

Ex-Post Project Evaluation 2014: Package II-3  
(Jamaica, Bolivia, Central America and the Caribbean)

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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)<sup>1</sup> 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<sup>2</sup>. 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

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<sup>1</sup> 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.

<sup>2</sup> 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<sup>2</sup> (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: 31<sup>st</sup> November to 18<sup>th</sup> December, 2014  
5<sup>th</sup> to 9<sup>th</sup> 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<sup>3</sup>)**

#### **3.1 Relevance (Rating: ③<sup>4</sup>)**

##### **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.

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<sup>3</sup> A: Highly satisfactory, B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

<sup>4</sup> 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.

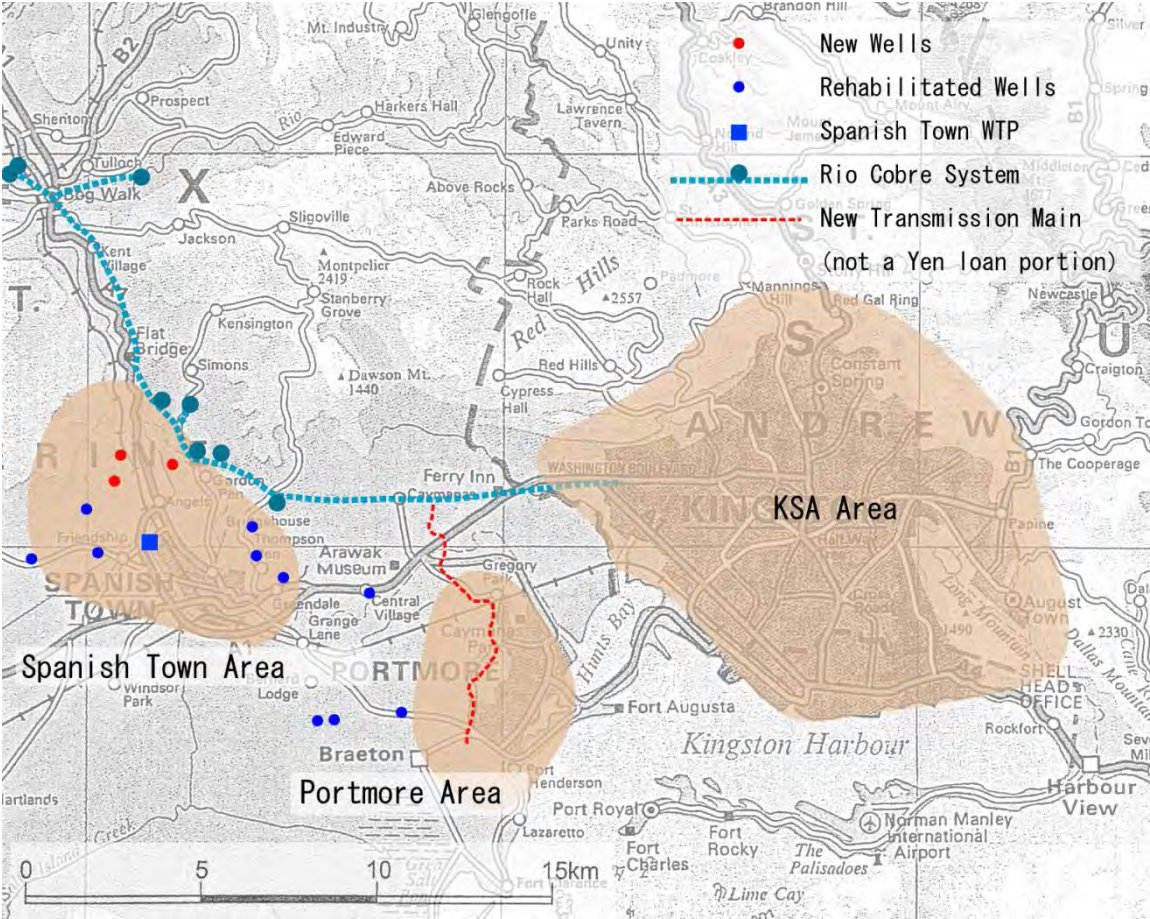


Figure 1 Water Supply Facility Constructed Under the Project

## 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”).<sup>5</sup> 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.<sup>6</sup> 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<sup>7</sup>. As unexpected changes of the population distribution and

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<sup>5</sup> The World Bank Programme included the rehabilitation of sewerage facilities.

