Jordan

FY2022 Ex-Post Evaluation Report of Japanese Grant Aid Project

"The Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate " /

"The Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate Phase 2"

External Evaluator: Tomoko Tamura, Kaihatsu Management Consulting, Inc.

0. Summary

Two projects were evaluated in an integrated manner in this ex-post evaluation: The Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate (hereinafter referred to as "Phase 1"), and The Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate Phase 2 (hereinafter, these two projects are referred to as "the projects"). The projects supported the improvement of water supply services in Deir Alla (hereinafter referred to as "Area D") and Ain Al Basha (hereinafter referred to as "Area A") in Balqa Governorate in Jordan. The projects were originally planned as a single project - they were carried out separately after changing the plan.

Improving water supply services was a priority for Jordan at both the time of planning and ex-post evaluation of the projects, and the objectives of the projects are in line with the development policy and sectoral strategy of the country. Renewal of water supply facilities was lagging in the project areas selected; there was a high level of poverty, which indicates that consideration was given to the socially vulnerable and to equity. The project was consistent with Japan's ODA policy at the time of planning. However, the other donors' projects that were envisaged for collaboration have not been implemented, and no complementary or synergistic effects with other JICA projects or those of other donors have created. Accordingly, the relevance and coherence of the projects are high.

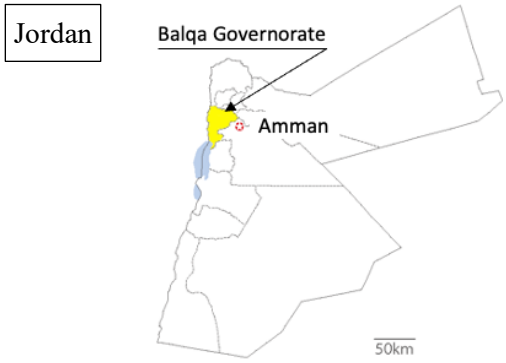
The projects developed reservoirs, pumping facilities and transmission and distribution lines generally as planned. The project cost exceeded the plan due to the provision of an additional grant. As mentioned above, construction work in the two areas had to be carried out separately. The process to change the plan took time, delayed the start of construction, and the projects significantly exceeded the planned project period. Therefore, efficiency of the projects is low.

The projects improved the volume of distribution, pressure, frequency and hours of water supply, and the volume of water consumption in the target areas. Project impacts included improved living conditions, removing concern about running out of water, and reduced the cost of electricity for both pumps and purchasing water from water lorries. The amount of electricity used for distribution pumps in Area A was reduced, contributing to rationalization of operation and maintenance. This indicates that the effectiveness and impact of the projects are high.

Regarding operation and maintenance of facilities developed by the projects - there are some minor problems with institutional arrangements, and the operation and maintenance system for the water distribution monitoring system was not in place. However, the prospects for improvement and resolution are high. Therefore, sustainability of the project effects is high.

In light of the above, the projects are evaluated to be satisfactory.

1. Project Description



Project Location

Ma'adi Reservoir (Phase 1)

Map provided by JICA; photo taken by the external evaluator.

1.1 Background

Jordan has one of the lowest levels of water resources in the world - 75% of its land is in desert areas, with an annual rainfall of less than 200 mm. The Jordanian Government planned to increase per capita water supply to an average of 100 litres per day, but actual supply averaged 60 litres - far below the target.[1] There was an urgent need to develop water sources and renew water supply facilities.

There was a rapidly growing population in the target areas of the projects, but the main water transmission and distribution pipelines had not been upgraded for 25 years. This had resulted in problems, including inadequate water supply volume, high non-revenue water ratio, excessive electricity consumption for pumps due to inappropriate water distribution design, and deteriorating water quality due to corroded transmission and distribution lines. The need to urgently upgrade water supply facilities was particularly acute in these areas, as it was likely the population would increase further due to the influx of Syrian refugees. The Government of Jordan requested grant assistance from the Japanese Government to solve these problems, mainly for construction of distribution reservoirs and renewal of transmission and distribution pipelines.

1.2 Project Outline

The objective of these projects is to improve water supply services at Areas D and A in Balqa Governorate, by improving transmission and distribution networks, optimizing water pressure, extending hours of water supply, improving water quality, reducing non-revenue water ratio, increasing efficiency of power consumption and others, thereby contributing to improving the living environment of the local community.

[1] In 2014. Jordan Response Plan 2017-2019, p58. Water for life, Jordan's Water Strategy 2008-2022, p3.

Item	Phase 1	Phase 2
Grant Limit / Actual Grant Amount	2,238 million yen/ 1,841 million yen	1,391 million yen/ 1,247 million yen
Exchange of Notes Date / Grant Agreement Date	November 2014/ November 2014	August 2017/ August 2017
Executing Agency	Water Authority of Jordan (WAJ)	
Project Completion	November 2019	January 2020
Target Area	Deir Alla (Area D)	Ain Al Basha (Area A)
Main Contractor(s)	Dai Nippon Construction Co., Ltd.	
Main Consultant	TEC International Co., Ltd.	
Preparatory Survey	February 2013 – March 2014	
Related Projects	None	

[Background of implementation of Phases 1 and 2]

The original plan was to upgrade water supply facilities in Areas D and A (Figure 1) under a project titled "The Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate". However, two companies that had expressed an interest declined to bid in the first round of tendering for work in these areas. Only one company submitted a bid in the second round of tendering. This failed because the bid price exceeded the estimated price, and implementation of the works was no longer feasible. This was mainly due to Japanese companies' concern about local security, because there were terrorist activities by the Islamic militant group ISIL at the time, foreign exchange fluctuations, the rising cost of construction materials, equipment and labor due to the booming Japanese construction industry, the fact that only a few Japanese companies were working in Jordan and the Middle East region, and lack of price reduction effects from competition as a result of the single-company tendering.

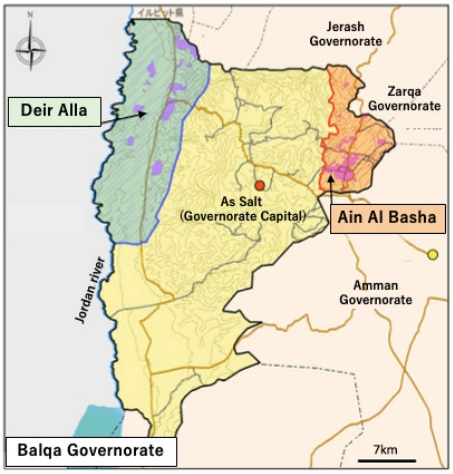


Figure 1: Project Area
(Source: Preparatory Survey Report)

Another factor that affected the willingness of Japanese companies to bid for the project was that the two construction areas in the project were 40 km apart. This meant that supervising construction in these two areas would require a lot of cost and time, and it would be difficult to allocate their staff efficiently.

Taking the above into account, and with the agreement of both countries, the plan was changed. An additional grant was provided so that construction work in Area D would be carried out in phase 1, and construction work in Area A in phase 2.

2. Outline of the Evaluation Study

2.1 External Evaluator

Tomoko Tamura, Kaihatsu Management Consulting, Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study:	December 2022 - March 2024
Duration of the Field Study:	February 20th, 2023 - March 8th, 2023,
	July 19th, 2023 - July 26th, 2023

[Integrated Evaluation]

In this integrated evaluation, the external evaluator first studied information, achievement and current situation of each project, and then evaluated them together, for relevance, coherence, effectiveness and sustainability. Regarding efficiency, the outputs, project costs and project duration of phase 1 were regarded as the outputs, project costs and project duration for the project as a whole. This is because, although what was originally planned as one project had been split into two, the project scope had not changed. For the actual outputs and project cost, the total of the two projects was considered as the actual. For the project period, the period throughout the two projects was considered as the actual. This is because the two projects can be regarded as being implemented as one - the detailed design of phase 2 was carried out in phase 1, the construction of the first and second phases were carried out at the same time, and the technical training (soft component) were implemented together. For each evaluation criterion, the two projects were evaluated as one and given sub-ratings; an overall evaluation and rating were given based on the sub-ratings.

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

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

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Jordan

Both at the time of planning and ex-post evaluation of the projects, the country's development policies, including the National Agenda (2006-2015) and Jordan 2025 (2016-2025), and the sector strategy, Jordan Water Strategy (2008-2022 and 2016-2025), identified the water sector as an important area, and aimed to provide safe drinking water. The projects' objective of improving water supply services was consistent with these development policies and the plans of the country throughout, from planning to ex-post evaluation.

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

[3] ④: Very High, ③: High, ②: Moderately Low, ①: Low

3.1.1.2 Consistency with the Development Needs of Jordan

As mentioned in “1.1 Project Outline”, at the time of planning the project there was a great need and urgency to upgrade water supply facilities in both the country and target area. At the time of the ex-post evaluation, the improvement of water supply services in order to efficiently distribute limited water resources was still an important need in the country. Water supply services were an essential service for population in the target areas both at the time of planning and during the ex-post evaluation. Without water supply, their only option is to purchase water from water lorries. The facilities constructed under the projects are important and indispensable facilities, which support water supply services in the target area. The total population of Area A and B was approximately 220,000 at the time of planning but had increased to approximately 290,000 at the time of the post-evaluation. Demand for water had increased in line with population growth. From this, it is viewed that there was still a need for the facility at the time of the ex-post evaluation.

