

The Arab Republic of Egypt

Ex-Post Evaluation of Japanese Grant Aid Project

“The Project for Rehabilitation of Monshat El Dahab Regulator on Bahr Yusef Canal”

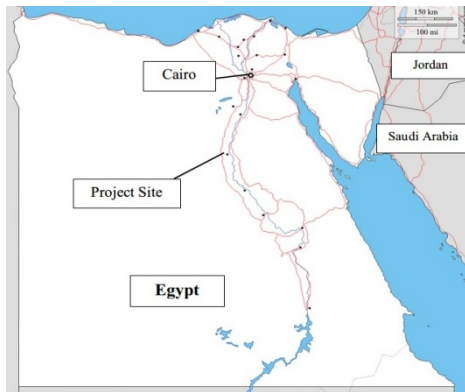
External Evaluator: Kenichi Inazawa, Octavia Japan Co, Ltd.

0. Summary

This project rehabilitated the aged Dahab Regulator on Bahr Yusef Canal, the functioning of which was deteriorating. Located in central Egypt, the rehabilitation aimed to stabilize water levels upstream of the Dahab Regulator and to provide stable irrigation water to the targeted areas. At the time of the ex-post evaluation, the Government of Egypt formulates the National National Water Resources Plan 2017 and the Government aims to further stabilize the supply of irrigation water and improve agricultural productivities in the targeted beneficiary areas through the rehabilitation of the Dairut Regulator Group, located upstream of the Dahab Regulator; thus, this project is consistent with development needs. The project is also consistent with the assistance policy of Japan such as the Japan's Country Assistance Program for Egypt. Therefore, its relevance is high. Both the project cost and the project period fell within the original plan; thus, efficiency of the project is high. On the other hand, although the volume of irrigation water delivered from Bahr Yusef Canal to the beneficiary areas increased from what it had been prior to the project's commencement, as a result of the rehabilitation of the Dahab Regulator, the target value has not been achieved. Agricultural production (wheat and clover) exceeded the baselines and targets set prior to the project's commencement; thus it is presumed that this project has contributed to improved agricultural productivity to some extent. Meanwhile, according to a beneficiary survey, it is difficult to conclude that agricultural production and agricultural incomes have improved as a result of this project. Thus, effectiveness and impact of this project are fair. On the other hand, there are no particular problems in the institutional, technical and financial aspects of the operation and maintenance of this project, and sustainability of the project effects is high.

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

1. Project Description



Project Location



Rehabilitated Dahab Regulator

1.1 Background

Bahr Yusef Canal¹, which supports the agriculture of central Egypt, receives five billion m³ of precious water; this is 9% of the country's scarce water resources, which are limited to 55.5 billion m³/year under the Nile Waters Agreement. Along the canal, four regulators have been constructed and played an important role in providing stable irrigation water to beneficiary areas. However, these regulators were almost 100 years old and were not functioning properly. Out of the four regulators, three regulators, i.e., the Lahoun Regulator (1997), Mazoura Regulator (2002) and the Sakoula Regulator (2006) were rehabilitated with Japanese assistance (Grant Aid Projects). The Dahab Regulator, which is located upstream of the three rehabilitated regulators, had a serious problem with water leaking from the installed gates (a total of 20 gates). Thus, there was a need to rehabilitate the Dahab Regulator with a view toward managing water properly, providing irrigation water to beneficiary areas in a stable manner and supplying the required discharge to downstream canals. Based on this situation, the Government of Egypt requested from the Japanese Government a grant aid project for rehabilitating the Dahab Regulator.

1.2 Project Outline

The objective of this project is to stabilize the water levels upstream of the Dahab Regulator and to provide stable irrigation water to the beneficiary areas by rehabilitating the Dahab Regulator located along Bahr Yusef Canal, which plays a central role in the irrigation system of central Egypt, thereby contributing to improve agricultural productivity and to the living

¹ An irrigation canal, the flow of which starts in the Minia Governorate in central Egypt and flows through Beni Suef, Faiyum and Giza. Its total length is approximately 300 km.

standards of farmers.

| | |
|--------------------------------------|---|
| Grant Limit / Actual Grant Amount | 2,141 million yen / 2,131 million yen |
| Exchange of Notes Date | June 2008 |
| Implementing Agency | Ministry of Water Resources and Irrigation (MWRI) |
| Project Completion Date | July 2010 |
| Main Contractor | Dai Nippon Construction Co., Ltd |
| Main Consultant | Sanyu Consultants Inc. |
| Basic Design | September 2007 |
| Detailed Design | June 2008 |
| Related Projects | <p>【Grant Aid Projects】</p> <p>Project for Rehabilitation and Improvement of Bahr Yusef Canal (1995-1997)</p> <p>Project for Rehabilitation and Improvement of Mazoura Regulator at Bahr Yusef Canal (2000-2002)</p> <p>The Project for Rehabilitation and Improvement of Sakoula Regulator on Bahr Yusef Canal (2004-2006)</p> <p>【Technical Cooperation】</p> <p>(Technical Cooperation for Development Planning)</p> <p>Feasibility Study on Rehabilitation and Improvement of Delivery Water System on the Bahr Yusef Canal (1990-1992)</p> <p>(Technical Cooperation Project)</p> <p>Improving Small-Scale Farmers' Market-Oriented Agriculture Project (2014-2019)</p> |

2. Outline of the Evaluation Study

2.1 External Evaluator

Kenichi Inazawa (Octavia Japan Co., Ltd.)

2.2 Duration of Evaluation Study

| | |
|------------------------------|--|
| Duration of the Study: | September 2014-September 2015 |
| Duration of the Field Study: | February 13, 2015-February 27, 2015 May 3, 2015-May 9, 2015 |

3. Results of the Evaluation (Overall Rating: A²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance to the Development Plan of Egypt

At the time of the project planning, the Government of Egypt had formulated the Fifth Five-Year Plan (2002-2007), which identified seven objectives for the country's long-term socio-economic development⁴. Among these, food security associated with the population increase⁵ was viewed as important. The government thus indicated its direction of (1) horizontal expansion (expansion of agricultural land) and (2) vertical expansion (production/productivity improvement) with a view toward improving food self-sufficiency. In this five-year plan, the Government of Egypt indicated that it would promote the integrated improvement of water resource development and an irrigation/drainage system as part of its policy for the agriculture/irrigation sector.

