Jamaica

Ex-Post Evaluation of Japanese Grant Aid Project

"KMA Water Supply and Rehabilitation Project"

External Evaluator: Hajime Sonoda, Global Group 21 Japan, Inc.

0. Summary

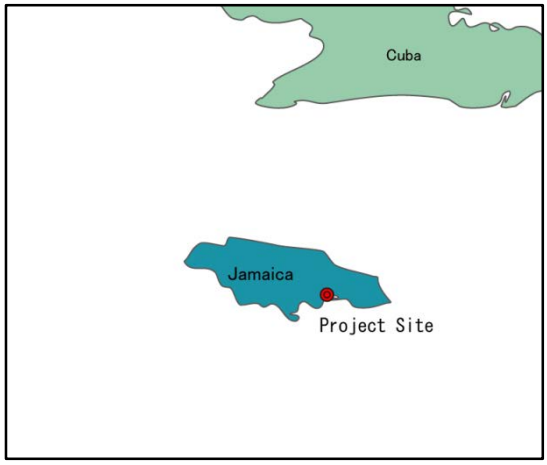
KMA Water Supply and Rehabilitation Project (hereinafter simply referred to as "the Project") was implemented in the Kingston Metropolitan Area (KMA)[1] with the aim of achieving stable water supply by means of developing new water sources using groundwater and rehabilitating as well as expanding a water treatment plant and transmission/distribution mains, thereby contributing to improvement of the daily life of residents[2]. At the time of both the appraisal and ex-post evaluation, the Project was found to be highly relevant to the development policies of Jamaica. The Project was a tangible response to the important as well as urgent task of improving the water supply in the KMA and was compatible with the ODA policies of Japan. As such, the relevance of the Project is high. For the implementation of the Project, the original plan was considerably revised twice because of (i) the cancellation of a World Bank-related program and (ii) the unavailability of expected groundwater sources. The actual project cost was within the originally planned cost, and the investment efficiency considering the revision to the Project scope was more or less as planned. On the other hand, the actual project period far exceeded the originally planned period because of the longer than anticipated groundwater survey, procurement process and work to revise the original plan. The delay of some of the work conducted by National Water Commission (NWC) due to insufficient budgetary appropriation also contributed to the prolonged project period. Because of this, the efficiency of the Project is judged to be fair. The actual water production volume of the project-related facilities was approximately 60% of the target. Among the target areas, a stable water supply was achieved in Spanish Town, significantly increasing the water consumption volume and level of sanitation there. In contrast, there was no improvement of the water supply in Portmore and neither the water consumption volume nor the level of sanitation increased in this district. The outcomes of the technical assistance designed to strengthen the organization of NWC were not fully utilised in the post-project period. Because of these shortcomings, the effectiveness/impact of the Project is judged to be fair. NWC possesses the necessary technical capability to operate and maintain the facilities newly constructed or rehabilitated under the Project but the number of employees assigned to front-line duties is insufficient. The maintenance of some facilities is inadequate because of the insufficient availability of spare parts, in turn caused by the insufficient maintenance budget. As such, the

[1] The KMA (population of 1,178,000 in 2011) consists of three parishes: Kingston Parish (population of 89,000 in 2011), St. Andrew Parish (population of 573,000 in 2011) and St. Catherine Parish (population of 516,000 in 2011). A parish is an administrative unit in Jamaica and there is a total of 14 parishes in the country.

[2] The original objective of the Project initially was to "achieve a stable water supply in the KMA by means of developing Rio Cobre River surface water and new groundwater sources and rehabilitating and expanding transmission/distribution mains, thereby contributing to improvement of the daily life of residents and preservation of groundwater," however, the plan underwent substantial revision due to changes in the yen loan agreement in 2000. The parts of this report pertaining to the Project objective are based on the plans that were revised in 2000. See "3.2.1.1 (1) Change of the Plan Due to Withdrawal of the World Bank" for the detailed background of the changes.

sustainability of the effects of the Project is fair. In the light of the above, the Project is evaluated as being partially satisfactory.

1. Project Description



Project Location

Spanish Town Water Treatment Plant

1.1 Background

Jamaica is an island country located in the Caribbean Sea. It has a population of 2.7 million (in 2011), a land area of 11,424 km^2 (similar to that of Akita Prefecture in Japan) and a tropical maritime climate. In Jamaica, the National Water Commission (NWC) prepared an integrated development plan for the irrigation sector as well as the water supply and sewerage sector in the mid-1990s to ensure the effective use of limited water resources while attempting to strengthen the body supervising the use of water resources and to create a legal framework for a centralized water management system. The development of water supply and sewerage systems were given high priority as an important sector for public investment. At that time, the coverage of the water supply system in the KMA was as high as approximately 95% (in 1994). However, the high level of leakage due to the ageing and insufficient maintenance of the facilities together with water theft and the insufficient collection of the water charge due to the lack of water meters meant that the level of unaccounted for water (UFW) was extremely high at more than 60%. Therefore, some areas were subject to restricted water supply of eight hours a day, illustrating the chronic water shortage. The expected average annual population increase of 1.8% at the time suggested a further worsening of the water supply shortage.

Under these circumstances, the Government of Jamaica made a request to the Government of Japan for ODA for improvement of the water supply facilities in the KMA. In response to this request, the Japan International Cooperation Agency (JICA) conducted the Special Assistance for Project Formulation for the KMA Water Supply Project in 1995. Following the appraisal of the proposed project, a loan agreement between JICA and the Government of Jamaica was concluded in 1996 to proceed to the implementation stage of the Project.

1.2 Project Outline

The objective of the Project was to achieve a stable water supply in the KMA by means of developing new groundwater sources and rehabilitating as well as expanding a water treatment plant (WTP) and transmission/distribution mains, thereby contributing to improvement of the daily life of residents.

Approved Loan Amount/ Disbursed Amount	6,644 million yen/ 6,561 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	June, 1996/ July, 1996
Terms and Conditions	Interest Rate: 2.5% (2.1% for the Consultant Portion) Repayment Period: 25 years (Grace Period: 7 years) Conditions for Procurement: General untied
Borrower/ Executing Agency	Ministry of Finance and Planning/ National Water Commission (NWC)
Final Disbursement Date	May, 2010
Main Contractors	Sogea-Satom (France) and Hazama Corporation (Japan)
Main Consultants	Nihon Koei (Japan) and MHW UK LTD. (UK) (Joint Venture)
Feasibility Studies, etc.	Special Assistance for Project Formulation for the KMA Water Supply Project (JICA: 1995); Special Assistance for Project Implementation of the KMA Water Supply Project (JICA: 1999)
Related Project	Capacity Building of Water Maintenance (JICA: 2007–2010)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda (Global Group 21 Japan)

2.2 Duration of the Evaluation Study

The ex-post evaluation study for the Project was conducted over the following period.

Duration of the Study : September, 2014 to July, 2015
Duration of the Field Survey: 31st November to 18th December, 2014
5th to 9th April, 2015

2.3 Constraints during the Evaluation Study

The loan agreement for the project was signed in July 1996 on condition that the Project would be implemented in tandem with another project simultaneously implemented by the World Bank in the KMA, however, following cancellation of the World Bank undertaking, the loan agreement couldn't become effective. Accordingly, in order to implement the Project without the participation of the World Bank, JICA implemented the Special Assistance for Project Implementation

of the KMA Water Supply Project (1999), made major revisions to the Project contents including the target area, and implemented the Project upon revising the loan agreement in April 2000. Because the Project plan at the time of review was scrapped following the cancellation by the World Bank and was eventually finalized based on the revised loan agreement, the ex-post evaluation was conducted based on the Project plan following loan agreement revision.