Thus, the projects were consistent with the development needs of the country and the target area, both at the time of planning and ex-post evaluation. There were also considerations regarding socially vulnerable people and equity, as the projects selected areas where replacement of water supply facilities was lagging, and the level of poverty was high.

3.1.1.3 Appropriateness of the Project Plan and Approach

As mentioned in “1.2 Project Outline”, the project plan was divided into two with the consent of both countries because of the unsuccessful bidding, mainly due to unpredictable matters such as deteriorating security situation in the country and exchange rate fluctuations; and the fact that the original plan included construction work in two distant locations, making efficient construction management and personnel allocation difficult. This arrangement was necessary and appropriate.

A gravity flow distribution system had been found effective in reducing electricity consumption in a similar project conducted in Jordan, “The Project for Improvement of the Water Supply for the Zarqa District Phase I/II,” which was implemented from 2002 and 2005. Taking this lesson learned from the earlier project, a gravity flow distribution system was introduced into these projects, and was found to have been effective in reducing electricity consumption (see the section of “Effectiveness” in this report). The plan and approach of the projects was appropriate.

3.1.2 Coherence (Rating: ②)

3.1.2.1 Consistency with Japan’s ODA Policy

Phase 1 corresponds to the specific measure "Programs for Use of Efficient Water Resources" of the development issue "Sustainable Management of Resources and Environmental Conservation" of the priority area "Promoting Autonomous and Sustainable Economic Growth" in Japan's Country Assistance Policy for Jordan (June 2012). Phase 2 corresponds to the specific

measure “Programs for Measures for Climate Change, Efficient and Sustainable Use and Management of Resources” of the development issue "Measures for Climate Change, Efficient and Sustainable Use and Management of Resources" of the priority area "Promoting Autonomous and Sustainable Economic Growth" in Japan's Country Assistance Policy for Jordan (August 2017). The projects were thus in line with Japan's ODA Policy at the time of planning.

3.1.2.2 Internal Coherence

Synergy and complementarity with other JICA projects were not planned and was not realized.

3.1.2.3 External Coherence

According to the ex-ante evaluation of the projects, other donors were planning projects at the time of planning, which included a project to upgrade distribution pipelines in Area D with support from the Gulf countries, and a secondary distribution networks in Area A with support from KfW (Kreditanstalt für Wiederaufbau, Reconstruction Credit Institute). As this project and these projects could be complementary to each other, it was planned to implement the projects while sharing information with each other.

At the time of the ex-post evaluation, the external evaluator tried to find out about the planned project that would be supported by Gulf countries, but could not find its name, duration, content or supporting agencies. It is therefore not clear if it was implemented. The name and duration of the planned KfW projects were also not known. No projects with similar content were being implemented during project implementation and at the time of the ex-post evaluation. According to WAJ, during the ex-post-evaluation, KfW was planning to support the renewal of the transmission pipeline from the Zai water treatment plant (see Figure 3), the source of water in Area A, to Area A; however, it was not clear if this was the planned project. From this, it is concluded that the projects referred to in the ex-ante evaluation have not been implemented and that no complementary or synergistic effects between the projects and other donors' projects have been created.

The projects were highly consistent with Jordan's development policy and development needs, and there were no problems with the project plan or approach. Although the project was consistent with Japan's ODA policy at the time of planning, it had not created any complementary or synergistic effects with other JICA projects or projects of other donors. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

Transmission and distribution lines, water pumps and distribution reservoirs have been

constructed as planned (Table 1, Figures 2 and 3). Actuals of the distribution reservoirs and water pump facilities are as planned. The extension of transmission and distribution pipelines reduced slightly - 16% reduction in total in the two areas.

The reduced extension of transmission and distribution pipelines in Area D was due to canceling the renewal of a distribution pipeline that separates the Ma'adi distribution zone from the Rajeb distribution zone, which is located outside the target area of the projects. This was because canceling the renewal was found not to affect water distribution to the target area of the projects. At that time details of the renewal in Area D were being reviewed, with the aim of avoiding a shortfall in project costs due to foreign exchange fluctuations.

The reduction in the extension of transmission and distribution pipelines in Area A was due to canceling the laying of 500 mm diameter distribution pipelines to the Al Baqa camp. The excavation survey carried out prior to construction found that the diameter of the distribution pipeline, which had been believed to be 300 mm, was 500 mm; this meant it was not necessary to lay the 500 mm diameter distribution pipelines.

As shown above, the reduction in the transmission and distribution pipe extension was the result of changes made based on the findings of review and investigations during detailed design and construction. These considered that the changes would not affect the facility operation or the effectiveness of the projects. It was confirmed during the ex-post evaluation that these changes did not affect the facility operation or the effectiveness of the projects.

Table 1: Planned and Actual Construction of the Main Facility in the Projects

Area	Planned	Actual	Planned vs. Actual
Area D Phase1	・ Transmission pipelines: 7,742 m ・ Distribution pipelines: 7,418 m ・ Total: 15,160 m	・ Transmission pipelines: 7,852 m ・ Distribution pipelines: 6,307 m ・ Total: 14,159 m	・ Transmission pipelines: 110 m more ・ Distribution pipelines:1,111 m less ・ Total: 1,001 m less （decreased by 7%） ・ Reason: Canceling replacement distribution pipeline separating Rajeb distribution zone
	・ Ma'adi pump station: Transmission pump 3 nos.	・ Ma'adi pump station: Transmission pump 3 nos.	・ As planned
	・ Ma'adi reservoir: 3,300 m^3	・ Ma'adi reservoir: 3,300 m^3	・ As planned

Area	Planned	Actual	Planned vs. Actual
Area A Phase 2	・ Transmission pipelines: 11,780 m ・ Distribution pipelines: 8,300 m ・ Total: 20,080 m	・ Transmission pipelines: 10,344 m ・ Distribution pipelines: 5,000 m ・ Total: 15,344 m	・ Transmission pipelines: 1,436 m less ・ Distribution pipelines: 3,300 m less ・ Total: 4,736 m less (decreased by 24%) Reason: Canceling installation of distribution pipeline to Al Baqa Camp
	・ Abu Nussair 1 reservoir: 900 m^3	・ Abu Nussair 1 reservoir: 900 m^3	・ As planned
	・ Abu Nussair 2 reservoir: 1,100 m^3	・ Abu Nussair 2 reservoir: 1,100 m^3	・ As planned

Source: Documents provided by JICA and the executing agency, field survey

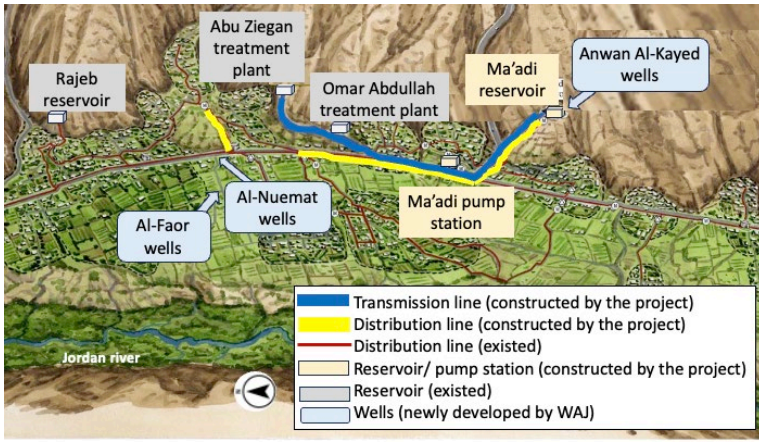


Figure 2: Location of the Facility in Area D

(Source: Prepared by external evaluator based on the Preparatory Survey Report)

Ma'adi Pump Station

Photo taken by the external evaluator

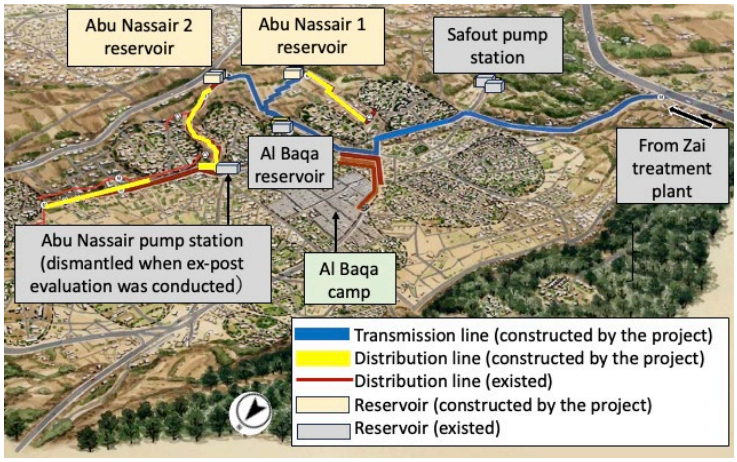


Figure 3: Location of the Facility in Area A

(Source: Prepared by external evaluator based on the Preparatory Survey Report)

Abu Nussair 1 Reservoir

Photo taken by the external evaluator

In addition to the main facilities listed in Table 1, a distribution monitoring system was installed as an ancillary facility to measure water distribution volumes in each distribution zone. This includes equipment, such as flow meters with data loggers (15 in Area D and 7 in Area A), and PC monitors (one in each area). The flow and water pressure measured by the flow meters are transmitted via the internet to servers at both area offices and WAJ's IT Department, where the measurements can be reviewed and compiled using a web-based application.