On the other hand, at the time of the ex-post evaluation, the Government of Egypt formulated a national strategic policy, the Strategic Framework for Economic and Social Development in 2011, with a target year of 2022. This policy stipulates the necessity for investing in the development and improvement of an irrigation system in order to protect the available land and water resources. In addition, the government also formulated its National Water Resources Plan 2017 in 2007 (revised in 2013), with a target year of 2017, which addresses the utilization and development of valuable water resources from socio-economic development and environmental perspectives, as well as the importance of utilizing irrigation water and its sustainable operation and maintenance.

In light of the above, this project was, and continues to be consistent with the development

² A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory and D: Unsatisfactory.

³ ③: High, ② Fair, ① Low.

⁴ (1) Conservation of natural resources and the development of cities in desert areas; (2) stable decrease of the current population increase rate; (3) attainment of a high GDP rate and its sustainable development; (4) a slow escape from the deficit of the national income and expenditures; (5) poverty reduction and a decrease in income unbalance; (6) development of human capital and the realization of full employment; (7) improvement of social welfare.

⁵ The population of Egypt was 57 million in 1991 and 70 million in 2004, prior to the project commencing. It is predicted that the population will reach 86 million by 2022. The source for these statistics is document provided by JICA (the Basic Design Study Report).

policy of Egypt at the time of the planning, as well as at the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of Egypt

At the time of the project planning, the Dahab Regulator, which existed upstream of the three regulators along the Bahr Yusef Canal and which had been rehabilitated with Japanese Grant Aid Projects (Lahoun Regulator, Mazoura Regulator and Sakoula Regulator), was extremely old and 100 years had elapsed since its construction. Water leaked severely from the gates (20 gates in total) installed at the regulator and it required time to open and close the gates, as they were manually operated using human power. Thus, their function, as well as operation of the main body of the regulator were unstable. In order to improve this situation, there was a great demand for proper water management, a stable supply of irrigation water to the beneficiary areas and controlled discharge to downstream of the Bahr Yusef Canal through the rehabilitation of the main body of the Dahab Regulator.

On the other hand, there continues to be a development need for realizing a stable supply of irrigation water along the Bahr Yusef Canal at the time of the ex-post evaluation. The Asyut Regulator is the third regulator being constructed along the River Nile and originates from the Aswan High Dam in southern Egypt. Water taken in by the Asyut Regulator flows through the Dairut Regulator Group⁶ to reach the Bahr Yusef Canal⁷. The Dairut Regulator Group is more than 100 years old and faces problems such as malfunctioning when opening and closing the gates. Therefore, the Government of Egypt is pursuing a plan to rehabilitate the Dairut Regulator Group with the aim of further stabilizing the supply of irrigation water to the beneficiary areas of the four rehabilitated regulators (Lahoun Regulator, Mazoura Regulator and Sakoula Regulator) along the Bahr Yusef Canal, which is located downstream of the Dairut Regulator Group, and to enhance agricultural productivity. JICA assisted the Feasibility Study for the Dairut Regulator Group Rehabilitation Project⁸ and in March 2015, signed a loan agreement for a new ODA project, the New Dairut Regulator Group Construction Project. Based on these factors, it was judged that the development need was high for improving agricultural productivity through a stable supply of irrigation water in central Egypt at the time of the ex-post evaluation.

In light of the above, the necessity for rehabilitating regulators along the Bahr Yusef Canal

⁶ It consists of five regulators.

⁷ Refer to Figure 1.

⁸ Feasibility Study (2009- 2010)

and for improving agricultural productivity is considered equally important; thus, this project is consistent with the development needs of the country at the time of planning, as well as at the time of the ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

The Japan's Country Assistance Program for Egypt, formulated in June 2000, sets out the following priority areas: (1) economic/social infrastructure and promotion of industry; (2) poverty countermeasures; (3) developing human resources and enhancing education; (4) conserving the environment and improving the living environment; (5) promoting tripartite cooperation (South-South cooperation). As part of the poverty countermeasures above, it said that "assistance relating to agriculture infrastructure and increased food production will be continued and that assistance is considered for agriculture/rural development, improved agricultural technology and agricultural processing and distribution as well as for fishery promotion." This project extended its assistance in the priority area listed above (2) poverty countermeasures: agriculture/rural development); thus, it is consistent with the assistance policy of Japan.

This project has been highly relevant to the development plan and development needs of Egypt, as well as to Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

Table 1 shows the (plan and actual) outputs of this project.

Table 1: Outputs of This Project (Plan/Actual)

| Plan (Before Project's Commencement) | | Actual (At the Time of Ex-Post Evaluation) |
|--|--|---|
| 【Japanese Side】 (Rehabilitation of the Dahab Regulator and Associated Facilities) | | |
| 1 | Rehabilitation of Dahab Regulator's main body (design water flow/design water level: maximum water flow 210.15m ³ /sec) | As planned |
| 2 | Renewal of water gates (installation of overflow gates: 8m x 4 gates) | As planned |
| 3 | Construction of regulator bridge (width: 10m) | As planned |
| 4 | Foundation work for a control house and installation of equipment such as remote consoles for the gates | As planned |
| 【Egyptian Side】 | | |
| 1 | Construction of the control house | As planned |
| 2 | Inspection and repair of secondary canals | As planned |
| 3 | Custom clearance and payment of customs | This was exempted and was thus not implemented. |
| 4 | Securing and preparing temporary yard | As planned |

Source: Document provided by JICA

The outputs by the Japanese and the Egyptian sides were generally implemented as planned⁹. Regarding the inspection and repair of secondary canals (refer to Table 2), which is input from the Egyptian side, the judgment was made at the time of planning that it was only necessary to improve the water distribution capacity of one canal (Rahiel Canal) among the secondary canals (13 canals in total). At the time, Rahiel Canal was narrow with a base width of 1.5m and its actual water flow was estimated to be 1.40m³/sec, compared to the design water flow of 2.08m³/sec; thus, it was deemed necessary to rehabilitate the canal, such as widening of the canal. This was planned and implemented by the Egyptian side, from the perspective of beneficiary's contribution. The reasons why the custom clearance and payment, which was input from the Egyptian side, was not implemented will be explained in the section "3.2.2.1 Project Cost".

⁹ In July 2010, the Egyptian side, using its own funds, constructed a concrete protection wall for some parts of the right side of the Dahab Regulator on landscaped grounds. This did not affect the actual cost and period of this project.