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

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance to Development Policies of Jamaica

As already mentioned in "1.1 Background", the priority of the Government of Jamaica at the time of the appraisal was improvement of the water supply and sanitation services. Vision 2030 Jamaica, the national development plan which was in force at the time of the ex-post evaluation and which was originally published in 2009 upholds the development of strong economic infrastructure as a policy objective to achieve the goal of economic prosperity while listing the provision of adequate and safe water supply and sanitation services as one of the identified national strategies. Meanwhile, the Medium-Term Socio-Economic Policy Framework for 2009 – 2012 published in 2009 mentioned the Project as a key action. The Water Sector Policy (2014) points out that the reliability and convenience of water supply and sanitation services require improvement and lists such goals as 24 hour continuous water supply in urban areas, reduction of UFW and improvement of customer management, operation, maintenance, financial independence and energy efficiency by NWC.

As such, improvement of the water supply and sanitation services and the reduction of UFW are important policy objectives at the time of both the appraisal and ex-post evaluation. The Project is, therefore, highly relevant to the development policies of Jamaica.

3.1.2 Relevance to Development Needs of Jamaica

As mentioned in "1.1 Background", there was a strong need at the time of the appraisal to improve the water supply and sanitation services in the KMA.

By the time of the ex-post evaluation, the coverage of the water supply system in the KSA (the area combining Kingston Parish and St. Andrew Parish), which is the eastern part of KMA, reached as high as 95% (2010) but the slow progress of investment in water supply facilities and the high UFW rate of 54% means that only 67% of the actual water demand was met in the dry season of 2010. In St. Catherine Parish including Spanish Town and Portmore where is the western part of KMA and the UFW rate of 68% is even higher, the volume of water production is sufficient to meet the local demand to the extent that nearly 10% of the produced water is sent to KSA. However, because of the rapid population increase of St. Catherine Parish, it is believed that a local water shortage may occur by 2030 unless the local UFW rate is substantially reduced.

---

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

[4] ①: Low; ② Fair; ③: High

As such, reinforcement of the water supply capacity and reduction of the UFW rate are important and urgent issues faced by the KMA at the time of both the appraisal and ex-post evaluation. The Project is, therefore, highly relevant to the development needs of Jamaica.

3.1.3 Relevance to Japan's ODA Policies

At the time of the appraisal, a Country Assistance Program or policies for Jamaica had not yet been prepared. However, the ODA Charter (June, 1992) identified infrastructure development as one of the priority issues for Japan's ODA. As the Project intended improvement of the infrastructure for water supply and sanitation services, the Project is highly relevant to Japan's ODA policies.

The Project is highly relevant to Jamaica's development policies and development needs as well as Japan's ODA policies and, therefore, its relevance is high.

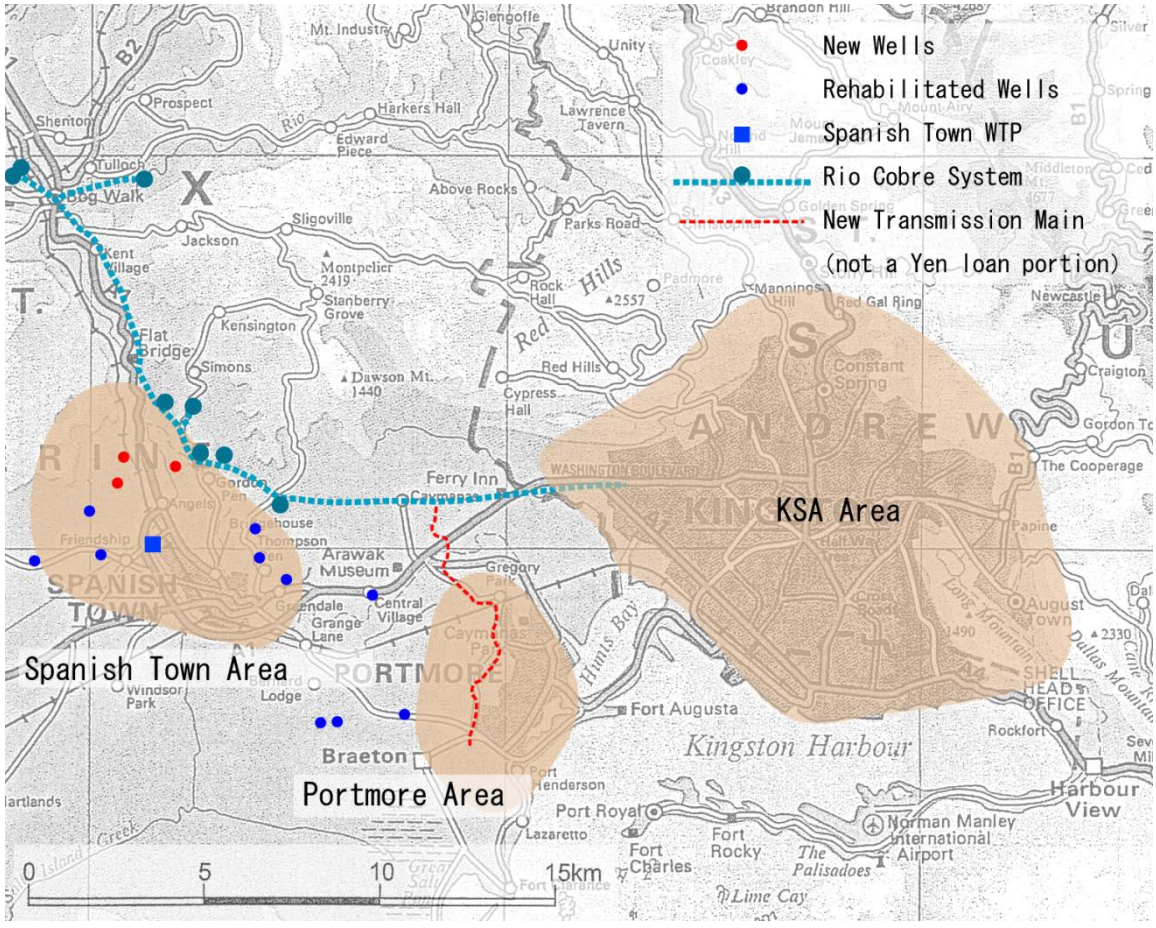


Figure 1 Water Supply Facility Constructed Under the Project

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The planned and actual outputs of the Project are shown in Table 1. As explained below, the originally planned contents of the Project were considerably revised twice.

(1) Change of the Plan Due to Withdrawal of the World Bank

The planned contents of the Project at the time of the appraisal involved the construction of water supply facilities to serve the entire KMA, including the development of new water sources using both surface water and groundwater. Neither rehabilitation of the existing facilities nor strengthening of the organization of NWC was included in the original scope of the Project. Meanwhile, the World Bank was planning at the same time to rehabilitate the water supply facilities in the KMA and to strengthen the organization of NWC under the Program for Rehabilitation and Improved Efficiency of the Water Supply and Sanitation Sector (hereinafter referred to as "the World Bank Program").[5] As the Project and the World Bank Program were considered to be mutually complementary, a cross-effectiveness clause whereby the loan agreement for the Project would become effective as soon as the World Bank Program was approved was added as a condition for the JICA's loan for the Project. The World Bank subsequently cancelled its own Program on the grounds that no consensus was reached regarding the issue of the privatization of NWC, making it impossible to proceed with the OECF loan for the Project. The JICA and NWC discussed a viable way forward and agreed on substantial changes of the scope of the Project and modification of the loan agreement, including (i) restriction of the target areas of infrastructure development by the Project to Spanish Town and Portmore where the water demand was rapidly increasing but have limited water sources and (ii) incorporation of part of the scope of the World Bank Program into the Project.[6] As a result, the contents of the Project included not only the construction of new water supply facilities but also the rehabilitation of some of the existing facilities and strengthening of the organization of NWC. From the viewpoint that the rehabilitation/construction of water supply facilities and strengthening of the organization of NWC were mutually complementary, the change of the scope of the Project while restricting the target areas in the aftermath of the cancellation of the World Bank Program is judged to be appropriate.

