day with a view to enforcing the management in and around the facilities.

(Improving and Reinforcing WAJ's Finance)

With respect to WAJ group's finances at the time of the ex-post evaluation, although operation and maintenance cost is recovered by water charges and other revenues, the total cost, including depreciation, bad loans and interest paid, is not recovered. While WAJ group continues to end in the red, investment in the development of new water sources keeps increasing; thus it can be said that WAJ is in a critical financial situation. Additionally, if there is a difficulty to secure sufficient operation and maintenance budget, WAJ may find itself trapped

in a vicious circle in the future such as undermining the efficiency of water supply system, increasing non-revenue water tariff rate and worsening the cost recovery ratio even further. In order to avoid such situation, it is recommended that (1) WAJ pursue a fine balance to the extent possible between the costs of new investment and operation and maintenance and the revenues, such as water charges; and (2) WAJ prepare and execute a business strategy, which includes measures to increase revenues, such as increasing water tariff rates with due consideration of low-income group.

In addition, although WAJ is pursuing an organizational strategy, which looks into profitability, structures and restructuring of revenues, there has not been any explicit policy indication to move toward an independent accounting system in the future. It is preferable that WAJ present a vision towards an independent accounting system, which includes stabilization of profitability and revenue structures, and make further efforts to strengthen its finances.

### 4.3 Lessons Learned

None.