Photo 1: Dahab Regulator before rehabilitation

Source: Document provided by JICA
(The Basic Design Study Report)



Photo 2: Dahab Regulator after rehabilitation
(At the time of the ex-post evaluation)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The initially planned project cost was approximately 2,458 million yen (of which 2,141 million yen was to be borne by the Japanese side and approximately 317 million yen was to be borne by the Egyptian side). In reality, the project cost was approximately 2,138 million yen (of which 2,131 million yen was borne by the Japanese side and approximately seven million yen was borne by the Egyptian side); thus, the project cost was lower than planned (approximately 84% of the plan).

While the actual project cost of the Japanese side remained almost within the plan, the project cost of the Egyptian side was significantly different from the initial plan. This was mainly because the custom duties for the materials and equipment that were budgeted at the time of the cost estimation were exempted by the Egyptian Government (the Ministry of Finance) following the project's commencement (worth approximately 280 million yen of the overall cost)¹⁰.

3.2.2.2 Project Period

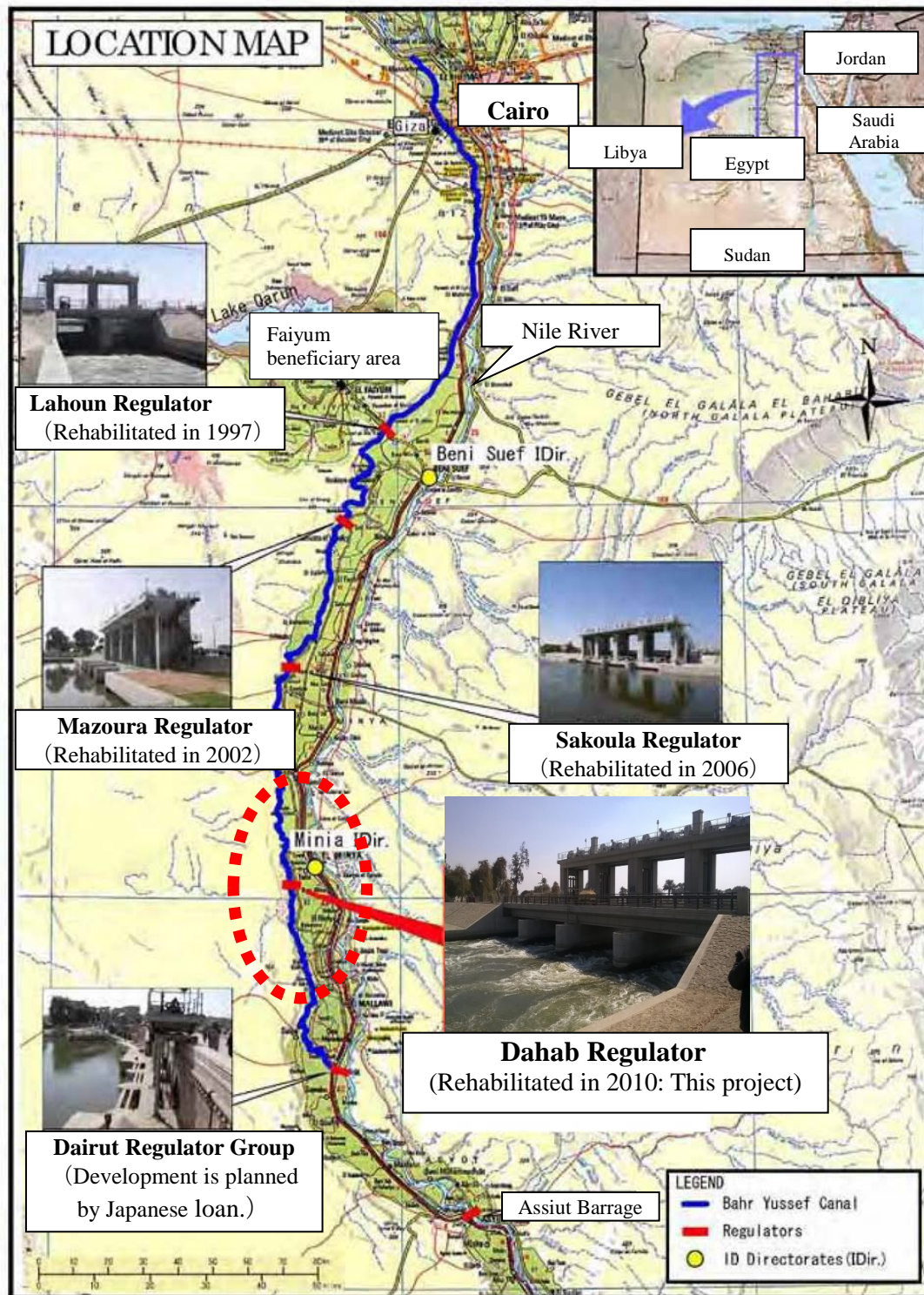
This project was planned to last for 34 months, starting from June 2008. The actual project period for the Japanese side was 26 months from June 2008 to July 2010, which was shorter than planned¹¹ (77% of the plan). It has been confirmed through interviews with the main

¹⁰ While there was a discussion at the time of planning that custom duties associated with this project might be exempted by the Egyptian government, it was included in the initial project cost because it was not certain.

¹¹ The construction borne by the Egyptian side was completed by July 2010.

consultant, the Ministry of Water Resources and Irrigation (the implementing agency) and the West Minia Irrigation Directorate (a local operation and maintenance body) that the construction proceeded smoothly and without delays.

Both the project cost and project period were within the plan. Therefore, efficiency of the project is high.



Source: Document provided by JICA (Basic Design Study Report), the field survey conducted during the ex-post evaluation

Figure 1: Rehabilitated Dahab Regulator along the Bahr Yusef Canal (bold line), the Beneficiary Areas of This Project (dotted line) and Locations of Other Regulators

3.3 Effectiveness¹² (Rating: ②)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

In this project, (1) the volume of irrigation water and (2) the waiting time caused by congestion at the regulator bridge were set as operation indicators, and (3) agricultural production was set as an effective indicator; for each indicator, baseline and target were set at the time of project planning. Actual values for each indicator were obtained through this evaluation study and the results of these analyses were as follows:

(1) Volume of irrigation water

Table 2 shows the volumes of irrigation water (baseline, target and actual) from the Bahr Yusef Canal and delivered to the beneficiary areas, i.e., Monshat El Dahab, East Minia and West Minia (three areas in total) through the Dahab Regulator, as rehabilitated by this project.