<sup>6</sup> 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.

<sup>7</sup> 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<sup>8</sup>. 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.<sup>9</sup> 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<sup>3</sup>/day or 91% of the planned output of 185,000 m<sup>3</sup>/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<sup>3</sup>/day was 37% of the planned capacity (62,000 m<sup>3</sup>/day) at the time of the appraisal or 57% of the revised plan (42,000 m<sup>3</sup>/day).

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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.

<sup>8</sup> 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.

<sup>9</sup> 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
<p>KSA &lt;Spanish Town &gt;</p> <ul style="list-style-type: none"> <li>• Intake facility: 50,000 m<sup>3</sup>/day</li> <li>• Construction of WTP: 23,000 m<sup>3</sup>/day</li> <li>• Construction of wells: 3 wells, 16,000 m<sup>3</sup>/day</li> <li>• Construction of related transmission and distribution facilities</li> </ul>	<p>&lt; Spanish Town &gt;</p> <ul style="list-style-type: none"> <li>• Rehabilitation of Spanish Town WTP: 15,000 m<sup>3</sup>/day</li> <li>• Rehabilitation of existing wells and related distribution facilities <ul style="list-style-type: none"> <li>- Rio Cobre System*: 61,000 m<sup>3</sup>/day</li> <li>- Other wells: 9 wells, 40,000 m<sup>3</sup>/day</li> </ul> </li> <li>• Construction of new wells and related transmission and distribution facilities: 4 wells, 20,000 m<sup>3</sup>/day</li> <li>• Renewal of distribution network: 2 areas, 18.4 km</li> </ul>	<p>18,000 m<sup>3</sup>/day</p> <p>78,000 m<sup>3</sup>/day 7 wells, 31,000 m<sup>3</sup>/day</p> <p>3 wells, 24,000 m<sup>3</sup>/day</p> <p>2 areas, 32.3 km</p>
<p>&lt; Portmore &gt;</p> <ul style="list-style-type: none"> <li>• Construction of wells: 7 wells, 23,000 m<sup>3</sup>/day</li> <li>• Construction of related transmission and distribution facilities</li> </ul>	<p>&lt; Portmore &gt;</p> <ul style="list-style-type: none"> <li>• Rehabilitation of existing wells and related transmission and distribution facilities: 9 wells, 27,000 m<sup>3</sup>/day</li> <li>• Construction of new wells, related transmission and distribution facilities: 7 wells, 23,000 m<sup>3</sup>/day</li> <li>• Construction of transmission main from Rio Cobre System and related transmission and distribution facilities (not planned)</li> </ul>	<p>3 wells, 18,000 m<sup>3</sup>/day</p> <p>Not implemented</p> <p>Transmission main: 10 km Distribution main: 3 km</p>
<ul style="list-style-type: none"> <li>• Extension of existing irrigation channels</li> <li>• Groundwater recharging facility</li> <li>• Consulting service <ul style="list-style-type: none"> <li>- Detailed design and work supervision, etc.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Extension of existing irrigation channels</li> <li>• Groundwater recharging facility</li> <li>• Consulting service <ul style="list-style-type: none"> <li>- Strengthening of organization of NWC</li> <li>- Detailed design and work supervision, etc.</li> </ul> </li> </ul>	<p>Not implemented**</p> <p>Not implemented***</p> <p>As planned.</p> <p>A detailed study on groundwater was added.</p>

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 <sup>3</sup> /day	42,000 m <sup>3</sup> /day	24,000 m <sup>3</sup> /day (57%)
Rehabilitated	(not planned)	143,000 m <sup>3</sup> /day	145,000 m <sup>3</sup> /day (101%)
Total	62,000 m <sup>3</sup> /day	185,000 m <sup>3</sup> /day	169,000 m <sup>3</sup> /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<sup>3</sup>/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<sup>10</sup> (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).<sup>11</sup> 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.<sup>12</sup> 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)

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<sup>10</sup> The effectiveness is rated in consideration of not only the effects but also the impacts.