Consulting services were implemented as planned. The technical training, which included guidance on water transmission and distribution data management, non-revenue water calculations and water supply pressure management using the above-mentioned monitoring system, was implemented as planned. There were no problems with the method of guidance; it was effectively implemented, and the expected results were achieved.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost was 2,238 million yen from Japan and 33 million yen from Jordan, totaling 2,271 million yen. The actual project cost was 3,087 million yen from Japan and 5 million yen from Jordan, totaling 3,092 million yen. The actual cost exceeded the plan (136%). The reason why the actual project cost from Japan exceeded the plan was due to the additional grant, as described in "1.2 Project Outline" of this report. The reason why the project costs from Jordan were significantly lower than planned was not clear.

3.2.2.2 Project Period

The planned project period was 30 months; from December 2014 to May 2017. The actual project period was 63 months, from November 2014 to January 2020. The actual period significantly exceeded the plan (210%) (Table 2).[4] The main reason for the delay was that it took 35 months from the start of the project to the start of construction of Phase 1, which was in October 2017, due to unsuccessful tenders and the need to split the project plan into two, as described in "1.2 Project Outline" of this report.

Table 2: Plan and Actual of the Project Period

Item	Planned	Actual		
		Phase 1	Phase 2	Phase 1 and 2 in total
Start	December 2014	November 2014	August 2017	November 2014
Completion	May 2017	November 2019	January 2020	January 2020
Period	30 months	61 months	30 months	63 months

[4] Signing the grant agreement was regarded as the start of the projects, and starting to use the facility was regarded as project completion, for both planned and actual.

Outputs were slightly lower than planned, the project cost exceeded what was planned, and the project period significantly exceeded the plan. Therefore, efficiency of the projects is low.

3.3 Effectiveness and Impacts[5] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The projects set the water supply pressure, average daily water distribution and electricity consumption as operation and effect indicators to measure if the projects achieved their objective of improvement of water supply services. The following improvements were expected.

- Improvement in water supply pressure: It was expected that the water supply would be implemented at an appropriate pressure, as a result of the projects constructing new distribution pumps and reservoirs, and installing or renewing transmission and distribution pipelines. Water would reach areas that had been difficult to reach, including those far from the distribution reservoirs and transmission pipelines, and where transmission and distribution pipelines were old and had deteriorated.
- Increase in average daily water distribution: At the time of planning, WAJ was planning to develop water sources and increase the volume of water transmitted to the target area. It was expected that the projects would construct and renew transmission and distribution facilities, the transmission and distribution capacity in the target area would increase, and an increased volume of water would be delivered appropriately.
- Reduction in electricity consumption: It was expected that a gravity flow distribution system would be used, removing the need to operate existing water distribution pumps, and thereby reducing electricity consumption in Area A.[6] It is appropriate to use electricity consumption as an indicator of project effectiveness in Area A. It was also expected that a gravity flow distribution system would be used in Area D, removing the need to use existing pumps to boost pressure, but the reduction in electricity consumption was expected to be small as a new water distribution pump station would be constructed. Electricity consumption can be used as an indicator of the effectiveness of the projects in Area D, but it is less important as the expected decrease was small. In both areas, electricity consumption per unit of water distribution was set as an indicator to measure the improvement more accurately, and to consider the increase in electricity consumption due to increased water distribution.

[5] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

[6] At the time of planning, electricity consumption was set as an operation and effect indicator in Area D as well; however, the expected reduction was marginal (baseline value - 0.688 kWh/m^3 , target value - 0.611 kWh/m^3). This was because the cost of electricity for the new water distribution pump would be added, although there would be no need to operate the existing pressure-boosting pumps as a result of introducing the gravity flow distribution system.

[Operation and Effect Indicators of Area D]

Area D partly achieved its target for water supply pressure and met its target for daily average amount of water distributed (Table 3). Although actual figures were not available for electricity consumption, the target was judged not to have been achieved because the planned suspension of use of pressure boosting pumps has not been realized.

Table 3: Plan and Actual of the Operation and Effect Indicators of Area D

Indicators	Baseline value	Target value	Actual value			Status of achievement (% achieved)
	2012	2022	2020	2021	2022	
		3 years after completion	1 year after completion	2 years after completion	3 years after completion	
Water Supply Pressure (bar)	0.01 – 3.0	**0.1 - 0.7**	n/a	n/a	**0.0 - 1.5**	Partially achieved
Daily average water distribution (m^3/day)	8.900	**9,100**	13,637	19,751	**19,758**	Achieved (217%)
Electricity Consumption (kWh/m^3)	0.688	**0.611**	n/a	n/a	**n/a**	Deemed not achieved

Source: Documents provided by executing agency

Notes:

1) Water supply pressure was measured in 10 distribution zones in Area D at the time of the ex-post evaluation in February 2023.
2) The daily average water distribution and electricity consumption are values for the entire city of Deir Alla, inclusive of the target area, both at the time of planning and ex-post evaluation. At the time of planning, the values for the entire city were used as representative values for the target area of the projects, because the value for only the target area was not known.
3) It was found that the amount of distribution for the period from January 2023 to June 2023 in Area D was 18,214 m^3/day, as per the study conducted during the second field survey of the evaluation. This value was not included in the table above because the summer months (July-September), when water use is high, were not included in this amount, and it was not useful for estimating trends after the target year.

- Improvement in water supply pressure: The target was partially achieved. Water supply pressure in seven out of ten zones in Area D was between 0.2 bar and 1.5 bar, which was on target; it was lower than 0.1 bar in three zones, which was not on target. The reason why some distribution zones had not improved their water supply pressure in line with the target is that there are old asbestos transmission pipelines in these zones. WAJ has to supply water at a lower pressure by using pressure-reducing valves to prevent the pipelines from bursting.[7]

[7] It was known at the time of planning that the performance of the old asbestos pipes had deteriorated; however, it was difficult to accurately determine their pressure resistance as they were buried underground. The asbestos pipes burst in several locations during the water flow tests after the facility construction was completed. It was therefore decided to use pressure-reducing valves to reduce the distribution water pressure in these locations to avoid bursting. These valves were installed by the projects to avoid the risk of bursting the asbestos pipes. In Area D, 2.6 km of old asbestos pipes

- Increase in daily average water distribution: The target was achieved (217% achieved). As planned, more water can be supplied using the pumping facilities constructed under the projects. The increase in water supply was well above the target because of the synergistic effect of the construction of the facilities by the projects, which increased the amount of water delivered to the target area as expected, and the development of new wells in the area by WAJ, which was not foreseen at the time of planning.[8]
- Reduction in electricity consumption: Although actual data on electricity consumption was not available, it can be assumed that the reduction in electricity consumption has not been achieved. The planned suspension of the use of pressure-boosting pumps, which was envisaged at the time of planning, has not been realized, and there were no major initiatives for reducing the electricity consumption. The indicator is judged not to have been achieved.

[Operation and Effect Indicators of Area A]

Area A achieved its targets for water supply pressure and daily average water distribution; and almost achieved its target for electricity consumption (Table 4).

Table 4: Plan and Actual of the Operation and Effect Indicators of Area A

Indicators	Baseline value	Target value	Actual value			Status of achievement (% achieved)
	2012	2022	2020	2021	2022	
		3 years after completion	1 year after completion	2 years after completion	3 years after completion	
Water Supply Pressure (bar)	0.01 – 2.0	**0.1 – 0.7**	n/a	n/a	**0.5 – 2.0**	Achieved
Daily average water distribution amount (m^3/day)	20,000	**27,200**	n/a	30,435	**34,315**	Achieved (126%)
Electricity Consumption (kWh/m^3)	0.458	**0.239**	n/a	0.474	**0.277**	Almost achieved (83%)

Source: Documents provided by executing agency

Notes: 1) Water supply pressure was measured in 11 distribution zones in Area A at the time of the ex-post evaluation in February 2023. Area A has many differences in elevation, and the water supply pressure is set higher in low areas to deliver water to higher areas. Water supply pressure was higher than the target in these areas.

2) Average daily water volume of distribution and electricity consumption are values for the entire city of Ain Al Basha, including the target area, both at the time of planning and ex-post evaluation for the same reason as for Area D.