(2) Change of the Plan Based on the Evaluation Results of Groundwater Resources

After modification of the original loan agreement in 2000, the subject wells for rehabilitation underwent a detailed diagnosis and the groundwater level of many wells in the planned area was found to be much lower than the anticipated level[7]. As unexpected changes of the population distribution and

---

5 The World Bank Programme included the rehabilitation of sewerage facilities.

6 The new scope of the Project was proposed by the Special Assistance for Project Implementation for the KMA Water Supply Project conducted by the JICA in 1999 and was subsequently agreed upon at the time of changing the particulars of the loan agreement in 2000. The district of KSA was omitted from the Project, however, the contents that were planned by JICA and the World Bank here were incorporated into the KMA Water Supply Improvement Project compiled by the Inter-American Development Bank.

7 According to NWC, the type of groundwater investigation and modelling that was implemented in the Project incurs massive costs, while well diagnosis interrupts water supply because it entails stopping production for around two weeks.

land use were also found, a detailed groundwater resources evaluation study (groundwater survey and modelling) on the target areas was conducted. This study confirmed that the rapid conversion of farmland which had been recharging the groundwater into residential areas had depleted the local groundwater resources and that illegal sand collection at many sites had opened up a risk of the direct contamination of groundwater. Based on such findings, it was concluded that the development of permanent groundwater supply sources in the planned area would be difficult.

Following such conclusion, the target existing wells for rehabilitation and the planned production volume of each of these wells were revised. The planned development of new wells in Portmore was withdrawn[8]. Furthermore, the related planned extension of the existing irrigation channels (as compensation for local farmers) was also withdrawn. Of the planned two groundwater recharging facilities in Spanish Town and Portmore, the one in Portmore was withdrawn as the planned development of new wells there was found difficult.[9] As an alternative water source for Portmore where the development of new water sources was abandoned, the construction of a transmission main from the Rio Cobre System to Portmore was added to the scope of the Project (although this was outside the scope of the loan). These changes are deemed to have been appropriate in respect to the conditions of water sources.

The plan formulated after the revisions described above included the renewal of 16.8 km of distribution mains and 1.6 km of connecting pipes (totaling 18.4 km) in two areas of Spanish Town. Based on the results of the detailed design study, however, one of these two areas was replaced by another area where the level of water leakage was thought to be much higher. Consequently, 18.6 km of distribution mains and 13.7 km of connecting pipes, totaling 32.3 km in length, were renewed. These changes of the original plan are judged to be appropriate from the viewpoint of improving the water leakage reduction effect.

While the important objective of the Project was to enhance the potable water supply capacity in the KMA by means of constructing water production facilities and reducing water leakage, the total water production capacity of the water production facilities which were newly constructed or rehabilitated under the Project was 169,000 m^3/day or 91% of the planned output of 185,000 m^3/day after modification of the loan agreement (hereinafter referred to as "the revised plan"). (See Table 2) The production capacity of the new facilities of 23,000 m^3/day was 37% of the planned capacity (62,000 m^3/day) at the time of the appraisal or 57% of the revised plan (42,000 m^3/day).

Therefore, it is difficult to implement such investigations in the feasibility study and planning stage, and they are often implemented after the start of the project before the detailed design.

8 Since some groundwater previously used for irrigation was diverted to the public water supply, the Project included the strengthening of irrigation facilities for utilizing surface water in the agricultural sector, however, because the groundwater development was cancelled and the area of farmland requiring irrigation was reduced, these plans were abandoned.

9 While the detailed design study and preparation of the tender for Spanish Town were completed, no work was conducted because of the funding shortage of NWC. The planned work was then excluded from the scope of the Project. The construction work related to the original plan commenced in 2014 with IDB funding and is scheduled to be completed in November, 2015.

Table 1 Planned and Actual Outputs

Planned Outputs at the Time of the Appraisal (1996)	Planned Outputs After the Modification of the Loan Agreement (2000)	Actual Outputs
KSA <Spanish Town > • Intake facility: 50,000 m^3/day • Construction of WTP: 23,000 m^3/day • Construction of wells: 3 wells, 16,000 m^3/day • Construction of related transmission and distribution facilities	< Spanish Town > • Rehabilitation of Spanish Town WTP: 15,000 m^3/day • Rehabilitation of existing wells and related distribution facilities - Rio Cobre System*: 61,000 m^3/day - Other wells: 9 wells, 40,000 m^3/day • Construction of new wells and related transmission and distribution facilities: 4 wells, 20,000 m^3/day • Renewal of distribution network: 2 areas, 18.4 km	18,000 m^3/day 78,000 m^3/day 7 wells, 31,000 m^3/day 3 wells, 24,000 m^3/day 2 areas, 32.3 km
< Portmore > • Construction of wells: 7 wells, 23,000 m^3/day • Construction of related transmission and distribution facilities	< Portmore > • Rehabilitation of existing wells and related transmission and distribution facilities: 9 wells, 27,000 m^3/day • Construction of new wells, related transmission and distribution facilities: 7 wells, 23,000 m^3/day • Construction of transmission main from Rio Cobre System and related transmission and distribution facilities (not planned)	3 wells, 18,000 m^3/day Not implemented Transmission main: 10 km Distribution main: 3 km
• Extension of existing irrigation channels • Groundwater recharging facility • Consulting service - Detailed design and work supervision, etc.	• Extension of existing irrigation channels • Groundwater recharging facility • Consulting service - Strengthening of organization of NWC - Detailed design and work supervision, etc.	Not implemented** Not implemented*** As planned. A detailed study on groundwater was added.

Sources: documents provided by JICA; NWC

Notes

* The Rio Cobre System is a water production system using fountains along the Rio Cobre (Cobre River) and several wells.

** The relevant study was partly conducted.

*** The detailed design study and preparation of the tender were conducted as part of the consulting service for the Project. Although the groundwater recharging facility in Portmore failed to materialize, the one in Spanish Town is under construction with funding by another project (scheduled to be completed in 2015) utilizing the detailed design and procurement documents.

Well W of the Rio Cobre System

Reservoir and Distribution Pumps next to the WTP

Table 2 Planned and Actual Water Production Capacity

	Planned Capacity at the Time of the Appraisal (1996)	Planned Capacity in the Revised Plan (2002)	Actual Capacity (proportion of actual and planned figures)
New	62,000 m^3/day	42,000 m^3/day	24,000 m^3/day (57%)
Rehabilitated	(not planned)	143,000 m^3/day	145,000 m^3/day (101%)
Total	62,000 m^3/day	185,000 m^3/day	169,000 m^3/day (91%)

Sources: documents provided by JICA; NWC

3.2.2 Project Inputs

As is stated in "2.3 Constraints during the Evaluation Study", analysis of Project cost and Project period under Efficiency in the ex-post evaluation was conducted based on the plans that were established when the loan agreement was changed in 2000.

3.2.2.1 Project Cost

The total project cost was lower than planned as it stood at 95% of the planned project cost in the revised plan after the cancellation of the World Bank Program (Table 3). Although the project contents were changed, the scope of the Project was determined to include as much work as possible within the approved loan amount. Accordingly, the actual project cost was within the planned cost. The longer than planned actual project period as described in the next section caused an increase of the construction cost as well as consulting service cost. Nevertheless, the total project cost was lower than planned because of efforts by NWC to lower the general administrative expenses by means of utilizing internal personnel instead of appointing external personnel and the exemption of part of the tax.