<sup>11</sup> Utilisation rate based on the operating hours = annual operating hours/(24 hours x 365 days)

<sup>12</sup> No data was obtained by the evaluator to distinguish between pre-planned production stoppages and production stoppages due to other reasons.

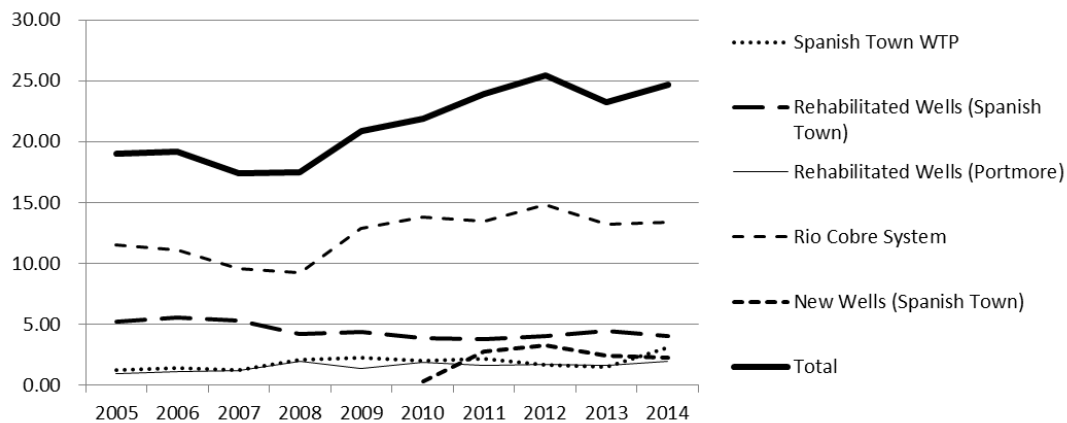
Table 5 Water Production Volume of Water Production Facilities  
Rehabilitated or Newly Constructed Under the Project

(Unit: 10,00  
0m<sup>3</sup>/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<sup>3</sup>/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<sup>13</sup>. 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

<sup>13</sup> 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%.<sup>14</sup> 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<sup>3</sup>/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<sup>3</sup>/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 m<sup>3</sup>/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.

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<sup>14</sup> 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
<b>Operation Indicator</b>			
Facility Utilization Rate (based on operating hours)	-	100%	WTP 97% Rehabilitated wells 76% Rio Cobre System 81% New wells 49% With all facilities 75%
<b>Effect Indicator</b>			
Water Production Volume	-	Rehabilitated 143,000 m <sup>3</sup> /day New 42,000 m <sup>3</sup> /day Total 185,000 m <sup>3</sup> /day	Rehabilitated 99,000 m <sup>3</sup> /day New 12,000 m <sup>3</sup> /day Total 111,000 m <sup>3</sup> /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).<sup>15</sup>

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<sup>3</sup>/day in total, almost all of which comes from facilities constructed or

<sup>15</sup> Of the daily water production volume of some 64,000 m<sup>3</sup> of the Rio Cobre System, some 9,000 – 14,000 m<sup>3</sup>/day goes to Spanish Town, 27,000 – 32,000 m<sup>3</sup>/day to Portmore and the remaining 18,000 – 23,000 m<sup>3</sup>/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<sup>3</sup> 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<sup>3</sup>/day, consisting of 14,000 m<sup>3</sup>/day from local wells (2012 – 2014 average) and 25,000 m<sup>3</sup>/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).<sup>16</sup> 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.

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<sup>16</sup> 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 1 <sup>st</sup> : water pressure and water charge 3 <sup>rd</sup> : customer service	1 <sup>st</sup> : water pressure 2 <sup>nd</sup> : supply hours 3 <sup>rd</sup> : 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<sup>3</sup> of water a day and around one-quarter (14,000 – 18,000 m<sup>3</sup>/day; 16,000 m<sup>3</sup>/day on average in the latest 12 month period) is sent to the KSA.<sup>17</sup> As the water demand in the KSA is approximately 182,000 – 218,000 m<sup>3</sup>/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<sup>3</sup>/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

<sup>17</sup> 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 m<sup>3</sup>/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<sup>18</sup>, 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.