Table 2: Volume of Irrigation Water (baseline, target and actual)

(Unit: Thousand m³/yr)

| Baseline | Target | Actual | | | |
|---|---|-------------------------------------|--------------------------------------|--|---------------------------------------|
| 2005 (Prior to project's commencement) | 2011 (One year after project completion) | 2011 (One year after completion) | 2012 (Two years after completion) | 2013 (Three years after completion) | 2014 (Four years after completion) |
| 427,445 | 489,650 | 465,782 | 451,070 | 451,795 | 445,635 |

Source: Document provided by JICA (prior to project's commencement); answers to the questionnaire (following the project's completion)

The actual values after completion have exceeded the baseline prior to the project's commencement. This is because the brick-style manual gates were upgraded to electric overflow gates with concrete bodies that can control the flow rate accurately and can be operated swiftly. As a result, water stopped leaking, which had been a problem prior to the project's commencement and the regulator was able to supply a stable volume of water.

On the other hand, the actual values have not reached their targets. According to the explanation, this may be due to the fact that for areas planted with rice, water consumption increased in the Faiyum beneficiary area (see Figure 1) near Lahoun, along the Bahr Yusef Irrigation Canal, after the project commenced and because the water demand is increasing in this area¹³. There is also significant water demand among farmers in beneficiary areas near the

¹² The sub-rating for Effectiveness is to be considered alongside Impact.

¹³ According to the West Minia Irrigation Directorate, following the social unrest in 2011 (the Arab Spring), an increasing number of people opted for migrating to the Faiyum beneficiary area to engage in farming; thus, there is an increasing demand for water in this area.

Lahoun and Sakoula Regulators. Additionally, the Assiut Irrigation Directorate under the Ministry of Water Resources and Irrigation, which is responsible for water allocation, tends to be influenced by requests from these downstream beneficiary areas. In other words, because water allocation to downstream areas is prioritized¹⁴, the volume of allocated irrigation water to the beneficiary areas near Dahab Regulator is affected and not increasing, as was intended (see Table 2). Another factor affecting the situation is rapid population increase of Egypt¹⁵, while Egypt's water resources are limited to 55.5 billion m³/year under the Nile Waters Agreement and cannot be increased. The more downstream and closer to the capital city, Cairo, the larger the population grows; accordingly, cultivation is expanding in the downstream beneficiary areas such as Faiyum, as mentioned above. Nevertheless, crop land near the Dahab Regulator is also one of the beneficiary areas; thus, it can be said that revisiting and improving the management system for water allocation is necessary for the entire Bahr Yusef Irrigation Canal¹⁶.

Other factors include the aging Dairut Regulator Group (see Figure 1), which exists upstream of the Dahab Regulator, as mentioned above. While irrigation water along the Bahr Yusef Canal flows through the Dairut Regulator Group, more than 100 years have elapsed since the construction of the latter and problems exist regarding the controlling and opening-and-closing of gates, as well as with the management of water distribution. At the time of the ex-post evaluation, the Government of Egypt requested the Japanese Government to assist the "New Dairut Regulator Group Construction Project", which aims to rehabilitate this regulator and improve the water management system including that of the Bahr Yusef Canal. In March 2015, the Government of Egypt and the Government of Japan agreed to implement this as an ODA loan project. After completion of this project, more stable water supply and efficient water distribution are expected for the Bahr Yusef Canal as a whole. Thus, irrigation water volume from the Dahab Regulator to its beneficiary areas is also expected to increase.

¹⁴ As the volume of irrigation water is limited, water is distributed by integrating requests from downstream areas, including the downstream beneficiary areas. In other words, water is distributed by taking into consideration the total irrigation water needed by all areas.

¹⁵ When this project commenced (2007), the population was 73.64 million; this number rose to 78.69 million at the project's completion (2010) and 84.63 million at the time of the ex-post evaluation (source: Central Agency for Public Mobilization and Statistics (CAPMAS)). According to IMF's projection, the population was estimated to reach 97 million in 2020 (source: World Economic Database, IMF (as of April 2015)). As explained in footnote 4, before the project's commencement, it was predicted that the population would reach 86 million in 2022. This means that the population is growing at a faster pace than what was estimated prior to the project's commencement.

¹⁶ Additionally, in some cases, water distribution from each regulator to secondary canals is coordinated among different irrigation directorates along Bahr Yusef; in other cases, each irrigation directorate distributes water by opening and closing gates based on requests from farmers. In other words, water distribution along the canal is not managed in accordance with established rules. It is considered necessary that a water distribution plan be revisited and improved.

2) Waiting Time at the Regulator Bridge Due to Congestion

Table 3 indicates the waiting time at the regulator bridge, which was rehabilitated along with the Dahab Regulator. There has not been any vehicle waiting time since the completion of this project (July 2010). As a result of this project, widening the bridge from 4m to 10m saw two-lane traffic realized and vehicles no longer need to wait on one side of the bridge for a clear lane, making the traffic smooth (see Photo 3 and 4). Through regulator bridge inspections and interviews with staff members maintaining the Dahab Regulator during the field survey of the ex-post evaluation, it has been confirmed that congestion was addressed after widening of the bridge and that this had led to the smooth transportation of agricultural products. It can therefore be said that this project addressed the problem of waiting time for vehicles crossing the bridge.

Table 3: Changes in Waiting Time at the Regulator Bridge due to Congestion
(Baseline, target and actual)

| Baseline | Target | Actual |
|---|---|---|
| 2005 (Prior to project's commencement) | 2011 (One year after the completion) | 2014 (Four years after the completion) |
| 5 minutes | 0 minute | 0 minute |

Source: Document provided by JICA (prior to the project's commencement); answers to the questionnaire and facts confirmed during the field survey (after completion)



Photo 3: Regulator Bridge and Road prior to Rehabilitation
(narrow with a 4m width and prominent congestion)



Photo 4: Regulator Bridge and Road after the Rehabilitation
(expanded to 10m wide by this project)

Source: Document provided by JICA (Basic Design Study Report)

3) Agricultural Production

Table 4 shows the changes in agricultural production (wheat and clover¹⁷) in the beneficiary area (approx. 38, 000 ha) served by the Dahab Regulator and rehabilitated by this project.