However, in the Project, because outputs were revised due to the changed plans in the implementation stage, it is not possible to simply compare the planned and actual Project costs. Therefore, by focusing on the water production capacity, which is the primary output of the Project,

and estimating the cost of investment per 10,000 m^3/day of capacity in the rehabilitated and constructed water production facilities, the actual investment is estimated to be 432 million yen, which is 99% compared to the planned investment of 437 million yen.

Summing up, the total Project cost is within the planned amount, and the investment efficiency taking changes in the Project scope into account is almost as planned.

Table 3 Planned and Actual Project Costs

	Planned (¥ million)		Actual (¥ million)	
	Total	Loan Amount	Total	Loan Amount
Total construction cost	4,910	4,642	5,431	4,640
Rehabilitation of facilities and renewal of the distribution network	(1,392)	(1,392)	(2,654)	(2,654)
Construction of wells and transmission/distribution facilities	(3,518)	(3,250)	(2,777)	(1,986)
Consulting service	1,511	1,511	1,913	1,913
General administrative expenses	295	0	48	0
Tax	903	0	275	0
Contingency	491	491	7	7
Total	8,110	6,644	7,674	6,560

Sources: documents provided by JICA; NWC

Note: The planned project cost was based on the revised plan after the cancellation of the World Bank Program and excluded the cost of the cancelled extension of irrigation channels, cost of constructing a groundwater recharging facility which was moved to another project and cost of land acquisition which was almost entirely related to the groundwater recharging facility. The planned costs assumed price escalation.
Foreign exchange rates: At the time of planning J$1 = ¥2.75
Actual J$1 = ¥1.38
(average rate in the project implementation period)

3.2.2.2 Project Period

Due to the cancellation of works by the World Bank, it took approximately four years until amendment of the loan agreement. According to the revised plan, it was scheduled for the Project to be completed in 71 months from revision of the loan agreement in April 2000 to February 2006. After modification of the loan agreement (April, 2000), it took 161 months to complete the Project in August, 2013 which was 227% of the planned project period. Table 4 shows the main milestones in implementation.

Table 4 Milestones in Project Implementation

1996, July	Signing of the loan agreement (scheduled completion in December 2000)
2000, April	Amendment of the loan agreement(scheduled completion in February 2006)
2007, February	Start of the works covered by the loan
2009, April	Start of the works not covered by the loan
2010, September	Completion of the works covered by the loan
2013, August	Completion of the works not covered by the loan (overall completion)

Sources: documents provided by JICA、NWC

According to NWC, this substantial extension of the project period was mainly caused by the following reasons.

- Just before the start of the Project, the official procurement procedure of the Government of Jamaica was changed, and more time was spent on procurement procedures because the NWC wasn't used to the new system. Moreover, because a lot of time was taken to conduct detailed review of the tender results, part of the package procurement was very time consuming.
- The added groundwater survey was found to be more technically challenging than expected following the start of work, and due also to limitations on the procured equipment from the local enterprise, it took approximately three years for a conclusion to be reached.
- The results of the groundwater survey necessitated a major change of the plan.
- The fiscal balance of the Government of Jamaica went into the red in 1996 and remained there until 2012. Because of the upper limit imposed by the government for annual spending by NWC, it was practically impossible for NWC to implement the work which was not covered by the loan in parallel with the work covered by the loan. Accordingly, the works not covered by the loan were not started until the loan works were nearly finished, and this further prolonged the Project period.

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

At the time of appraisal, the financial internal rate of return (FIRR) and economic internal rate of return (EIRR) were calculated to be 5.5% and 6.3% respectively based on the pre-revision Project plan. In the ex-post evaluation, upon performing new calculation based on the following assumptions in reference to the analysis method at the time of appraisal, the FIRR was found to be 2.5% and the EIRR was 4.6%. However, considering that the Project plan underwent such a major change, these results cannot be compared with the values calculated at the appraisal.

Costs: Initial investment cost, operation and maintenance costs
Benefits: <Repair works>
Increased revenue from tariffs due to higher water production and sales
Reduction of operation and maintenance costs
<Construction works>
Revenue from sale of water
Project life: 20 years
(In calculation of the EIRR, economic prices are adopted for the costs and benefits)

Although the project cost was within the planned cost and the investment efficiency considering the modifications of project scope was almost as planned level, the project period far exceeded the planned period. Therefore, the efficiency of the Project is fair.

3.3 Effectiveness[10] (Rating: ②)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

The Project was implemented with the aim of stabilizing the water supply in the KMA by means of maintaining or increasing the water supply capacity and reducing water leakage in Spanish Town and Portmore in the KMA. For the purpose of analyzing the effectiveness of the Project, the evaluator used the utilization rate of the newly constructed or rehabilitated water production facilities under the Project and the actual water production volume as quantitative indicators.

3.3.1.1 System Utilization Rate at the Water Production Facilities

Rehabilitation of the water production facilities of the Project was completed by August, 2008, and construction of new water production facilities was completed by December, 2010. The utilization rate of 75.2% based on its actual operating hours was modest (average during January 2012 to August, 2014).[11] One well has been closed down due to a problem with the raw water quality while three wells have been out of order for more than a year because of the breakdown of the pump or control panel. Water production can be halted due to various reasons, including stoppage caused by a power outage which occurs several times a month. At some wells, the operating hours are restricted in view of the limited capacity of the distribution facility or in consideration of the supply and demand balance.[12] As the utilization rate for entire Jamaica is 73% (October, 2014), the utilization rate of the water production facilities related to the Project is more or less on a par with the national average.

3.3.1.2 Water Production Volume

When the three year period between the commencement of operation of those water production facilities under the Project from 2005 to 2007 is compared to the three year period from 2012 to 2014 when all the facilities were in operation, the water production volume during the latter is 32% more than the water production volume during the former. This increase is primarily attributable to the rehabilitation of the Rio Cobre System and the availability of new wells. (See Table 5 and Figure 2)

[10] The effectiveness is rated in consideration of not only the effects but also the impacts.

[11] Utilisation rate based on the operating hours = annual operating hours/(24 hours x 365 days)

[12] No data was obtained by the evaluator to distinguish between pre-planned production stoppages and production stoppages due to other reasons.

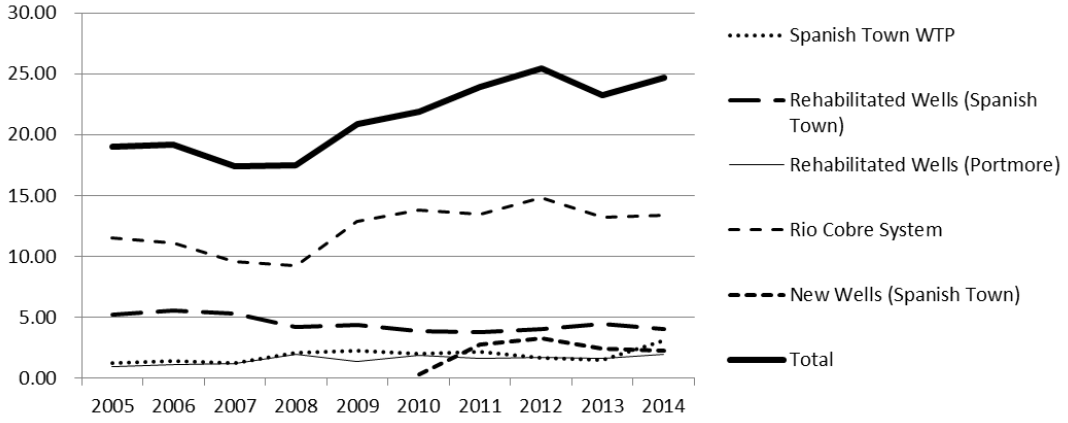
Table 5 Water Production Volume of Water Production Facilities Rehabilitated or Newly Constructed Under the Project