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<sup>18</sup> 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.<sup>19</sup>

The earning ratio<sup>20</sup> 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<sup>21</sup>. 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

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<sup>19</sup> 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.

<sup>20</sup> Earning ratio = net income (EBITDA – debt payment) / working capital

<sup>21</sup> 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 dismantled 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 <sup>3</sup> /day	As planned
- Rehabilitation of existing wells and related distribution facilities		
- Rio Cobre System	61,000 m <sup>3</sup> /day	78,000 m <sup>3</sup> /day
- Other wells	9 wells, 40,000 m <sup>3</sup> /day	7 wells, 31,000 m <sup>3</sup> /day
- Construction of new wells and related transmission and distribution facilities	4 wells, 20,000 m <sup>3</sup> /day	3 wells, 24,000 m <sup>3</sup> /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 <sup>3</sup> /day	3 wells, 18,000 m <sup>3</sup> /day
- Construction of new wells, related transmission and distribution facilities	7 wells, 23,000 m <sup>3</sup> /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
- Detailed design and work supervision, etc.		(A detailed study on groundwater was added.)
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

Plurinational State of Bolivia

Ex-Post Evaluation of Japanese Grant Aid Project

“Project for Development of Potable Water, San Juan River System in Potosí”

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

## 0. Summary

The Project was implemented with the aim of realizing continual supply of safe water in sufficient quantity to residents of the service area of the San Juan River System serving the western half of Potosí by means of constructing a new WTP and rehabilitating the existing water intake and conduction pipeline, thereby contributing to improvement of the sanitation and living environment of the project area. At the time of both the ex-ante evaluation and ex-post evaluation, the Project was found to be highly relevant to the development policy and development needs of Bolivia and also to Japan’s ODA policy at the time of the ex-ante evaluation. Therefore, the relevance of the Project is high. The planned outputs were achieved and both the project cost and project period were within the plan. As such, the efficiency of project implementation is high. The construction of conduction pipeline protection facilities has reduced the water cuts caused by damage to the conduction pipeline and the treatment of the raw water at the new WTP has eliminated water cuts due to raw water with high turbidity. The water quality standards, including the turbidity standard, have been met by the supplied water even in the rainy season when the turbidity of the raw water is high, achieving the supply of clean water throughout the year. The improvement of the water quality has increased convenience in using water on the part of users. Therefore, the effectiveness as well as impacts of the Project are high. AAPOS (Autonomous Administration of Sanitary Works Potosí) has maintained its profitable operation and does not face any financial problems. While the maintenance of the WTP poses no problems, there is some concern in regard to the security arrangements at the water intake. In regard to the maintenance of the conduction pipeline, adequate maintenance had been lacking because of the fact that the knowhow transferred under the Soft Component have not been fully utilised. Therefore, the sustainability of the Project is fair. In the light of the above, the Project is evaluated as highly satisfactory.

## 1. Project Description



Location Map



Rio San Juan Water Treatment Plant

## 1.1 Background

In 2009, the Government of the Plurinational State of Bolivia (hereinafter simply referred to as “Bolivia”) had the National Basic Sanitation Plan (2000 - 2010) which focused on improvement of the water supply and sewerage facilities with the target of improving the national coverage of water supply to 90% by 2010.

The city of Potosí (with a population of approximately 150,000 in 2008) is the capital of the Potosí Department which is located in the mountainous southwest corner of Bolivia with a mean elevation of 4,000 m. The Potosí Department is one of the poorest areas of the country. In the city of Potosí, AAPOS is in charge of the provision of water services. The water distribution system in Potosí consists of two distribution systems which serve their respective areas. In the case of the Kali Kali System, a water supply system, including a water treatment plant (hereinafter simply referred to as “WTP”) with a treatment capacity of 150 litres/sec, was completed with a loan of KfW Development Bank in 2008. In contrast, as there was no WTP serving the San Juan River System, untreated water from San Juan River was supplied. The use of untreated river water meant the occasional suspension of the supply due to a high level of turbidity after rain or the distribution of high turbidity water. Meanwhile, the 51 km long conduction pipeline from San Juan River to Potosí was liable to prolonged water cuts due to scouring of the foundations, falling rocks and other reasons as it was laid on unstable ground together with the absence of proper rainwater drainage along the route. Furthermore, neither the dirt removal facility nor air valve functioned properly, necessitating their urgent rehabilitation.