Table 4: Agricultural Production (baseline, target and actual)
in the Dahab Regulator Beneficiary Area

(Unit: Thousand ton)

| Crop | Baseline | Target | Actual | | | |
|--------|---|---|---|--|--|---|
| | 2005 (Prior to project's commencement) | 2011 (One year after completion) | 2011 (One year after completion) | 2012 (Two years after completion) | 2013 (Three years after completion) | 2014 (Four years after completion) |
| Wheat | 132,872 | 142,173 | 150,643 | 163,397 | 161,921 | 182,798 |
| Clover | 390,882 | 434,998 | 462,662 | 471,433 | 421,831 | 453,843 |

Source: Document provided by JICA (prior to the project's commencement); answers to the questionnaire (after the project's completion)

The actual values (for 2011 and onwards) have exceeded the baseline and target set prior to the commencement of this project. While through this project, the rehabilitation of Dahab Regulator has presumably contributed to improved agricultural productivity to a certain extent, it is perhaps more attributed to other factors such as improvement in agricultural technologies. According to farmers in the beneficiary areas who were interviewed during the ex-post evaluation, production increased because fertilizer and seedlings improved and because agricultural machinery became widely available¹⁸.

At the time of the ex-post evaluation, a problem of waste dumping was observed such as livestock carcasses, household waste and waste from harvests (hereafter referred to as "wastes") by farmers and residents in some areas along terminal irrigation canals. Additionally, some areas did not receive sufficient irrigation water according to the persons in charge and the site visits conducted during the field survey. These factors may hinder improvement in agricultural productivity. An imperfect waste collection system is one of the factors influencing the situation. There are no designated places for waste disposal, and farmers easily dump wastes along the canals as their awareness is limited. Although the West Minia Irrigation Directorate contracts private firms to clean and remove silt from the canal (major clean-ups are conducted semi-annually), waste is dumped directly after the cleaning. Therefore, it can be said that the

¹⁷ These are the two main agricultural products of the beneficiary areas of this project. Clover is produced as livestock feed, particularly for horses, cows and goats.

¹⁸ Although some farmers stated that agricultural productivity increased because of the water from the Dahab Regulator, its extent was limited.

irrigation directorate need to collaborate with municipalities to establish a more frequent and reliable waste collection system¹⁹.

3.3.2 Qualitative Effects (Other effects)

1) Efficient Operation of Pumps

Some beneficiary areas along the secondary canal to which irrigation water is supplied from the Dahab Regulator (Monshat El Dahab Canal) use water-intake pumps, branch canals and relay pumps for irrigation. Prior to the commencement of this project, suction water levels of the water-intake pumps were not constantly stable, as the water level of the Dahab Regulator was unstable. It was expected that this project would stabilize suction water levels of the water-intake pumps by rehabilitating the Dahab Regulator, thereby improving the efficiency of pump operation. At the time of the ex-post evaluation, it was confirmed through interviews with the West Minia Irrigation Directorate and site inspections that the suction water levels of the pumping stations (two areas) along the Monshat El Dahab Canal were constantly stable. Therefore, it can be judged that there are no problems concerning the efficiency of water distribution from the Dahab Regulator to the beneficiary area, or with the operation of the pumping facilities.

2) Improvement in Sanitation

Prior to the commencement of this project, the Dahab Regulator was so old that some gates were not functional and an underflow discharge was applied²⁰. Livestock carcasses and wastes that float over from the upstream Bahr Yusef Canal accumulated on the upstream side of the regulator, which decayed and worsened the water quality. This project installed overflow-type gates at the regulator, making overflow discharge²¹ possible. As a result, wastes stopped accumulating and sanitation around the regulator has improved.

¹⁹ This issue is not limited to the beneficiary area of this project, but is a common problem for Egypt. It has been confirmed through the interviews with the Ministry of Water Resources and Irrigation and other stakeholders that there are similar problems in other areas.

²⁰ Water gets discharged by going under the gate. In other words, the gate is lifted so that water can flow under the gate in this method.

²¹ To the contrary to the underflow discharge method, water is discharged over the gate. It is relatively easier to control water levels and discharge rates as compared to the underflow method.

3.4 Impacts

3.4.1 Intended Impacts

3.4.1.1 Improvement of Agricultural Productivity and the Living Standards of Farmers in Central Egypt

It was expected that this project would stabilize irrigation water supply through the rehabilitation of the Dahab Regulator and thereby contribute to improvement in the agricultural productivity and living standards of farmers. As part of this ex-post evaluation, a beneficiary survey was conducted, targeting farmers who are receiving irrigation water from the Dahab Regulator through secondary canals, in order to assess improvements in the agricultural productivity and living standards of farmers. The questions and responses are summarized in Figures 2-5²².

Regarding the level of satisfaction with the rehabilitation of the Dahab Regulator, approximately 64% respondents said that they were “dissatisfied” or “very dissatisfied”, as shown in Figure 2; thus, there were relatively more farmers who were not satisfied. Although it is not directly linked to this project, many of those who were dissatisfied stated that the distribution of irrigation water was not efficient for the terminal canals. There is no problem concerning the water intake functioning of the Dahab Regulator and water distribution from the regulator; however, waste dumping along the terminal canals seems to be disturbing the water distribution. On the other hand, interviews revealed that many of the farmers who answered “very satisfied” and “satisfied” (28% in total) cultivate land upstream of the secondary canal close to the Dahab Regulator. This illustrates that there is waste-related water problems along the terminal canals, which explains why the level of dissatisfaction with the Dahab Regulator is high.

Regarding the improvement in agricultural incomes, many respondents answered “slightly improved” and “no change” (78% in total), as shown in Figure 3. The question shown in Figure 4 was exclusively directed at those who answered “greatly improved” and “slightly improved”. Many respondents mentioned “improved seeds/seedlings, fertilizer and pesticides”. As many selected “improved seeds/seedlings, fertilizer and pesticides”, it can be said that the contribution of this project to improvement in agricultural income is limited.

Figure 5 concerns a question regarding improvement in living standards. Many respondents

²² With the aim of measuring effectiveness and impacts accurately, farmers who have been cultivating in the target beneficiary areas (Monshat El Dahab, East Minia and West Minia) since before the rehabilitation of the regulator (prior to 2007). The beneficiary survey was conducted using a questionnaire and samples were drawn using the random sampling method. (n=103, out of which 98 were male and five were female.)

chose “no change” (96% in total); thus, it can be said that farmers are not truly experiencing improvements in living standards as a result of this project.