(Unit: 10,000m^3/day)

	2005 – 2007	2012 – 2014	Increase	Rate of Increase
Spanish Town WTP	0.6	0.9	0.3	48%
Rehabilitated Spanish Town Wells	2.5	1.9	-0.6	-22%
Rehabilitated Portmore Wells	0.5	0.8	0.3	58%
Rehabilitated Rio Cobre System	4.9	6.3	1.4	29%
Newly Constructed Wells	0	1.2	1.2	-
Total	8.4	11.1	2.7	32%

Source: NWC

(Unit: 10,000m^3/day)



Source: NWC

Figure 2 Historical Trend of the Water Production Volume

(1) Spanish Town WTP

After the Project, stable water production became possible at the Spanish Town WTP. Prior to the Project, this WTP stopped operation when the turbidity of the raw water was high because it could not adequately treat water of extremely high turbidity. Today, it can continue operation regardless of the turbidity level of the raw water. Surface water using Rio Cobre as the source can be used all year round and the introduction of a reserve pump and a water storage tank has much improved the reliability of the water supply service. According to the laboratory of NWC, the quality of the treated water by the Spanish Town WTP is the highest in Jamaica[13]. Because of the use of irrigation water as the raw water, it is necessary to pay a usage fee to the irrigation authority. Consequently, the water

[13] No Escherichia coli was detected and the standard for residual chlorine concentration was met by all the samples tested during January – November, 2014.

production cost at this WTP is higher than the water production cost at wells using groundwater. Because of this, the production volume at this WTP was intentionally reduced for 2012 and 2013 when the water production capacity of the wells had a surplus. From 2014 onwards, the production volume at this WTP has increased because of the decision to supply water from this WTP to some residential areas in the KSA which had hitherto received water supply from the Rio Cobre System. The WTP recorded a peak monthly production volume in April - May, 2014, up to 98% of the installed capacity.

(2) Rehabilitated Wells in Spanish Town and Rio Cobre System

Of the seven rehabilitated wells in Spanish Town, three wells increased the production volume while four wells suffered from a decline of the production volume. As a result, the total production volume of these seven wells fell by 22%.[14] In 2013 and 2014, the production volume of some wells fell because of a lower rainfall level. In contrast, the water production volume of the rehabilitated wells of the Rio Cobre System increased by 29% from the pre-project level.

(3) Rehabilitated Wells in Portmore

Of the three rehabilitated wells in Portmore, one was subsequently closed down because of a problem with the water quality (presence of manganese). The findings of a water resources evaluation study led to the decision that the use of wells in Portmore would be temporary due to limited availability and sub-optimal quality of underground water in that the water production operation of these wells would be reduced or terminated after the completion of a conducting pipeline from the Rio Cobre System.

(4) New Wells

The four new wells that were constructed in Spanish Town have had a low operating rate of 49% and production of just 12,000 m^3/day (51% of planned capacity) due to stoppages caused by breakdowns. Use of one of the wells was suspended from October 2013 to December 2014.

The average water production volume of the entire project from 2012 to August, 2014 was 111,000 m^3/day. The water production under the Project were originally planned to increase their production levels according to the increase in service population and would be in full operation in 2013 at a rate of 185,000 m3/day. The achievement rate of the target water production volume is 61%, and this lower achievement rate was primarily caused by the less than expected groundwater resources (in turn caused by the depletion of such resources due to changes of land use and the technical difficulty of assessing the groundwater resources in a limestone formation) and low operating rate of the facilities due to power outages, insufficient maintenance and other reasons.

[14] At these four wells where the water production volume had declined, the production volume actually increased in the first half of the 2000s, reaching a peak in 2005 or 2006. Because of this, it is impossible to say that the earlier decline was due to over-extraction.

Table 6 Planned and Actual Performance of Operation and Effect Indicators

	Baseline	Target	Actual
	-	2013	January, 2012 to August, 2014
	-	Seven years after the project completion	Two to four years after the completion of Yen loan components
Operation Indicator			
Facility Utilization Rate (based on operating hours)	-	100%	WTP 97% Rehabilitated wells 76% Rio Cobre System 81% New wells 49% With all facilities 75%
Effect Indicator			
Water Production Volume	-	Rehabilitated 143,000 m^3/day New 42,000 m^3/day Total 185,000 m^3/day	Rehabilitated 99,000 m^3/day New 12,000 m^3/day Total 111,000 m^3/day

Source: JICA; NWC

Note: 1) Baseline data was unavailable. The target values were set referring to the "Special Assistance for Project Implementation of the KMA Water Supply Project" (JICA; 1999).
2) In the modified plan, the target year was 2013, that is seven years after the planned completion in February, 2000.
3) The actual performance of the indicators were evaluated for the above period, as there are several wells suspended operation for a year or so and therefore more balanced judgement can be made for longer period.

3.3.2 Qualitative Effects

3.3.2.1 Reduction of Water Leakage

In Spanish Town where the aged distribution pipes were replaced, the number of water leakage repair works fell by some 40% from 460 repairs/month in 2006 before the replacement to 280 repairs/month (in 2013), suggesting a positive impact of the Project on reduction of the water leakage. However, it is difficult to quantitatively verify this water leakage reduction effect.

3.3.2.2 Improvement of Water Supply

Spanish Town (Estimated population in 2011; around 190,000) and Portmore (Estimated population in 2011; around 230,000), both of which were target areas of the Project, receive water supply from local wells and the WTP in addition to some supply by the Rio Cobre System which also supplies water to the neighboring KSA (Estimated population in 2011; around 650,000).[15]

Spanish Town has a WTP, which was the subject of the Project, and 10 wells. As part of Spanish Town can receive water from the Rio Cobre System, the available water supply capacity for Spanish Town is sufficient to meet the local demand. The actual water supply volume is approximately 55,000 m^3/day in total, almost all of which comes from facilities constructed or

[15] Of the daily water production volume of some 64,000 m3 of the Rio Cobre System, some 9,000 – 14,000 m3/day goes to Spanish Town, 27,000 – 32,000 m3/day to Portmore and the remaining 18,000 – 23,000 m3/day to the KSA. In the dry season, water supply for business and commercial premises in the KSA where the water shortage is usually acute in the dry season is given priority, reducing the water supply volume for Spanish Town and Portmore during the day.

rehabilitated under the Project. Even though the dry season in 2014 was especially harsh, restriction of the water supply in Spanish Town was unnecessary.

In Portmore, as water supply by three wells rehabilitated under the Project is insufficient, production is continuing at some other wells even though these wells were excluded from the scope of the Project because of the difficulty of continuing water production for a long time based on the conclusion of the water resources evaluation study. The level of the water demand is high in Portmore which is experiencing rapid population growth, making it necessary to receive some 23,000 to 27,000 m^3 of water a day from the Rio Cobre System. As there was a prospect that those wells rehabilitated under the Project based on the findings of the above-mentioned study would be unable to produce water for a long period of time, it was planned to eventually supply water from the Rio Cobre System to Portmore via a new transmission main to meet the entire water demand of Portmore. The water supply volume in recent years has been 39,000 m^3/day, consisting of 14,000 m^3/day from local wells (2012 – 2014 average) and 25,000 m^3/day from the Rio Cobre System. In the dry season when the water supply volume from the Rio Cobre System is reduced, there is a water shortage which results in a lower water pressure in daytime. In 2014 which was a dry year, the water supply volume was reduced from March to September to the extent that some areas experienced a water cut in the daytime.