Under these circumstances, the Government of Bolivia made a request to the Government of Japan for the provision of grant aid for improvement of the water supply and sewerage facilities in the San Juan River System. In response, the Japan International Cooperation Agency (JICA) conducted the Basic Design Study in 2009 and implemented the Project from 2009 to 2011.

## 1.2 Project Outline

The objective of the Project was to realize continual supply of clean water in sufficient quantity for the citizens of Potosí in Bolivia by means of the construction of a new WTP and the rehabilitation of the water intake and conduction pipeline, thereby contributing to improvement of the sanitation and living environment in the project area.

Grant Limit/Actual Grant Amount	1,316 million yen/1,316 million yen
Exchange of Notes Date/Grant Agreement Date	October, 2009/October, 2009
Implementing Agency	Autonomous Administration of Sanitary Works Potosí (AAPOS)
Project Completion Date	November, 2011
Main Contractor	Hazama Corporation
Main Consultant	Tokyo Engineering Consultants Co., Ltd.
Basic Design Study	October, 2008

Detailed Design Study	November, 2009
Related Project	KfW Development Bank “Drinking Water Supply, Potosí”

## 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: 28<sup>th</sup> October to 9<sup>th</sup> November, 2014, and  
12<sup>th</sup> to 14<sup>th</sup> April, 2015

## 3. Results of Evaluation (Overall Rating: A<sup>1</sup>)

### 3.1 Relevance (Rating: ③<sup>2</sup>)

#### 3.1.1 Relevance to Development Policies of Bolivia

As already mentioned in “1.1 Background”, at the time of the ex-ante evaluation, the Government of Bolivia emphasised improvement of the water supply and sewerage services. The Basic Sanitation Sector Development Plan (2011 - 2015) which was in force at the time of this ex-post evaluation upholds the notion that access to water supply and sanitation services is a basic human right. While stressing the role to be played by the public sector, this Plan adopts a target access rate to water supply of 90% (95% in urban areas and 80% in rural areas), focusing on improvement of the water supply and sewerage facilities. As such, the Project is highly relevant to the development policies of Bolivia at the time of both the ex-ante evaluation and ex-post evaluation.

#### 3.1.2 Relevance to Development Needs of Bolivia

As already mentioned in “1.1 Background”, the construction of a new WTP and improvement of the conduction pipeline for the San Juan River System in Potosí at the time of the ex-ante evaluation were urgently required. In subsequent years, the population increase of Potosí was much higher than estimated in the preliminary study because of the development of local mines. As a result, the water supply in 2014 of 300 - 340 litres/sec was well below the demand of some 500 litres/sec, worsening the water shortage. Therefore, AAPOS started examinations on securing new water sources and

<sup>1</sup> A: Very High, B: High; C: Moderate; D: Low

<sup>2</sup> ③: High; ②: Fair; ①: Low

construction of new water treatment facility<sup>3</sup>. Accordingly, there is a strong need for stable water supply using the facilities constructed or improved under the Project even at the time of this ex-post evaluation. As such, the Project is highly relevant to the development needs of Bolivia at the time of both the ex-ante evaluation and ex-post evaluation.

**3.1.3 Relevance to Japan’s ODA Policies**

The Project falls under “Water and Sanitation” in “Social Development” which is one of the priority sectors identified by Japan’s Country Assistance Program for Bolivia (2009) and is relevant to Japan’s ODA policies.

This project is highly relevant to the country’s development plan and development needs as well as Japan’s ODA policy. Therefore its relevance is high.

**3.2 Efficiency (Rating: ③)**

**3.2.1 Project Outputs**

The following outputs were planned under the Project.

- Construction of a WTP : Rapid filtration system with a production capacity of 150 litres/sec.
- Rehabilitation of the conduction pipeline : Rehabilitation of the water intake along San Juan River, protection work for the conduction pipeline at 28 sites, rehabilitation of dirt removal facility and air valve at 39 sites.
- Soft component : Transfer of knowhow relating to the maintenance of the WTP and conduction pipeline

The above outputs were produced almost as planned. The only change from the Basic Design was strengthening of the metal mesh work which was incidental to the slope protection work at some sections of the conduction pipeline. This change was necessary because of the ground conditions and its impacts on the construction period and project cost were minimal. The field visit by the present evaluator did not find any special problems regarding the planning and construction of the various facilities under the Project. According to AAPOS, the facility plan for the Project was adequate and the quality of the work was sufficiently high.