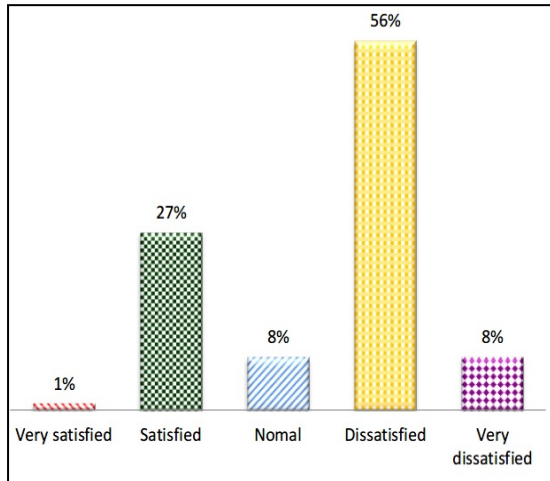


Figure 2: Are you satisfied with the rehabilitation of the Dahab Regulator?

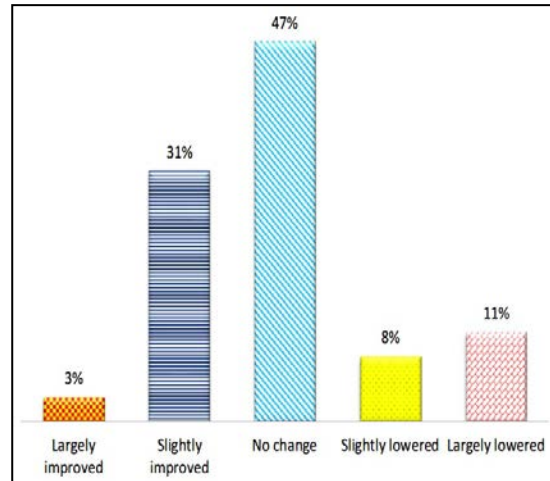


Figure 3: Has your agricultural income improve after the completion of this project?

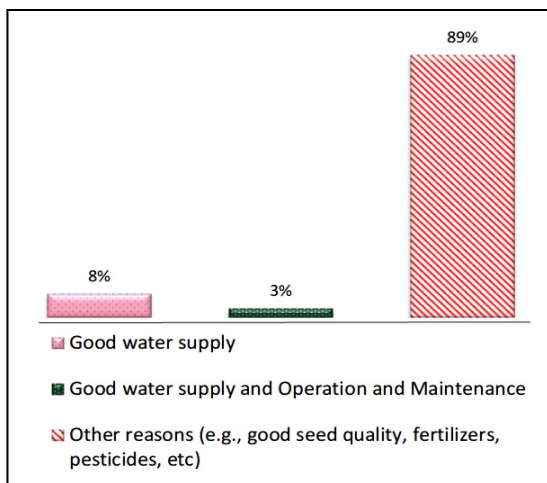


Figure 4: Why did your agricultural income improve? (n=35; this question was exclusively for those who answered “greatly improved” or “slightly improved”).

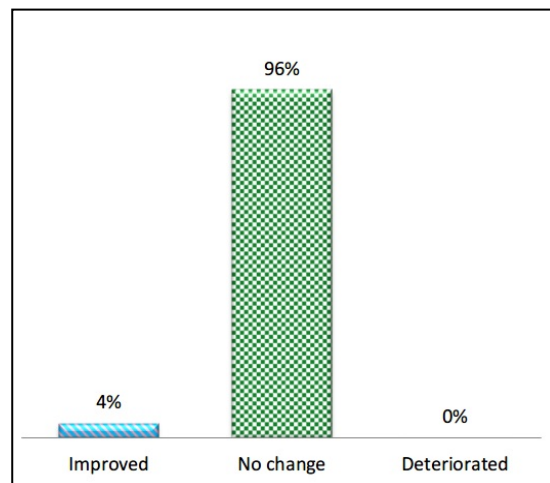


Figure 5: Do you think the living standard has improved compared to before the completion of this project?

In the interviews with the Ministry of Water Resources and Irrigation and the West Minia Irrigation Directorate, they commented on farmers’ incomes as follows: “While the incomes from the sales of agricultural products are increasing, the costs of fertilizer, seeds/seedlings, agricultural machineries and land rent are also increasing; thus, expenses are also substantial.” The impacts of the project on agricultural production and socio-economic vitalization are judged

to be limited because even though farmers' incomes increase, increase in costs due to inflation possibly offset the profits. In order to improve this situation, the above-mentioned issue of waste dumping along the terminal canals should be addressed. In addition, the improvement of water management for the entire Bahr Yusef Canal through the New Dairut Regulator Group Construction Project is also thought to be necessary. Such measures can enhance the impacts of this project.



Photo 5: Dairut Regulator Group
(The mobile pulley above opens and closes the gates.
The structure is generally old.)
(At the time of the ex-post evaluation)



Photo 6: Beneficiary Area of This Project
(The crop is clover)
(At the time of the ex-post evaluation)

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

At the time of planning, it was judged that this project would not negatively impact the national environment and local society, as it aimed to rehabilitate the existing Dahab Regulator and its accessories. On the other hand, as environmental considerations during the project's implementation, it was planned that low-noise generators would be used and an oil fence would be installed along the canal for the cofferdam construction with the aim of preventing water pollution. It has been confirmed through interviews with the West Minia Irrigation Directorate and the Dahab Office that such considerations were implemented. Thus, it can be judged that this project has had no negative impact on the national environment.

With regard to the system for environmental monitoring related to this project's facilities such as the Dahab Regulator and the regulator bridge, it has been confirmed that the West Minia Irrigation Directorate is fulfilling its responsibilities. Should an environmental problem occur near the regulator, the Monshat El Dahab Irrigation Office staff members will respond, as will be elaborated in section "3.5.1 Institutional Aspects of Operation and Maintenance" below.

3.4.2.2 Land Acquisition and Resettlement

This project primarily concerned rehabilitation. Through the questionnaires and interviews with the Ministry of Water Resources and Irrigation and the West Minia Irrigation Directorate, it has been confirmed that no new land acquisition or resettlement took place.

At the time of the ex-post evaluation, the water intake function of the Dahab Regulator was strengthened and the leakage problem was addressed as a result of the rehabilitation of the Dahab Regulator. Although the volume of irrigation water from the Bahr Yusef Canal to the beneficiary areas exceeded the baseline, it has not reached the target yet. Additionally, there is a problem with water passing in some parts of the terminal canals due to waste dumping, although this problem falls outside the scope of the project. While agricultural production is above the baselines and targets, many farmers attributed the increase in production to the improvement of fertilizers and seeds/seedlings, as per the interviews of the beneficiary survey. Thus, it can be said that this project's contribution to improved agricultural production was limited.