3) It was found that the volume of distribution for the period from January to June 2023 in Area A was 31,249 m^3/day, as per the study conducted during the second field survey. This value was not included in the table above for the same reason as for Area D.

in the target area were renewed under the projects, and 2.5 km were renewed using WAJ's budget after the projects were completed. 3 km has not yet been renewed.

[8] The Al-Nuemat and Anwan Al-Kayd wells, and Al-Faor wells, started transmission to Area D from 2021 and 2022 respectively (see Figure 2 for location of the wells).

- Improvement in water supply pressure: The target was achieved. All distribution zones had water supply pressure of 0.5- 2.0 bar. The projects have resulted in water distribution using the gravity flow distribution system as planned, the transmission and distribution pipelines have been improved, and the water supply pressure has been improved.
- Increase in daily average water distribution amount: The target was achieved (126% achieved). The amount of water distributed increased more than the target because more water can now be supplied using the Abu Nussair 1 and 2 distribution reservoirs and transmission lines constructed under the projects as planned. The increase in volume of transmission expected at the time of planning was also realized.
- Reduction in electricity consumption: The target was almost achieved. Gravity flow distribution was realized as expected, and electricity consumption per unit of water distributed decreased from 0.459 kWh/m^3 at the time of planning, to 0.277 kWh/m^3 in 2022 at the time of the ex-post evaluation. Comparing the targeted reduction of 0.220 kWh/m^3 with the actual reduction of 0.183 kWh/m^3, the target has been 83% achieved (Fig. 4). In March 2023, pumping by the Abu Nussair pumping station was stopped, as they were able to distribute water using gravity flow to the entire target area. Therefore, a further reduction in electricity consumption is expected from 2023 onwards. For reference, the electricity consumption per unit of water distributed from January 2023 to June 2023 was 0.137 kWh/m^3.

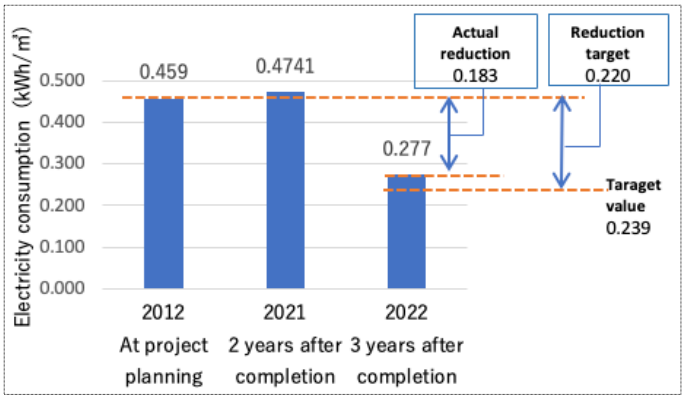


Figure 4: Electricity Consumption and Target Achievement Status in Area A

Source: Illustrated by external evaluator based on electricity consumption data provided by the executing agency.

The projects were completed in January 2020, but electricity consumption did not decrease until 2022. This was because WAJ's office in Area A could not switch to the gravity flow distribution system for the entire target area immediately after the projects were completed. After completion of the projects, they distributed water using a gravity flow distribution system, and found they could not deliver water to houses in several locations. Therefore, they had to continue to pump water to these locations until this problem was solved. The main reason for the failure to deliver water to the houses was the small diameter or age of the distribution pipeline networks in

these locations. They identified the locations that had problems through site inspections, renewed the distribution networks, and conducted testing to see if water was delivered by the gravity flow distribution system. They repeated this process in various locations and completed it in March 2023. Only then were they able to distribute water by gravity flow to the entire project area.

The annual electricity cost for pumping water in Area A was 600,253 JD[9] in the year of project completion in 2020, and 332,697 JD in the year of ex-post evaluation in 2022, a reduction of 267,556 JD (approximately 50 million yen[10]). The projects had made a significant contribution to cost savings for the offices.

3.3.1.2 Qualitative Effects (Other Effects)

In addition to the operation and effect indicators presented above, ways to improve the water supply services were studied in detail in this evaluation. This included analyzing changes in water supply frequency, supply hours and pressure through beneficiary surveys,[11] studying data provided by the relevant offices in each area and conducting interviews with the directors of the two offices. As a result, it was confirmed that there were improvements in water supply pressure, frequency, hours, and volume of consumption in the target areas, as shown below.

[Improvement of Water Supply Services]

79% (22 households) in Area D, 60% (18 households) in Area A, and 69% (40 households) in these areas combined answered "water supply services have improved in the last couple of years" when we asked this question in the beneficiary survey (Figure 5). The most common improvement was in water supply pressure (36 households), followed by water quantity (25 households), frequency of water supply (24 households), duration of water supply (22 households) and water quality (3 households) (Figure 6). Households in Area D mentioned improved water quality. Staff from the office of Area D explained that, before the projects were completed, rust in the aging

[9] JD is the local currency in Jordan, the Jordanian dinar.

[10] Calculated using the IMF average rate for 2022: 1USD = 0.7JD, 1USD = 131.5JPY.

[11] A household survey and case studies were conducted with beneficiaries. For the household survey, a total of 60 households, 30 in each area, were visited and interviewed. The number of households having a water supply connection in the distribution zones in the two areas were provided by the area offices. The sample size for the distribution zones was determined in proportion to these numbers. Area D excluded 2 of the 30 households for which information was collected from the analysis, as they were not considered to be suitable samples (One of the households was in a special situation, where the son of the household head was a water truck driver and always had access to water. In another household, the respondent was very dissatisfied with the government or government officials and was likely to indicate a negative response to the question on purpose). The total sample size was therefore 58 households. In Area D, a list of consumers was obtained, and random sampling was conducted. In Area A, consumer information was maintained on a GIS map; therefore, samples were selected using the quota sampling method by looking at the location of the consumer households in the GIS maps. The external evaluator conducted face-to-face interviews with the sample households using a questionnaire, with assistance from staff of the area offices. If the sample household was absent or did not participate in the survey, the nearest household was included in the survey. One person from each household responded. The demographics of the respondents were 14 females and 44 males. The age distribution was 15 respondents aged 39 years or younger, 16 respondents in their 40s, 15 respondents in their 50s, 10 respondents aged 60 years or older, and 2 respondents did not respond their ages. The average age of respondents was 49 years old.

asbestos pipes sometimes got into the water, and this problem was solved with the replacement of these pipes by the projects.

[Frequency of Water Supply]

We asked how many times each week water was supplied at the time of the ex-post evaluation and in 2019. On average it had increased from 0.9 to 1.1 times in Area D, and from 1.2 to 1.3 times in Area A (Figure 7).

[Hours of Supply]

We also asked for how many hours water was supplied each week. On average this had increased from 23 to 28 hours in Area D, and from 40 to 44 hours in Area A (Figure 8).

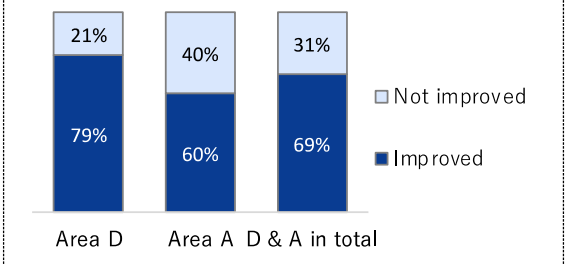


Figure 5: Improvement of Water Supply Services (n=58)

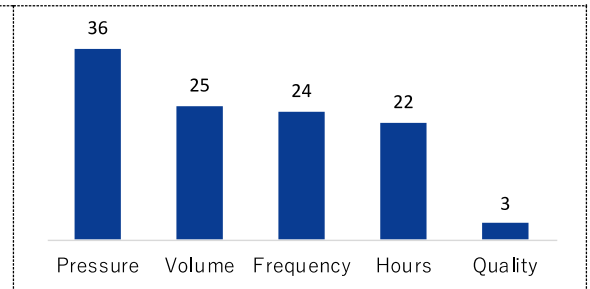


Figure 6: Items improved

(Unit: households, n=40, multiple answers allowed)

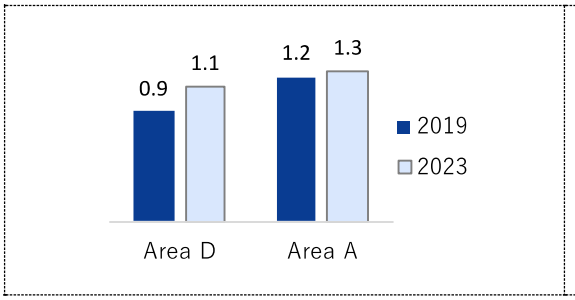


Figure 7: Frequency of Supply per week

(Unit: Times/week, n=58)

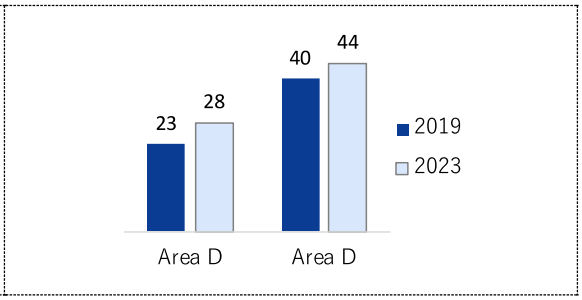


Figure 8: Hours of Supply per Week

(Unit: Hours/week, n=58)

Source: Beneficiary Survey

[Volume of Water Consumption]

It was found that average monthly water consumption had increased from 12.7 m^3 to 14.3 m^3 in Area D, and from 9.6 m^3 to 14.0 m^3 in Area A, when we compared the results of the beneficiary household survey with the results of the preparatory survey[12] conducted at the time of planning and analyzed whether there had been any changes. (Figure 9)

[12] A total of 300 households, 165 in Area A and 135 in Area D, were interviewed in March 2013 (Preparatory Survey Report).