A beneficiary survey was conducted as part of the ex-post evaluation to determine the degree of improvement of the water supply service in Spanish Town and Portmore and also the degree of satisfaction with the service among local residents (Table 7).[16] Some 90% of the residents of Spanish Town are satisfied with the current water supply service compared to a mere 30% in Portmore. Noticeable improvements have been made in Spanish Town in terms of the water pressure, water supply hours and water quality. In Portmore, although the water pressure has somewhat improved, hardly any improvements have been made in terms of the water supply hours and water quality. The water charge, facility maintenance (water leakage repair, etc.) and customer service have improved in Spanish Town. In contrast, many of the respondents of the questionnaire survey, i.e. beneficiary survey, in Portmore said that these have worsened.

[16] The answers were obtained through a questionnaire survey conducted with 51 households in Spanish Town and 50 households in Portmore that were randomly selected.

Table 7 Degree of Satisfaction with and Degree of Improvement of the Water Supply Service

	Spanish Town	Portmore
The current water supply service is satisfactory.	88%	28%
If unsatisfactory, what are the problems?	Joint 1st: water pressure and water charge 3rd: customer service	1st: water pressure 2nd: supply hours 3rd: water charge
Degree of improvement of the water supply service (Each figure is the result of subtracting the percentage of negative replies from the percentage of positive replies.)	Water pressure: 64% Supply hours: 52% Water quality: 47% Water charge: 23% Maintenance: 49% Customer service: 35%	Water pressure: 19% Supply hours: 3% Water quality: 0% Water charge: -15% Maintenance: -11% Customer service: -3%

Source: Beneficiary Survey

In short, while major improvements have been achieved in Spanish Town, improvements in Portmore which still experiences a water shortage in the dry season have been modest. However, the water supply situation in both areas would have been much worse if the Project had not been implemented, therefore it is fair to say that the Project made certain contribution also in Portmore.

Following an increase of the water production capacity of the Rio Cobre System under the Project, it has become possible to supply a certain amount of water to the KSA where the water shortage is severe in the dry season. The Rio Cobre System produces an average of 63,000 m^3 of water a day and around one-quarter (14,000 – 18,000 m^3/day; 16,000 m^3/day on average in the latest 12 month period) is sent to the KSA.[17] As the water demand in the KSA is approximately 182,000 – 218,000 m^3/day, the Rio Cobre System appears to meet some 10% of the KSA's water demand. Because of the severe daytime water shortage in the KSA during the 2014 dry season, the water supply volume from the Rio Cobre System to the KSA was increased up to 45,000 m^3/day.

3.3.2.3 Strengthening of Organization of NWC

The consulting service for the Project produced recommendations and an action plan for each of such themes as (i) operation and maintenance of electrical and mechanical equipment, WTP and drainage facilities, (ii) measures to combat UFW, (iii) information system, (iv) customer service and (v) asset management, while conducting the gathering and analysis of information by small groups consisting of members representing various related fields, mostly in the project area.

According to NWC, the simultaneous occurrence of the organizational reform of NWC for decentralization and the consulting service meant that the efficiency of the latter suffered, because of the need to allocate much time to analysis of the organizational set-up of NWC. As the NWC did not

[17] As the water resources evaluation study found that it was difficult to continually rely on groundwater supply in Portmore, the construction of a new WTP (68,000 m3/day) which would be required to supply water to Portmore via the Rio Cobre System was planned. This plan, however, has not materialised due to lack of funds.

entirely execute the action plan, the outputs of technical assistance in the area of organizational strengthening have not been fully utilized. However, according to NWC, the capacity of individual participants is believed to have been enhanced through the participatory approach employed for the technical assistance. In subsequent efforts by the NWC to strengthen organization, some of the proposals made by the consulting service were put into practice, and the knowledge acquired by the NWC employees via the Project technical assistance was utilized in this. For example, in the Project target area, asset management was enhanced and commendations were received from one international organization, while the technical assistance of the Project was reflected in organizational strengthening implemented by the EC and helped improve the asset management system for the NWC overall.

3.4 Impacts

3.4.1 Intended Impacts

The Project was expected to have positive impacts on the convenience of daily life and health and sanitation through improvement of the water supply service.

According to the beneficiary survey, the ratio of people in possession of a water tank and the ratio of people purchasing bottled water are high in Portmore (Table 8), presumably because of the relatively poor groundwater quality in Portmore with a high concentration of salt and manganese, etc. In Spanish Town, both the water consumption volume and frequency of hygiene-related practices (hand-washing, bathing and washing, etc.) significantly increased. It may be that the improved water supply service facilitated the improvement of sanitation management. No similar increases were observed in Portmore. Important positive changes related to water supply and water use (improved water quality and increased convenience of water use, etc.) were reported often in Spanish Town than in Portmore.

Table 8 Results of the Survey on the Impacts on Water Use, Sanitation Management and Other

		Spanish Town	Portmore
Possession of a water tank		37%	63%
Purchase of bottled water (no drinking of tap water)		29%	50%
Increase of the water consumption volume (ratio of households with increased consumption – ratio of households with decreased consumption)		29%	2%
Increase of the frequency of sanitation management practices (ratio of households with increased frequency – ratio of households with decreased frequency)	Hand-washing	33%	8%
	Bathing	16%	4%
	Washing	4%	-10%
	Flushing of toilet	22%	-8%
Important positive changes related to water use		69%	39%

Source: Beneficiary survey

According to data of the Ministry of Health, the number of infants which were treated for diarrhea at the Spanish Town Hospital was halved from 1,359/year (2006 – 2008) before the Project to 622/year (2011 – 2013) after the Project. The number of outpatients other than infants also considerably declined. The Ministry of Health believes that such positive changes can be much attributed to improved school education on sanitation, improved school meals and the active education of parents on the importance of sanitation, and that an impact of the Project is not big. There is a possibility that the Project has contributed to such positive changes through improved sanitation management although verification of this is difficult. No outbreak of diarrhea due to contaminated tap water has been confirmed in the last 10 years.

3.4.2 Other Impacts

It was judged after the modification of the Loan Agreement that an EIA was not to be required because of the likely minor impacts of the Project on the environment. After obtaining an environmental permit in 2001 from the National Environment and Planning Agency, a plan to minimize any environmental impacts was prepared prior to the implementation of the Project. The contents of this plan were such general issues as the prevention of noise and vibration.

NWC monitors the groundwater level at its own wells. While the groundwater level is affected by the rainfall and water production (extraction) levels, there has been a declining tendency at some wells in Spanish Town since 2005. This may lead to a situation where the production volume will need to be regulated in the future and deserves close attention.

The groundwater recharging facility constructed under another project (the facility originally included in the Project; the first phase to be completed in 2015) is expected to prevent the incursion of salt water into and to increase the water production volume of wells in the western part of Spanish Town. Phase I of this project is scheduled to be completed in 2015.

Thus, no major environmental impacts can be seen at the time of the ex-post impact, however, ongoing monitoring of the groundwater level is required in some of the wells in Spanish Town.

The Project did not involve any resettlement and caused no special social problems.