This project has to some extent achieved its objectives. Therefore effectiveness and impact of the project are fair.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The implementing agency of this project is the Ministry of Water Resources and Irrigation. On the other hand, the operation and maintenance of the rehabilitated Dahab Regulator and the associated regulator bridge is the responsibility of the West Minia Irrigation Directorate under the Ministry. However, the West Bahr Yusef Inspectorate under the Directorate carries out the actual operation and maintenance works. Furthermore, the Monshat el Dahab Irrigation Zone Office (hereafter referred to as "Dahab Office") under the Inspectorate functions as the field office²³. Table 5 shows the organizations and roles concerning the operation and maintenance of this project.

²³ The discharge allocation plan and water usage plan for the four regulators along the Bahr Yusef Canal and for the Dahab Regulator were completed by the Assiut Irrigation Directorate (functioning as an overall irrigation directorate) under the Ministry of Water Resources and Irrigation.

Table 5: Organizations and Roles concerning the Operation and Maintenance of This Project

| Organizations | Operation and Maintenance Roles |
|--|---|
| West Minia Irrigation Directorate | Responsibility for maintenance of the Dahab Regulator and the Bahr Yusef Irrigation Canal within the Minia Governorate, communicating design water level, allocating budget, etc. |
| West Bahr Yusef Inspectorate (under the West Minia Irrigation Directorate) | Dredging of the canal along the Dahab Regulator, water intake facilities, operation and maintenance supervision of the facilities for branch canals, communicating design water levels, responsibility for the allocation of staff and budget, etc. |
| Monshat el Dahab Irrigation Zone Office (Field Office of the West Bahr Yusef Inspectorate) | On-the-ground management of the Dahab Regulator (day-to-day works), operation and maintenance of branch canal facilities, patrolling and guidance of the Dahab Regulator by technical staff, operation of the Dahab Regulator gates by gate operators, etc. |

Source: Document provided by JICA (Basic Design Study Report) and interviews conducted during the field survey.

The number of staff at the time of the ex-post evaluation was 1,333 for the entire West Minia Irrigation Directorate, 194 for the West Bahr Yusef Inspectorate, and nine for the Dahab Office. The Dahab Regulator and the control houses were visited and the Dahab Office staff members were interviewed during the field survey, and it was confirmed that the office had a sufficient number of staff for the management of the regulator. Regarding the organizational structure for maintaining the Dahab Regulator, staff members of the Dahab Office developed maintenance plans and inspected the operation on a daily-basis.

The overall operation and maintenance of the Bahr Yusef Canal is the responsibility of the Ministry of Water Resources and Irrigation. Regarding each water-intake regulator, the Reservoirs and Grand Barrages Sector of the Ministry (hereafter referred to as “RGS”) is in charge of major repairs when the need arises. (However, up until the time of the ex-post evaluation, the need for major repairs was not arisen; thus, RGS has not yet performed any duty in this regard.)

In light of the above, it can be judged that there are no major problems with the institutional aspects of the operation and maintenance of this project at the time of the ex-post evaluation.

3.5.2 Technical Aspects of Operation and Maintenance

The staff members of the Dahab Office, under the West Bahr Yusef Inspectorate, open and close gates and maintain the Dahab Regulator, based on the operation and maintenance manual

provided by the contractor during the project's implementation. Additionally, they received training pertaining to the operation of the facilities and equipment (primarily the operation of overflow gates) during the project's implementation, as well as after the project's completion. Furthermore, they have three to five years of work experience on average and some of them are certified electricians²⁴. Thus, it is observed that there are no issues with the technical aspects of the project.

Since the project's completion, staff members of the Dahab Office have not received any training. This is because the Dahab Regulator, which was manually operated prior to the project's commencement, is now power operated, which means less works for staff and no need for special training. The staff members are already equipped with the knowledge and skills for operating the equipment and handling the opening-and-closing of gates, because of the training they received during the project's implementation and upon completion of the project. They are handling the day-to-day operations based on the above-mentioned operation and maintenance manual. Thus, they are not in need of additional training. Through the interviews with the Dahab Office and the West Minia Irrigation Directorate, it has been confirmed that on-the-job training (OJT) is regularly provided to newly recruited staff. Newly recruited staff acquires knowledge and skills about the equipment and opening-and-closing of gates from existing staff.

In light of the above, it can be judged that there are no major problems with the technical aspects of the operation and maintenance concerning this project.

3.5.3 Financial Aspects of Operation and Maintenance

Table 6 shows the personnel cost, operation cost, maintenance cost and long-term repair cost of the Dahab Regulator. According to the West Minia Irrigation Directorate, which allocates the funds for these costs, necessary staff salaries have been expended and the needed necessary expenses have been expended, although the actual expenditure has not been made available²⁵. Regarding long-term repairs, no expenditure has been made, because there has been no breakage or trouble since the completion of the project. It was confirmed through the interviews with RGS and the West Minia Irrigation Directorate that should the needs arise in the future, RGS would allocate funds and necessary repairs will be provided immediately.

²⁴ For example, it is thought that they can deal with troubles relating to gate remote console and gate opening-and-closing system (electronic control).

²⁵ As mentioned above, the Dahab Regulator, which used to be manually operated before the project's commencement was upgraded to electric operation; as a result, less labor is required for maintenance works. It is presumed that this explains why the maintenance costs are not very high.