[Satisfaction with Water Supply Services]

When we asked households in the beneficiary survey about their satisfaction with water supply services, 82% in these areas said they were satisfied (24.5 households in Area D and 23 households in Area A). This is the average of the results of questions for summer and winter. [14] In the preparatory survey, 2% (3 households) in Area D and 33% (54 households) in Area A answered "satisfied" to the same question. The proportion of households satisfied with water supply services increased significantly (Figure 10).

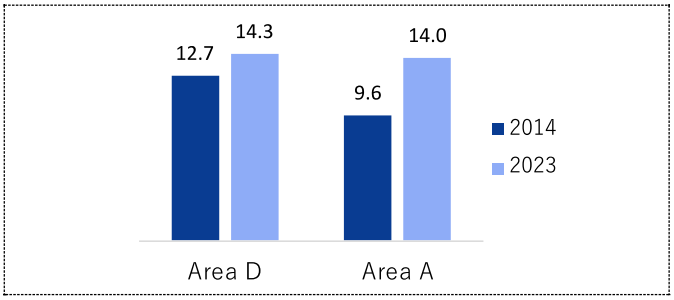


Figure 9: Average Monthly Water Consumption

(Unit: m^3/month, n=300 for 2014, n=58 for 2023)

Sources: Preparatory Survey Report for 2014 and Beneficiary Survey for 2023 [13]

[Sufficiency of Water Supply]

When we asked, "Do you currently get enough water for your daily needs from your water supply services?" in the household survey, 89% (25 households) in Area D, 97% (29 households) in Area A, and 93% (54 households) in these areas combined, answered 'yes' (Figure 11). [15] The sufficiency of water supply is high.

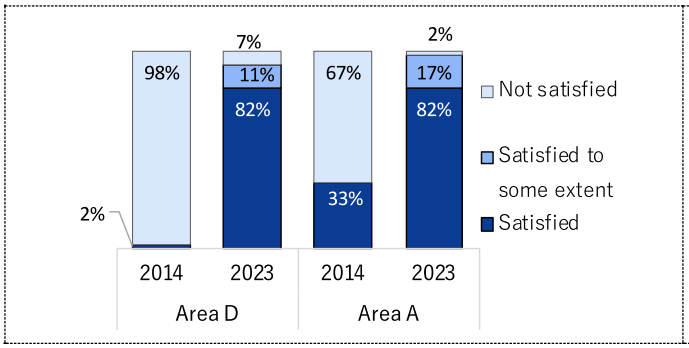


Figure 10: Satisfaction with the Water Supply Services

(n=300 for 2014, n=58 for 2023)

Sources: Preparatory Survey Report for 2014 and Beneficiary Survey for 2023

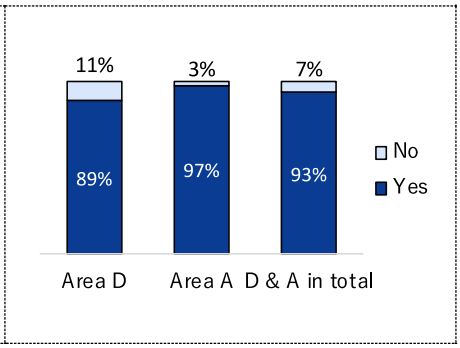


Figure 11: Sufficiency of Water Supply (n=58)

Source: Beneficiary Survey

[13] Water consumption was calculated by asking the question "What is your average water consumption over the last three months?" and dividing the answer by three. We asked in this way because water bills are read once every three months in the target areas. Data on water consumption by individual households was used if it was available with the staff of WAJ or Miyahuna who were accompanying the household survey.

[14] The option "partially satisfied" was not provided in the survey conducted in 2014. In the household survey conducted in the ex-post evaluation, this option was provided because several households indicated that they were satisfied in the winter but dissatisfied in the summer. In the household survey in the ex-post evaluation, questions were asked about summer and winter and the average of the responses was used for analysis; the number of households is 24.5 instead of 25 because it is an average.

[15] Questions were asked for summer and winter, and the average of the responses was used for analysis.

[Complaint]

We also asked about complaints in the household survey. The proportion of households that answered 'Yes' to the question 'Have you notified the water utility of a complaint in the past year?' was 64% (18 households) in Area D, and 47% (14 households) in Area A (Figure 12). The most common complaint was 'notified of leakage from roadside distribution pipelines (18 households)', followed by water pressure (7 households) and water quantity (4 households). It seems that the proportion of households that reported a complaint had increased, as in the preparation survey 39% (53 households) in Area D and 35% (58 households) in Area A reported a complaint.

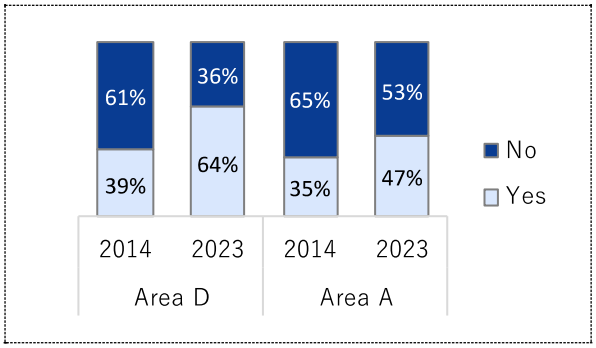


Figure 12: Complaints in the past One Year

(n=300 for 2014, n=58 for 2023)

Sources: Preparatory Survey Report for 2014 and Beneficiary Survey for 2023

[Non-Revenue Water Ratio]

The non-revenue water ratio in 2022 was confirmed with both district offices, and was 56% in Area D and 57% in Area A. We attempted an analysis of the contribution of the projects but could not do this as reliable figures of non-revenue water ratio at the time of planning or prior to the completion of the projects were not available.

[Number of Household Using Water Supply]

The number of households using the water supply before and after completion of the projects was provided by the offices for these areas. It increased from 3,855 in 2018 (before completion of the projects) to 4,337 in 2022 at the time of the ex-post evaluation in Area D. Similarly, it had increased from 12,384 in 2018 to 14,970 in 2022 in Area A.[16] The Director of these area offices explained that the increase in water distribution capacity due to the projects contributed to the increase in the number of user households.

[Rationalization of maintenance and management of water supply facilities]

The projects also contributed to rationalization of the maintenance and management of water supply facilities. As mentioned above, in Area A the projects enabled the area office to distribute water by a gravity flow distribution system, which significantly reduced electricity costs for pumping. In addition, the directors of both area offices said they earlier had to frequently repair leakages from aging pipelines. However, this work was no longer needed on the transmission and distribution pipelines renewed by the projects. Reducing leakage contributes to the efficient distribution of limited water resources.

[16] This information comes from a document provided from the two area offices and is as of March 2023.

3.3.2 Impacts

3.3.2.1 Intended Impacts

"Improved living conditions for local residents through improved water supply services" was expected to be an impact of the projects. The following impacts were found to have been realized when we asked the respondents of the household survey, who mentioned that their water supply services had improved. (Figure 13)

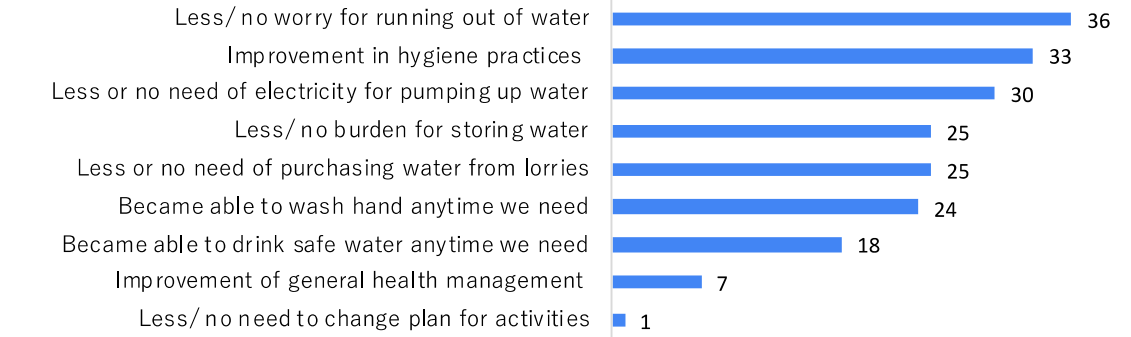


Figure 13: Changes in Living Environment due to Improvement in Water Supply Services[17]

(Unit: households, n=40, multiple answers allowed)

Source: Beneficiary Survey

Case studies were conducted with general households to identify examples of improved living conditions.[18] The following is a summary of an interview with a household with five members – parents and their three children.