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<sup>3</sup> The Strategic Development Plan (2010 - 2014) of AAPOS calls for (i) education of residents to be much more aware of water use and environmental conservation and also to improve the corporate image of AAPOS, (ii) strengthening of the organizational system, skills and finance through collaboration with related organizations and (iii) introduction of new information technologies (accounting information service system for customers, customer database and telemetric flow meters, etc.)





Figure. 1 Water Supply Facilities in Potosí

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The planned and actual project costs are shown in Table 1. The project cost was lower than planned as the actual cost was 93% of the planned cost.

Table 1 Planned and Actual Project Costs

	Planned	Actual
Japanese portion	1,340 million yen	1,247 million yen
Bolivian portion	3 million yen	2 million yen
Total	1,343 million yen	1,249 million yen

Sources: documents provided by JICA, AAPOS

#### 3.2.2.2 Project Period

The planned project period was two years and four months (28 months) from the date of the signing of the Exchange of Notes. The actual project period was shorter than planned, as it was two years and two months (26 months, 93% of the planned period) from the signing of the E/N in October, 2009 to completion in November, 2011.

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

### **3.3 Effectiveness<sup>4</sup> (Rating: ③)**

#### **3.3.1 Quantitative Effects (Operation and Effect Indicators)**

##### **3.3.1.1 Reduction of Water Cuts**

The Project aimed at reducing the frequency of water cuts due to the high level of water turbidity or damage to the conduction pipeline and envisaged that no water cuts would occur due to these reasons once the Project was completed. In the post-project period, there have been no water cuts due to high turbidity water or maintenance works of water distribution facility and the risk of water cut due to an accident has been reduced. Accordingly, this objective was mostly achieved.

##### **(1) Water Cuts Due to High Turbidity Water**

Prior to the Project, high turbidity water caused water cuts for 27 days a year.<sup>5</sup> No water cuts due to high turbidity of raw water have been recorded in the post-project period as the turbidity of the supplied water has met the relevant standard throughout the year.

##### **(2) Water Cuts Due to Breakage of Conduction Pipeline**

According to AAPOS, before the Project, the conduction pipeline for the San Juan River System suffered damage by natural phenomena such as land slide and rock fall one or two times per year. Man-made damages such as damages by road works also happened almost once a year.

In the three year post-project period, there were no damages caused by natural phenomena, because the conduction pipeline has been adequately protected by the Project<sup>6</sup>.

Before the Project, vehicle access to the water intake was impossible because of slope failure along the access road. The renewed protection of the conduction pipeline as well as the access road under the Project has enabled vehicle access to the water intake throughout the year. Therefore, it is judged that the risk of water cut due to troubles at the water intake has been significantly reduced, as prompt action could be taken when a problem occurs.

##### **(3) Water Cuts due to Maintenance Work at Water Distribution Facilities**

Maintenance of the water intake (cleaning of the settling basin) must be conducted approximately once a month during the rainy season and approximately once every three months during the dry season. Before the Project, it was necessary to suspend water intake operation for eight hours each time. After the Project, however, operation continues during maintenance work as a bypass pipeline is now available. The San Juan Reservoir required cleaning works every three months before the Project as the

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<sup>4</sup> The effectiveness is rated in consideration of not only the effects but also the impacts.

<sup>5</sup> The interview with AAPOS as part of this ex-post evaluation found that high turbidity water was supplied in the pre-project period as it was unless the turbidity was extremely high. The criteria to suspend water supply could not be clarified.

<sup>6</sup> On the other hand, there was one man-made accident in 2011 which caused a water cut for eight hours.

water turbidity was very high and mud accumulated quickly. In the post-project period, such maintenance works has not been required. Based on these facts, it is reasonable to conclude that the frequency of water cuts due to maintenance work has been much reduced<sup>7</sup>.