Table 6: Personnel Cost, Operation and Maintenance Cost and Long-term Repair Cost

(Unit: Egyptian pound (LE))

| Item | Target (After 2010/11) | Actual | | | |
|--------------------------|---------------------------|--|---|---|---|
| | | 2010/11 (Completion year) | 2011/12 (One year after completion) | 2012/13 (Two years after completion) | 2013/14 (Three years after completion) |
| Personnel Cost | 100,000 | 103,000 | 110,000 | 112,650 | 124,680 |
| Operation Cost | 6,000 | 6,800 | 6,500 | 6,714 | 6,650 |
| Maintenance Cost | 3,000 | (Although the actual amount is unknown, the West Minia Irrigation Directorate has been disbursing it.) | | | |
| Long-term Repair Cost | 673,000 | (In case of trouble/breakage, RGS will allocate funds for long-term repairs.) | | | |
| Total | | 109,800 | 116,500 | 119,364 | 131,330 |

Source: Document provided by JICA (target after completion); answers to the questionnaire (following the project's completion)

Remark: 1 Egyptian pound (LE) = approximately 16 Japanese yen (early March 2015)

Table 7: Operation and Maintenance Costs of the West Minia Irrigation Directorate (actual)

(Unit: Egyptian pound (LE))

| Expense | Actual | | |
|--|------------|-----------|-----------|
| | 2011/12 | 2012/13 | 2013/14 |
| Operation costs (including facility construction costs) | 4,825,000 | 4,712,000 | 7,051,000 |
| Maintenance costs | 13,385,000 | 7,492,000 | 3,450,000 |

Source: Answers to the questionnaire

Remark: 1 Egyptian pound (LE) = approximately 16 Japanese yen (early March 2015)

The maintenance budget for the cleaning and dredging of terminal canals has been declining nation-wide in Egypt. This is because the budgets of governmental organizations have been reducing since the social unrest referred to as “the Arab Spring”, which occurred in 2011. Regarding this project, the Ministry of Water Resources and Irrigation has been allocating the full amount requested by the West Minia Irrigation Directorate for necessary maintenance up to the time of the ex-post evaluation²⁶. Thus, it can be judged that there should be no particular concerns regarding the budget allocation for the time being. Table 7 shows the annual operation and maintenance budget allocated to the West Minia Irrigation Directorate in recent years. The maintenance budget of the West Minia Irrigation Directorate decreased from 2011/12 to 2013/14, because the budget up to 2013 was temporarily inflated due to large-scale dredging works and

²⁶ It was confirmed through the interviews with the West Minia Irrigation Directorate.

major gate repairs along terminal canals during the period of 2011-2013. Thus, it was explained that this should not be interpreted as a budget reduction. Based on these facts, it is judged that there are no concerns regarding maintenance budgets at the time of the ex-post evaluation²⁷.

In light of the above, it can be judged that there are no particular problems with the financial aspects of the operation and maintenance of this project.

3.5.4 Current Status of Operation and Maintenance

It has been confirmed through site visits during the field survey that the Dahab Regulator is fully functioning as an appropriate civil structure at the time of the ex-post evaluation, thanks to proper maintenance works. No problems were observed in the operational status of the main body of the regulator, gates, hoists or consoles inside the control building. Silt and wastes are being removed around the Dahab Regulator and the regulator bridge and roads are regularly cleaned.

With regard to spare parts, it has been confirmed that these are stored inside the constructed control building. There are sufficient numbers of gate hoist wires and grease, all of which can be procured domestically in Egypt. It has been confirmed through interviews that there are no particular problems with the procurement system concerning spare parts.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, sustainability of the project's effects is high.

²⁷ (Although it is outside the project scope) water is unable to pass along the terminal canals because of waste dumping, as explained earlier. As this issue should be addressed in order for agricultural productivity and agricultural incomes to improve, concerned organizations need to establish a better waste collection system while securing sufficient maintenance budget.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project rehabilitated the aged Dahab Regulator on Bahr Yusef Canal, the functioning of which was deteriorating. Located in central Egypt, the rehabilitation aimed to stabilize water levels upstream of the Dahab Regulator and to provide stable irrigation water to the targeted areas. At the time of the ex-post evaluation, the Government of Egypt formulates the National National Water Resources Plan 2017. In addition, the Government aims to further stabilize the supply of irrigation water and improve agricultural productivities in the targeted beneficiary areas through the rehabilitation of the Dairut Regulator Group, located upstream of the Dahab Regulator; thus, this project is consistent with development needs. The project is also consistent with the assistance policy of Japan such as the Japan's Country Assistance Program for Egypt. Therefore, relevance is high. Both the project cost and the project period fell within the original plan; thus, efficiency is high. On the other hand, although the volume of irrigation water delivered from Bahr Yusef Canal to the beneficiary areas increased from what it had been prior to the project's commencement, as a result of the rehabilitation of the Dahab Regulator, a target has not been achieved. Agricultural production (wheat and clover) exceeded the baselines and targets set prior to the project's commencement; thus it is presumed that this project has contributed to improved agricultural productivity to some extent. Meanwhile, according to a beneficiary survey, it is difficult to conclude that agricultural production and agricultural incomes have improved as a result of this project. Thus, the effectiveness and impact of this project are fair. On the other hand, there are no particular problems in the institutional, technical and financial aspects of the operation and maintenance of this project, and sustainability of the project's effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

The West Minia Irrigation Directorate commissions private companies to clean and remove silt from the canals (major clean-ups are conducted twice a year). However, it has been observed that farmers dump wastes the minute the silt removal/cleaning has been conducted. It is desirable that the West Minia Irrigation Directorate discuss with the West Minia Governorate and relevant municipalities the division of labor and the allocation of sufficient personnel for waste collection in the beneficiary areas, thereby exploring the establishment of an appropriate

cleaning and waste collection system together with those municipalities. Additionally, it is advised that advocacy works be conducted with a view toward preventing waste dumping by farmers.

4.2.2 Recommendations to JICA

Following completion of the New Dairut Regulator Group Construction Project, it is worth considering evaluating the impacts of Japanese assistance to the Egyptian irrigation sector, such as the rehabilitation of water intake regulators along the Bahr Yusef Canal thus far, including this project, as well as assessing improvement in agricultural productivity in all beneficiary areas along the Bahr Yusef Canal (e.g., through an impact study). Combined with the rehabilitation of the Dairut Regulator Group, it is believed that the water distribution management plan along the Bahr Yusef Canal can be improved. Positive impacts are also expected in terms of the volume of water intake and agricultural productivity among the beneficiaries near each regulator.

4.3 Lessons Learned

Enhancing Project Effects by Implementing Soft Component and Dispatching Technical Cooperation Experts

In the case of this project, although no problems were observed with the water intake function of the Dahab Regulator and water distribution from the regulator, water was unable to pass smoothly along terminal canals due to waste dumping. It would have been effective for the Japanese side to implement a soft component or dispatch technical cooperation experts with a view toward establishing a proper system for waste collection, by incorporating advocacy work within the project, such as seminars and workshops for farmers. Incorporating such soft components within the project is expected to realize regular waste collection and nurture moral behavior among farmers (not to dump waste), which will lead to a reduction in waste dumping.