[17] Validity of an abbreviated individual water insecurity experiences (IWISE-4) - Scale for measuring the prevalence of water insecurity in low- and middle-income countries, Hilary J. Bethancourt, Edward A. Frongillo, and Sera L. Young, Journal of Water, Sanitation & Hygiene for Development, IWA publishing, 2022 (iwaponline.com) was referred to when developing the questionnaire for the household survey on changes in living environment.

[18] Two general households in Area D were visited for the survey in February 2023.

Case Study: A General Household in Al-Balad, Ma'adi distribution zone, Area D

Until 2019, water was only supplied once every two weeks. We used to purchase water from a water lorry, because it was not enough. Currently, we have 24-hour water supply once a week, and sufficient water pressure and quantity. It is a great help for our household economy because we no longer need to purchase expensive water from water lorries.[19] We are also happy that the household electricity bill has been reduced by around 25%, as for about the last two years water can be lifted to the tank without using a pump. We used a pump previously since water pressure was low. It was removed as it is no longer used.

It is also helpful that the water is supplied on a fixed day. Before, I had to wait patiently for water to be supplied, and sometimes missed a chance to go out. Things now go according to what I plan, and I can do washing and cleaning when I need to. I no longer have the mental burden of storing water or worry of running out of water.

I am satisfied with the water supply service. It would be even better if there was water supply two days a week.

Interview with the household

The house and water tanks of the household

Source: Photos taken during the ex-post evaluation.

It was also found from case studies conducted with schools, hospitals and other public facilities that the projects have improved the frequency and water pressure of the water supply, ensuring that water is always available, and that education and health services are provided without disruption.[20] The projects also brought economic benefits, including a reduction in electricity costs and expenses, because they can store water in rooftop tanks without a pump because of the increased water pressure, and they no longer need to purchase water from water lorries.

Water quality has improved in Area D, increasing safety, and reducing the frequency of filter changes in the purifier, leading to cost savings. An example of the case studies is given below.

[19] WAJ officials explained that water rates for water lorries can be ten times higher than the rate for piped water supply, especially in summer when water use is high.

[20] For case studies of public facilities and business establishments, a total of five sites were visited in the target areas - two schools, one health center, one hospital and one factory; face-to-face interviews were conducted according to pre-prepared interview guidelines. The sites visited were purposively selected based on recommendations from the respective offices in the areas, on the condition that water consumption was relatively high, and that the responsible person for the facility can explain the situation before and after the projects.

Case Study: Princess Iman General Hospital in Area D

The hospital is a 60-bed general hospital with specialised outpatient clinics, internal medicine, surgery, obstetrics and gynecology, ICU, laboratories, an imaging laboratory, an operating theater, dialysis rooms and an emergency department. The facility management manager was interviewed in March 2023 about the water supply situation before and after the implementation of the projects.

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Previously, we had water supply only once every two weeks. We called a water lorry in every two days because water quickly ran out. Water lorries were sent on a priority basis as this is a hospital; therefore, we never ran out of water. However, we always felt nervous, as if we were in an emergency. The water filters had to be changed frequently because the tap water sometimes contained dust and mud.

We have received a constant water supply since the JICA project was completed about two years ago. There is no longer any worry or mental stress about running out of water. There is no need to call a water lorry. The water quality is good, and is sufficient to supply raw water for dialysis, sterilization rooms and laboratories. We are very grateful for these improved water services.

Water purification plant for dialysis rooms, sterilization rooms and laboratories

Princess Iman General Hospital

Source: Photos taken during ex-post evaluation.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

The projects were classified as category C, based on the JICA Guidelines for Environmental and Social Consideration (April 2010), since they had minimal undesirable impacts on the environment. Considerations were made as planned regarding noise, vibration, waste, drainage and sewage treatment, safety, accidents, traffic, and water cut-offs during construction, and there were no negative environmental impacts, problems, or complaints.

2) Resettlement and Land Acquisition

There was no resettlement. There were two land acquisitions, both of which were completed through formal procedures. Complaints were lodged by residents of adjacent land regarding the construction of the Abu Nussair 2 distribution reservoir in the Phase 2. These were settled by changing the location and specifications for construction of the reservoir. There were no problems with this settlement.

3) Gender Equality

In the household survey, 27 households (69%) stated that the improved water supply services had solved some problems faced by women in the household, with specific examples given as “I no longer worry about running out of water”, and “I no longer have a problem finding water for cleaning and household work”. Another respondent stated that they were "free to go out, pick up their children from school and do other work". However, some respondents said that this was not limited to women but applied equally to men.

4) Marginalized People

The case studies confirmed that there are some households where water was not supplied properly or at all, due to their location at the end of the distribution networks or at high altitude; these are now supplied with water because of the projects. The household survey confirmed that the projects have also brought benefits to Palestinian refugee camps, where the size of the household is relatively high, poorer areas and densely populated. The evaluation thus found that the projects had an impact on residents who had not been receiving adequate water services or were left out of water services due to geographical factors, poverty, housing conditions and other factors.

5) Social Systems and Norms, Human Well-being, and Human Rights

Household surveys and case studies identified examples of the impact of the projects on improved water supply services, which have freed households from the worry and psychological stress of running out of water.

This project has mostly achieved its objectives. Therefore, effectiveness and impacts of the projects are high.

Analysis with a viewpoint of “Leave No One Left Behind (LNOB)”

[Equal benefits for the poor]

In the survey conducted for this evaluation, the households were categorized into low-income (21 households), middle-income (23 households) and high-income (14 households) groups to study and analyze whether the effects of the projects equally benefitted low-income groups from the perspective of “Leave No One Left Behind.”[21] The survey results showed that

[21] Income levels were estimated from the housing situation and environment of sample households as a simple method that can maintain a certain degree of objectivity and uniformity, because there were no statistics available on the income and expenditure of households in the project areas. First, based on the opinions and information provided by the area offices and the research assistant for this evaluation, characteristics on housing conditions and housing environment of low-, middle-, and high-income households were identified. Then, during visits to the households, the evaluator and research assistant observed the housing situation and living environment of each household. The income levels of the sample households were comprehensively determined and classified, not only by the above-mentioned information, but also taking into account the answers given in interviews about the source of income (occupation) and content of the conversations.

water supply services have improved for low-income groups, indicating that the projects have brought benefits to them. However, frequency of water supply, whether water supply services have improved, satisfaction with and fulfilment of water supply services, were slightly lower for the low-income group than other income groups. This may be due to the fact that the sampled low-income groups have more family members than other groups, and thus water per family member tends to be less.[22]

However, it is not possible to determine with these results whether the projects had an equal effect on low-, middle- and high-income groups because the total sample size (58) was small. Therefore, there is a possibility of bias in the responses, and the fact that income groups were estimated following observations of the evaluator.

[Benefit to Palestinian refugees in Al-Baqa camp]

The Palestinian refugee Al-Baqa camp in Area D is densely populated, and generally regarded as a low-income neighborhood. According to the Area D office, it is very difficult to supply water to every location in the camp. In addition to the high housing density, there are problems with the water supply facilities. These include long and narrow distribution lines in the camp, which make it difficult for water to reach the end of the pipelines; the increase in water consumption due to population growth has outpaced the increased volume of water distributed; and the capacity of the Al-Baqa reservoir, the source of water distribution, is inadequate.

Living environment of Al-Baqa camp
Photo taken by the external evaluator.

From the viewpoint of LNOB, we studied whether the projects could have developed a plan that focused on the camp, which had the greatest need for improved water supply services and living conditions in the target area, and a large population (The population of the camp represents 49% of the total population of the two target areas.[23]).

According to the consultant for the projects, water supply services in the camp would have been improved if the distribution networks in the camp had been renewed, but at the time of planning they could not include this renewal in the plan since foreigners were not able to enter the camp. It was not possible for Japanese consultants to survey the camp, or for Japanese contractors to construct the pipelines.

The projects could have developed a plan to focus on the camp and meet its needs if there had not been these constraints.

[22] The average number of members in a sample household in the survey was 7.6 in the low-income group, 6.8 in the middle-income group, and 5.9 in the high-income group.

[23] Areas D and A had a population of 50,786 and 112,883 respectively, for a total of 163,669 at the end of 2022. Of these, 79,705 are in Al-Baqa camp (source: data provided by the two area offices and Jordanian Bureau of Statistics). The population of Al-Baqa camp was not shown in data from the Bureau of Statistics. Therefore, it was estimated based on the census report in 2015 and the average population growth rate of the project areas.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

It is expected that the importance of a safe and secure drinking water supply as set out in the country's national policy "Jordan 2025 (2016-2025)" at the time of the ex-post evaluation, and the sector plan "Jordan Water Strategy (2016-2025)", and the policy of increasing the efficiency of operation of water utilities through privatization, would continue and support the sustainability of the effects of the projects.