In summary, although the Project aimed at realizing a stable water supply in the project area (Spanish Town and Portmore) by means of improving the water production and distribution facilities, the actual water production volume of the facilities newly constructed or rehabilitated under the Project is some 60% of the target. In Spanish Town, a stable water supply was achieved and both the water consumption volume and frequency of the sanitation management practices significantly increased after the Project. In contrast, the water supply situation has not much improved in Portmore and no significant change of the water consumption volume or the frequency of sanitation management practices has been observed. Moreover, the outcomes of the technical assistance for the strengthening of NWC's organization have not yet been fully utilized as they are. Based on these results, the effectiveness/impact of the Project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspect of Operation and Maintenance

The operation and maintenance of the facilities newly constructed or rehabilitated under the Project are the responsibility of the St. Catherine Office of NWC's Eastern Division and the Technical Services of NWC's Head Office. The Water Production Unit of the St. Catherine Office is in charge of the operation of the WTP, wells and pumping stations while the Customer Relations Unit is in charge of the maintenance of the distribution network, collection of the water charge and other aspects of customer services.

At the Spanish Town WTP, four operators (a total of eight operators) work a 24 hour shift and this manpower level is adequate. Some 20 operators are responsible for the operation of the wells and pumping stations. Each well or pumping station is visited two or three times a day to record the operation and also for the visual and other types of checking for any abnormal sound or vibration, etc. A guard is deployed at some wells located near residential areas.

Electrical and mechanical engineers belonging to the Technical Services of the Head Office are assigned to each local office to conduct preventive maintenance and minor repairs. The Head Office in Kingston has a workshop which is capable of repairing motors, pumps and control systems, etc. Any repair beyond the capability of this workshop is outsourced. The St. Catherine Office has two electrical engineers and four mechanical engineers. The Head Office has a laboratory which is capable of conducting water quality testing. This laboratory checks the quality of sampled water from WTPs two to five times per week, water supply tanks and water taps in the eastern part of the KMA.

According to the Technical Services, NWC is unable to fully implement preventive maintenance as its personnel is generally under pressure to conduct repair work, indicating an insufficient number of engineers[18], requiring an increase of personnel by another 20~30%. The on-site visits by the evaluator sometimes found that facilities were not thoroughly cleaned.

In short, while the organizational arrangements for operation and maintenance are clearly established, the size of the front-line manpower is insufficient, making it difficult to effectively conduct preventive maintenance.

3.5.2 Technical Aspect of Operation and Maintenance

NWC has been operating many WTPs and wells for many years and its level of experience regarding the operation and maintenance of civil engineering structures and electrical/mechanical equipment appears to be adequate. Given the actual performance of facility operation, there are no technical problems regarding the operation and maintenance of the Spanish Town WTP. Similarly, no technical issues have been found regarding the wells and pumping stations included in the scope of the Project. Manuals and other technical documents necessary for the operation and maintenance of the project-related facilities are kept at NWC's Head Office and are referred when required.

[18] Two electric technicians and four mechanical technicians are allocated in the St. Catherine Office of NWC

In the JICA's technical cooperation project (capacity building of water maintenance: March, 2007 to November, 2010), the Spanish Town WTP was one of the four subject WTPs of this project. Training was provided on (i) the preparation and use of the agent injection manual and filtration basin cleaning manual and (ii) the introduction of routine maintenance. Operators of the Spanish Town WTP highly value the practicality and usefulness of this training. The operating rate and the facility utilization rate of the Spanish Town WTP are high. According to NWC's laboratory at the Head Office, the water purification performance of the Spanish Town WTP is the highest among all WTPs in Jamaica. According to the laboratory engineers, the reason for such an excellent performance is the superior technical design of the Spanish Town WTP. It is likely that the JICA's technical cooperation mentioned above is another contributory factor.

The St. Catherine Office was the first to see the introduction of the practices of asset management and predictive maintenance (physical monitoring of the equipment conditions to ensure timely inspection and preventive maintenance work) in Jamaica and the efficiency of operation and maintenance has much improved. Such practices are based on some of the outcomes of the technical assistance under the Project for the strengthening of NWC's organization.

Under the Project, NWC gained practical experience of the groundwater surveying of a limestone formation which is commonly considered to be a difficult technical challenge. It now plans to conduct a more accurate assessment using stable isotopes.

In summary, there are no major technical issues concerning the Project sustainability.

3.5.3 Financial Aspect of Operation and Maintenance

NWC has been operating its own facilities without a government subsidy since the Project which was the last instance of any such subsidy. (Table 9 and 10) The operating income has continued to increase in the last three years, recording an operating profit. The water tariff is set to cover the expenses and efforts have been made to reduce costs to ensure profit-making operation with the guidance of the Ministry of Finance and Planning.[19]

The earning ratio[20] of NWC of around 29% - 37% has been high in the last three years, enabling NWC to meet its operating expenses and debt repayment without borrowing. The EBITDA margin has increased from 9% to 16% in the last three years, showing improved profitability[21]. As the current ratio exceeds 125%, the cash flow situation is healthy.

The biggest problem for the financial health of NWC is the high rate of UFW of 68% (Fiscal Year 2010/11), the principal causes of which are water leakage from the deteriorated distribution network and water theft. The financial situation of NWC is being squeezed as the falling value of the

[19] The water supply and sewerage service tariffs are determined under the supervision of the Office of Utilities Regulation (OUR) to ensure an adequate level to meet the cost of each service. The factors considered include the rate of inflation, cost of the work to reduce water leakage, reserve funds for investment in facilities, such as new sewerage facilities (K-factor) and incentive for improvement of the operational efficiency (X-factor). As wages in the public sector, including NWC, were frozen four years ago, the personnel cost has been controlled.

[20] Earning ratio = net income (EBITDA – debt payment) / working capital

[21] The EBITDA margin is the EBITDA (Earnings before interest, taxes, depreciation and amortization) divided by turnover, and this is one indicator for the profitability of a business.

Jamaican dollar has considerably pushed up the repayment of loans in foreign currency and the cost of imported materials.

Table 9 Financial Performance of NWC

(Unit: J$ million)

	End of March, 2012	End of March, 2013	End of March, 2014
Current Assets	10,131	11,933	19,350
Fixed Assets	34,506	62,580	65,688
Total Assets	44,637	74,513	85,038
Current Liabilities	7,358	9,394	10,286
Fixed Liabilities	37,657	49,731	60,618
Total Liabilities	45,015	59,125	70,904
	FY2011	FY2012	FY2013
Operating Income	19,522	21,553	23,849
Operating Expenses	18,567	18,470	21,093
Operating Profit	955	3,083	2,756
EBITA Margin	9.0%	19.2%	16.1%
Current Ratio	138%	127%	188%

Source: NWC

Table 10 Breakdown of Operating Expenses

(Unit: J$ million)

	FY2011	FY2012	FY2013	FY2014
Personnel Cost	6,034	6,196	6,094	6,507
Repair/Maintenance	1,857	2,606	2,253	3,149
General Administrative Expenses	2,999	3,306	3,490	4,228
Electricity	4,357	5,840	5,965	6,487
Telephone	103	117	111	113
Fuels and Oil	207	256	265	280
Raw Water	154	246	292	329
Total	15,710	18,567	18,470	21,093

Source: NWC

Because of the situation described above, NWC has been unable to secure sufficient funds to conduct proper maintenance and to invest in the renewal of old facilities as well as better customer service. According to NWC's maintenance department, even though the maintenance budget is increased every year, the actual amount is far below the required budget size. To make matters worse, the strict procurement procedure in the public sector sometimes prolongs repair work as several months may be required for the procurement of necessary spare parts.

Thus, the NWC is financially self-supporting. However, the high UFW rate and maintenance budget constraints are issues.