3.4.2 Institutional/Organizational Aspect

The Ministry of Water and Irrigation has been promoting the transfer of water and wastewater utilities to public corporations and private companies to improve management efficiency.[24] Both project areas were operated and maintained by WAJ at the time of planning the projects. Miyahuna had taken this over in Area A at the time of the ex-post evaluation, as it was officially transferred to them in 2023. Miyahuna is a company, structured with 100% shareholding by WAJ. The operation and maintenance of Area D is undertaken by WAJ, as at the time of planning.

The organization and structure of the two area offices is as follows. Area A office is under the Balqa Governorate Office of Miyahuna, which has four departments: administration (16 staff), finance (4 staff), consumer services (20 staff) and operations and maintenance (42 staff). There are 84 staff in total as of March 2023, including the director and monitoring and inspection officers. Area D office is under the Balqa Governorate Office of WAJ. There are three departments: the Administration and Finance Department (19 staff), Consumer Services Department (14 staff) and Operations and Maintenance Department (67 staff). There are 102 staff in total as of March 2023, including the director and general supervisor. Area D is also due to start the process of transferring to Miyahuna by the end of 2023. The roles and responsibilities of the departments in the office are clear in both area offices.

The structure of the Operation and Maintenance Department, which is in charge of the operation and maintenance of transmission and distribution facilities developed by the projects, is as follows. General operation and maintenance (1 person), water supply line (16 persons), pumping station and well (18 persons), sewage line (1 person) and complaint handling (5 persons), are assigned by the Operation and Maintenance Department at the Area A office. The operation and maintenance of the transmission and distribution facilities of the projects is handled by staff in-charge of water supply lines and the pumping stations and wells. A water distribution supervisor (1 person), general operation (1 person), distribution (4 persons), pipeline operation (38 persons),

[24] Miyahuna has been responsible for the operation, maintenance and development of water and sewage facilities in Amman Governorate since 1999, Madaba Governorate since 2023, and Zarqa Governorate since 2015. For Balqa Governorate, the company has been responsible for the operation, maintenance and development of water and sewage facilities in Mahis and Fuheis regions since 2020, and in Salt and Ain Al-Basha cities since 2023.

general maintenance (15 persons), welding (2 persons), and pipe repairs (5 persons) are assigned by the Operation and Maintenance Department at the Area D office. All personnel are involved in the operation and maintenance of the transmission and distribution facilities of the projects. The roles and responsibilities of each person in charge are clear, and there are enough staff members assigned to carry out the work in these offices.

Thus, there are no staffing challenges that would hinder sustainability of the effects of the operation of distribution reservoirs and distribution lines, which are the main facilities developed under the projects.

However, at the time of the ex-post evaluation, there was no system in place to utilize the water distribution monitoring system installed by the projects. The projects installed a monitoring system to facilitate efforts to reduce non-revenue water in each distribution zone. Commissioning and training for the system was conducted in the technical training before the projects were completed. However, the system remained unutilized due to the Covid-19 outbreak shortly afterwards, which led to curfews and staff absenteeism. When WAJ attempted to use the system in late 2022, after the outbreak had been contained, it was found to be partially inoperative. Subsequently, at WAJ's request, consultants and contractors investigated the cause of this, and made the necessary repairs and replacements. The system was operational by March 2023. However, when the evaluator examined the system in July 2023, it was found that the system was not being used, as there was no defined method for reporting and utilizing the results of the distribution monitoring, and there was no specific person taking responsibility for operation and maintenance of the system. It was noted that these area offices are willing to utilize the system, and that WAJ Headquarters is planning to send out specific instructions on how to utilize the system. There are no technical or financial problems relating to the use of the system, and it is highly likely that the system will be utilized once specific instructions are issued. As the system was not utilized at the time of the ex-post evaluation, the volume of water distributed per distribution zone was not monitored, but the total volume of water distributed in the target area is monitored by flow meters installed at various locations on the distribution pipelines.

As mentioned above, there are some minor problems with the institutional and organization aspect of operation and maintenance; however, there is a high potential for improvement.

3.4.3 Technical Aspect

There are no equipment or facilities that are not used or used extremely infrequently due to technical problems. Operating partition valves and pumps, checking water levels and distribution reservoirs, identifying, and repairing leaks, and cleaning strainers on pressure-reducing valves are the main tasks required for the operation and maintenance of facilities of the projects. They are basic and do not require any new technology. These operations were carried out in the two offices even prior to implementation of the projects. The staff responsible for these operation and

maintenance tasks in the two offices have acquired the necessary skills to carry out the tasks, and there are no technical problems with operation and maintenance.

For operation of the water distribution monitoring system, all that required is the operation of web-based applications, which can be done with basic personal computer operating skills. There are staff in the two offices who participated in the technical training, and therefore there are no specific technical concerns. In addition, the IT Department of WAJ maintains the same type of equipment, and the maintenance of equipment for the system for the projects can be carried out in the same way.

3.4.4 Financial Aspect

The operation and maintenance of facilities of the projects mainly involves pump operation, opening, closing, and adjusting gate valves, daily and periodic inspections, and repairs. These can be conducted using personnel costs of the current budget, and do not require significant investment. According to explanations from the directors of these area offices, the budget required for operation and maintenance of the project facilities has been allocated, and no budgetary problems have occurred so far.[25]

WAJ and Miyahuna have been continuously operating at a loss in recent years and depend on state assistance. However, WAJ's net profit deficit decreased in 2020 and 2021 after receiving support from the IMF (International Monetary Fund) to improve its finances (Table 5). The cost / revenue ratio also improved, to 1.37 in 2019, 1.32 in 2020, and 1.28 in 2021. Miyahuna has also seen a continuous increase in operating profit and a decrease in operating expenses between 2019 and 2021, with the amount of operating losses decreasing (Table 6). The cost / revenue ratio has improved to 1.19 in 2019, 1.10 in 2020 and 1.06 in 2021. In this way, WAJ and Miyahuna are improving their management, and their financial situation may improve in the future. They have included cost of depreciation to prepare for future facility replacement.

The Jordanian Government has prioritized financial subsidies to WAJ and Miyahuna under its policy of keeping water tariffs low, and operating water and wastewater services as a public utility, for civil stability. This policy and financial subsidies are expected to continue in the future, as the Government emphasizes the importance of a safe and secure drinking water supply in its national development policy and sector plans.

Based on the above, it can be concluded that there are no financial challenges that would hinder the sustainability of the projects.

[25] The budget and actual expenditures for these area offices could not be identified, since WAJ and Miyahuna do not maintain specific budgets and expenditures for the area offices.

Table 5: Summary of Profit and Loss Statement of WAJ for the Last 3 years

(Unit: Jordanian Dinar)

Item of Account		2019	2020	2021
Operational	Revenues	289,127,180	269,859,889	292,793,966
	Expenses	395,713,418	356,136,177	373,885,117
	Deficit from operating activities	-106,586,238	-86,276,288	-81,091,151
Non Operational	Revenues	8,015,009	11,455,643	17,440,097
	Expenses	-165,053,688	-127,429,061	-129,722,111
	Deficit from non-operating activities	-157,038,679	-115,973,418	-112,282,014
Deficit before financing expenses and tax		**-263,624,917**	**-202,249,706**	**-193,373,165**
Loss /gain of foreign loans revaluation		12,334,652	-43,539,808	33,402,078
Financial cost		-59,652,714	-45,735,530	-37,305,929
Deficit before tax		**-310,942,979**	**-291,525,044**	**-197,277,016**

Source: Documents provided by WAJ

Note: "Loss/gain of foreign loans revaluation" is the difference between the value at the time of acquisition of the foreign loans and the current value. Financial cost are expenses, interest, service charges, and others for finance.

Table 6: Summary of Profit and Loss Statement of Miyahuna for the Last 3 Years

(Unit: Jordanian Dinar)

Item of Account		2019	2020	2021
Operational	Revenue	160,377,539	164,048,811	167,638,354
	Expenses	191,083,947	180,200,320	178,046,671
	Deficit from operating activities	-30,706,408	-16,151,509	-10,408,317
Non-operational	Revenue	3,395,630	3,300,069	6,648,594
	Expenses	-9,287,849	-16,962,933	-1,374,217
	Deficit from non-operating activities	-5,892,219	-13,662,864	5,274,377
Deficit before tax		**-36,598,627**	**-29,814,373**	**-5,133,940**

Sources: Annual reports of Miyahuna

3.4.5 Environmental and Social Aspect

The external evaluator did not identify any negative environmental or social impacts that would happen in future because of the projects.

3.4.6 Preventative Measures to Risks

No risks were identified that could hinder the continued effectiveness of the projects.

3.4.7 Status of Operation and Maintenance

The facilities developed by the projects were of a general nature, including transmission and distribution lines, distribution reservoirs and pumps. They are operated and maintained with the current skills of staff in the area offices. The field inspection confirmed that staff monitor and inspect each facility on a routine basis, and clean or repair any defects that are identified - although no maintenance and inspection guidelines or records were available. For pressure-reducing valves, the strainers are cleaned every five to six months to ensure that water does not clog. Daily and periodic inspections are carried out on the pumps, and if there are any leaks the rubber parts are

replaced and adjusted. All the main facilities developed under the projects are well utilized, in good operating and maintenance condition, and no problems have occurred.

In the target area, projects supported by USAID (United States Agency for International Development), KfW (German Reconstruction Loan Corporation), GIZ (German Association for International Cooperation) and EIB (European Investment Bank) are being planned and implemented to upgrade transmission and distribution facilities and to improve the non-revenue water ratio at the time of the ex-post evaluation, and these projects are expected to sustain and develop the effect of the projects.

At the time of the ex-post evaluation, it was found that the monitoring panel at the Ma'adi pumping station in Area D was not displaying the water level and flow rates correctly. For the water level, a staff member visits the distribution reservoir, reads the water level gauge at the reservoir, takes a photo on a smart phone, and sends it to the person in charge at the pumping station. The flow rate is estimated from the pump capacity and operating hours. Therefore, the daily operation of the pumps is not disrupted. WAJ has asked the contractor who installed the panel to repair it, and there is a high possibility of improvement. There are no problems in the facilities or equipment in Area A.

Slight issues have been observed in the institutional/organizational aspects of operation and maintenance; however, there are good prospects for improvement and resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Two projects were evaluated in an integrated manner in this ex-post evaluation. The projects supported the improvement of water supply services in Area D and A in Balqa Governorate in Jordan. The projects were originally planned as a single project - they were carried out separately after changing the plan.

Improving water supply services was a priority for Jordan at both the time of planning and ex-post evaluation of the projects, and the objectives of the projects are in line with the development policy and sectoral strategy of the country. Renewal of water supply facilities was lagging in the project areas selected; there was a high level of poverty, which indicates that consideration was given to the socially vulnerable and to equity. Although the project was consistent with Japan's ODA policy at the time of planning, it had not created complementary or synergistic effects with other JICA projects or those of other donors. Accordingly, the relevance and coherence of the projects are high.

The projects developed reservoirs, pumping facilities and transmission and distribution lines generally as planned. The project cost exceeded the plan due to the provision of an additional grant. As mentioned above, construction work in the two areas had to be carried out separately.

The process to change the plan took time, delayed the start of construction, and the projects significantly exceeded the planned project period. Therefore, efficiency of the projects is low.

The projects improved the volume of distribution, pressure, frequency and hours of water supply, and the volume of water consumption in the target areas. Project impacts included improved living conditions, removing concern about running out of water, and reduced the cost of electricity for both pumps and purchasing water from water lorries. The amount of electricity used for distribution pumps in Area A was reduced, contributing to rationalization of operation and maintenance. This indicates that the effectiveness and impact of the projects are high.

Regarding operation and maintenance of facilities developed by the projects - there are some minor problems with institutional arrangements, and the operation and maintenance system for the water distribution monitoring system was not in place. However, the prospects for improvement and resolution are high. Therefore, sustainability of the project effects is high.

In light of the above, the projects are evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Utilization of remote water distribution monitoring systems

At the time of the ex-post evaluation, the water distribution monitoring system installed by the projects was not utilized as there was no defined method for reporting and utilizing the results of monitoring, and there was no specific person undertaking responsibility for operation and maintenance of the system. Commissioning of and training in the system was conducted in the technical training before the projects were completed. However, the Covid-19 outbreak delayed its use. When WAJ attempted to use the system in late 2022, around two years after the project completion, it was found to be partially inoperative. Subsequently, necessary repairs and replacements were conducted, and the system was operational at the time of the ex-post evaluation. The system is useful to facilitate efforts to reduce non-revenue water in each distribution zone. The Ministry of Water and Irrigation, WAJ and Miyahuna need to provide the necessary instructions to the two area offices on use of the system to reduce non-revenue water, as well as to support them in setting up an institutional arrangement for operation and maintenance of the system.

(2) Replacement of distribution networks in the project areas

A household survey conducted during this evaluation found that the proportion of households who have complained to area offices of the projects has increased since the time of planning, and that the most common complaint is leakage from distribution lines. The non-revenue water ratios in these area offices were as high as 56% and 57% in Areas D and A respectively in 2022. One of the main reasons for non-revenue water is that although the main transmission and distribution lines have been replaced by the projects, there are distribution networks within the project areas

that are either obsolete or have not yet been properly laid. For example, the evaluator visited these areas and found many distribution lines that had not been buried and were exposed above ground. These above-ground piping are prone to damage from passing vehicles, and this can also lead to theft of water.[26]

To maximize the benefits of the projects, WAJ and Miyahuna need to ensure that the distribution networks within these areas are properly laid and renewed as soon as possible to reduce leakages.

(3) Urgent renewal of existing asbestos pipes in Area D

The evaluation found that there are still some old asbestos pipes in Area D, the water supply pressure has not improved in some areas due to these pipes, and pressure-boosting pumps are still used because they cannot introduce gravity flow distribution in some places. The projects replaced 2.6 km of old asbestos pipes in Area D, and WAJ replaced 2.5 km after the projects were completed at their cost. A further 3 km needs to be replaced. WAJ should urgently replace these, stop using pressure-boosting pumps, and switch to a gravity flow distribution system to ensure water supply at the correct pressure and reduce the electricity costs of the pumps.

(4) Prompt repair of faulty monitoring panels at the Ma'adi pumping station

The evaluation found that the water level and flow rate display on the monitoring panel at the Ma'adi pumping station in Area D was faulty. The water level is read manually, and the flow rate is estimated, and this does not interfere with the daily operation of the pumps. However, it is important, for the efficiency and accuracy of operation and maintenance and to detect faults at an early stage, to see the water level displayed on the panel when operating the pumps, and to confirm the flow rate accurately using the display on the panel. WAJ needs to repair the faulty panel as soon as possible.

4.2.2 Recommendation to JICA

(1) Monitoring the implementation of recommendations to the executing agencies to ensure further effective use of the projects' facilities and sustained effectiveness

The projects have created the effects as planned in general. However, as explained above, there are some issues, including under-utilization of the distribution monitoring systems, water leakage from existing distribution networks, existence of old asbestos pipes in Area D, and a faulty monitoring panel at Ma'adi pumping station in Area D. It is recommended that JICA continue to monitor progress in solving these issues in the future. If the water distribution monitoring systems continue to remain underutilized, it is important for JICA to identify the factors, provide advice, and take lessons for similar projects in the future.

[26] These distribution lines were not laid by the projects.

4.3 Lessons Learned

Careful decision-making is needed based on the cost of construction and safety management, and the tendering environment is required when planning a project that has construction sites far from each other.

The projects were planned to develop facilities in Areas A and D in phase 1. However, there were no bids received in the first round of bidding, and the second round was unsuccessful. The construction sites in these areas are 40 km apart, and Area D needs to be visited through a valley with many differences in elevation. One of the reasons why contractors were not motivated to bid for the projects was the significant cost and time required for construction management at the two remote locations, and efficient staffing was difficult as the projects had to carry out construction in these two areas.

The plan was changed to implement a project in each area, tenders and construction contracts were awarded for the two areas, and the projects were implemented. However, the time taken to change the plans and re-tender delayed completion of the projects significantly. Accordingly, realization of the project effects and impact were also delayed.

In order to implement projects includes construction sites far from each other without delay, the staffing and institutional arrangement required for construction and safety management at these sites should be considered at the time of planning, and the necessary costs should be included in the project cost. If necessary, consider measures such as implementing the project as two projects or separating bidding packages for each site by considering efficiency in terms of construction and safety management, and the bidding environment, including public safety and local characteristics, whether it is appropriate to implement the project as a single project/package and whether this would reduce the contractors' incentive for bid.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None.

5.2 Additionality

The project areas have many differences in elevation - 420 m (480 m to 900 m) in Area D, and 260 m (-330 m to -70 m) in Area A[27] - making it very difficult to design water supply facilities. The elevation differences within each water distribution district are also large. It is very difficult to reliably distribute water to all locations of areas with this topography. Before the project was implemented there were many locations where water was not supplied. Water pressure was weak,

[27] Source: Preparatory Survey Report

and the amount of water supplied was low because, in addition to age and inadequate capacity of the pipelines, the facilities were not designed to distribute water evenly with appropriate water pressure in such a terrain.

The projects improved the water supply and distribution and increased the water volume and pressure in both areas, meaning that places that were previously unserved now receive water. Water is distributed by gravity flow in Area A, which realized a significant reduction in the electricity cost of pumps. In addition to efforts of the executing agencies in operation and maintenance of the facilities, the Japanese consultancy firm for the projects contributed to this through their skilled and advanced water supply facility design techniques, experience in the water sector in Jordan, and optimum design based on the detailed collection of information on the pipe networks.

(END)