3.5.4 Current Status of Operation and Maintenance

The Spanish Town WTP has been operating smoothly with a facility utilization rate of 97% in recent years. In contrast, the utilization rate of wells is an average of 74% (see 3.3.1.1). Power outages

occur several times a month, greatly affecting the operation of various facilities. Even though some wells are equipped with a generator, the use of such generators is only limited at the time of acute water supply shortages. Three wells have been left unrepaired for more than one year because of a lack of budgetary allocation for repair and also because of a lack of urgency to obtain water from these wells. At the time of the field survey, seven out of 20 wells were not in operation due to stoppage of the power supply (two wells), water quality problems (two wells) and repair work in progress (three wells).

A well without proper cleaning
（Cookson 3 Well）

A well for which one of the chlorine injection pumps was removed to take spare parts
（Friendship Well）

During the field survey at project-related facilities, the evaluator found that the area around a well, etc. is not properly cleaned and there are many instances of reserve equipment in use as the necessary repair work was on hold due to a shortage of spare parts and that spare parts had been taken from reserve equipment. The shortage of spare parts appears to be particularly serious in the case of electronic parts for chlorine injection pumps and control panels. At many wells, one of the two originally installed chlorine injection pumps (one is a reserve pump) has been dismounted for use at another well or for cannibalizing.

Thus, the situation regarding maintenance of Project wells is not good.

The maintenance regime for the facilities newly constructed or rehabilitated under the Project has minor problems in terms of the system and finance. Problems are also seen in the maintenance of some facilities. Therefore, the sustainability of the project effects is fair.

4 Conclusions, Lessons Learned and Recommendations

4.1 Conclusions

The Project was implemented in the KMA with the aim of achieving stable water supply by means of developing new water sources using groundwater and rehabilitating as well as expanding a water treatment plant and transmission/distribution mains, thereby contributing to improvement of the

daily life of residents. At the time of both the appraisal and ex-post evaluation, the Project was found to be highly relevant to the development policies of Jamaica. The Project was a tangible response to the important as well as urgent task of improving the water supply in the KMA and was compatible with the ODA policies of Japan. As such, the relevance of the Project is high. For the implementation of the Project, the original plan was considerably revised twice because of (i) the cancellation of a World Bank-related program and (ii) the unavailability of expected groundwater sources. The actual project cost was within the originally planned cost, and the investment efficiency considering the revision to the Project scope was more or less as planned. On the other hand, the actual project period far exceeded the originally planned period because of the longer than anticipated groundwater survey, procurement process and work to revise the original plan. The delay of some of the work conducted by NWC due to insufficient budgetary appropriation also contributed to the prolonged project period. Because of this, the efficiency of the Project is judged to be fair. The actual water production volume of the project-related facilities was approximately 60% of the target. Among the target areas, a stable water supply was achieved in Spanish Town, significantly increasing the water consumption volume and level of sanitation there. In contrast, there was no improvement of the water supply in Portmore and neither the water consumption volume nor the level of sanitation increased in this district. The outcomes of the technical assistance designed to strengthen the organization of NWC were not fully utilised in the post-project period. Because of these shortcomings, the effectiveness/impact of the Project is judged to be fair. NWC possesses the necessary technical capability to operate and maintain the facilities newly constructed or rehabilitated under the Project but the number of employees assigned to front-line duties is insufficient. The maintenance of some facilities is inadequate because of the insufficient availability of spare parts, in turn caused by the insufficient maintenance budget. As such, the sustainability of the effects of the Project is fair. In the light of the above, the Project is evaluated as being partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- In order to increase the utilization rate of wells rehabilitated and constructed in the Project and boost the project effect, the NWC should allocate appropriate human resources and budget to well maintenance, secure spare parts and implement appropriate preventive maintenance.
- In order to enhance the sustainability of wells in the west of Spanish Town, the NWC should promptly complete construction and start operation of the groundwater recharging facilities that are currently being constructed under separate funding from the Project. Moreover, because lowering tendency of the groundwater level can be seen in some of the wells in Spanish Town, it is necessary to implement ongoing monitoring.
- In order to adequately assess sustainability of the Rio Cobre System which relies on underground water and reflect it on long-term planning of water supply in KMA, NWC should be mindful and aware of the changes in land use and future developmental plans

within Rio Cobre Basin and close proximity to its water supply facilities, i.e. Rio Cobre System.

- When it comes to advancing organizational strengthening aimed at improving organizational efficiency in the future, it is hoped that the NWC fully refers to and utilizes the proposals and action plans for organizational strengthening provided by the Project consulting service regarding operation and maintenance of electrical and mechanical equipment, water distribution network, and WTP, asset management, customer services, measures to counter UFW, information management system and so on.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Importance of resource evaluation in groundwater development around urban areas:

In urban areas where there are frequent changes in land uses, it is possible that the conditions of groundwater sources will rapidly change due to the reduction of farmland which offers groundwater recharging functions. Therefore, in order to conduct groundwater development around urban areas, it is important to evaluate groundwater resources on an ongoing basis through monitoring land use and groundwater level, conduct well diagnosis at the time of pump exchange, etc. If it isn't possible to utilize sufficient information when planning a project, it is necessary to consider implementation of field survey including diagnosis of wells.

Comparison between the Original Plan and the Actual Results

Item	Original Plan	Actual Results
① Outputs		
<Spanish Town>		
- Rehabilitation of Spanish Town WTP	18,000 m^3/day	As planned
- Rehabilitation of existing wells and related distribution facilities		
- Rio Cobre System	61,000 m^3/day	78,000 m^3/day
- Other wells	9 wells, 40,000 m^3/day	7 wells, 31,000 m^3/day
- Construction of new wells and related transmission and distribution facilities	4 wells, 20,000 m^3/day	3 wells, 24,000 m^3/day
- Renewal of distribution network	2 areas, 18.4 km	2 areas, 32.3 km
< Portmore >		
- Rehabilitation of existing wells and related transmission and distribution facilities	9 wells, 27,000 m^3/day	3 wells, 18,000 m^3/day
- Construction of new wells, related transmission and distribution facilities	7 wells, 23,000 m^3/day	Not implemented
- Construction of transmission main from Rio Cobre System and related transmission and distribution facilities	(not planned)	Transmission main: 10 km Distribution main: 3 km
- Extension of existing irrigation channels		Not implemented
- Groundwater recharging facility		Not implemented
- Consulting service		
- Strengthening of organization of NWC		As planned (A detailed study on groundwater was added.)
- Detailed design and work supervision, etc.		
② Project Period	April, 2000 – February, 2006 (71months)	April, 2000 – August, 2013 (161months)
③ Project Cost		
Foreign Currency	4,645Mil.Yen	4,645 Mil.Yen
Local Currency	3,645 Mil.Yen (1,325Mil.JMD)	3,029 Mil.Yen (2,195Mil.JMD)
Total	8,110 Mil.Yen	7,674 Mil.Yen
Japanese ODA Loan Portion	6,644 Mil.Yen	6,560 Mil.Yen
Exchange Rate	1JMD*=2.75Yen (As of February, 2002)	1JMD=1.38Yen (Average for 2000-2013)

* JMD: Jamaican Dollar

Evaluation Department, Japan International Cooperation Agency (JICA)

Opinion of JICA Evaluation Department on Ex-post Evaluation of "KMA Water Supply and Rehabilitation Project" in Jamaica

[Project Period in the Aspect of Efficiency] (Related Section: 3.2.2.2 Project Period)

In the section of Efficiency of the ex-post evaluation report, the project period was regarded as 161 months from the amendment of the loan agreement in April 2000 to the project completion in August 2013, which was 227% of the planned project period. On the other hand, since it has taken much longer for this project to demonstrate any effect than the initial appraisal plan, one could evaluate the efficiency based on the project period planned at the time of appraisal. In that case, project period would be 205.3 months from the appraisal time in July 1996 to the completion in August 2013, which was 380% of the planned project period.