Water Intake



Slope Protection for the Access Road to Water Intake

**3.3.1.2 Increased Coverage Rate of Clean Water Supply**

The Project aimed at increasing the coverage rate of clean water supply by means of water treatment and adopted the target of increasing the clean water supply rate to Potosí to 94.5% in 2011.

At the time of the ex-ante evaluation, the access rate to water supply in Potosí was 81%. However, the coverage of safe water supply was even lower at 54% because of the lack of water treatment of San Juan River System. After the Project, the coverage rate of safe water supply is estimated to have increased to some 96% in October, 2014.<sup>8</sup>

The water quality has much improved, especially in terms of turbidity. The number of days when the turbidity of the raw water exceeded the relevant water quality standard in Bolivia of 5 NTU was five days in 2013 and 20 days in 2014.<sup>9</sup> There have been no occasions of the turbidity of the treated water exceeding 5 NTU (Fig. 2). Water quality inspection in 2013 found that all of the water quality standards were met at both the WTP and the distribution network and no coliform bacilli were found.<sup>10</sup> The

<sup>7</sup> The beneficiary survey found that water cuts due to work involving the water distribution network, etc. still occur 2.6 times a year on average, affecting the water supply for five days in total.

<sup>8</sup> The number of service pipe connections in the San Juan River System in October, 2014 stands at 17,783, accounting for 52.3% of all service pipe connections in Potosí. The size of population benefiting from this system, which covers the western half of the city, is estimated to be approximately 93,000.

<sup>9</sup> At the time of the ex-ante evaluation, the number of days when the turbidity of the raw water exceeded 5 NTU was 131 days a year even though the actual measurement data at the existing WTP indicated that the number of such days was much lower. The level of turbidity is strongly affected by rain. According to rainfall data collected at Potosí Airport, the rainfall level during the second half (March and April) of the rainy season in 2013 and 2014 was significantly lower than that of an average year, resulting in much fewer days of high turbidity raw water in these years. NTU (Nephelometric Turbidity Unit) is a unit for turbidity.

<sup>10</sup> Water quality inspection is conducted on a daily basis at the WTP.

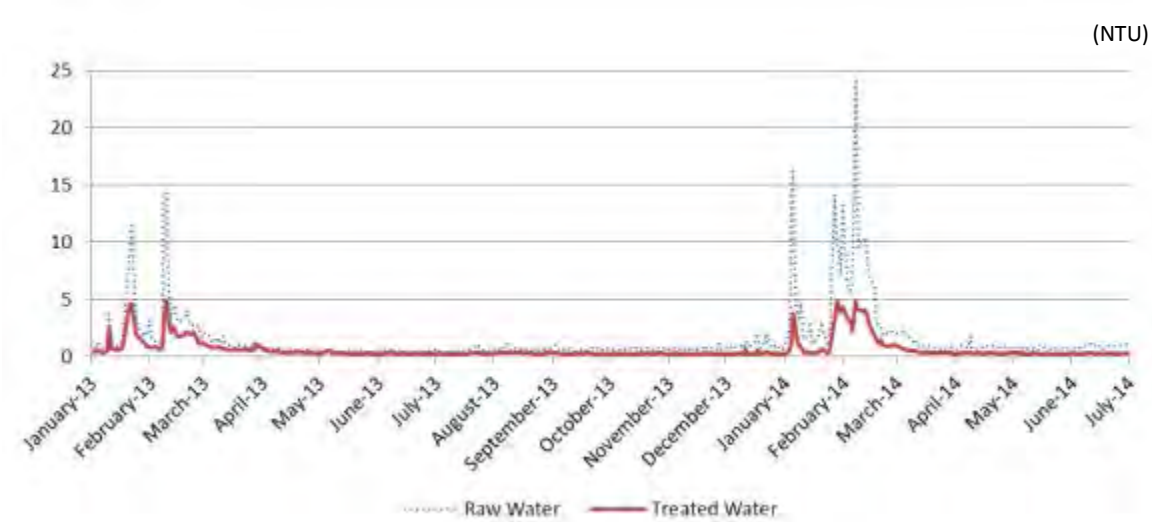
beneficiary survey with 116 households living in the benefitted area<sup>11</sup> found that 66% of the surveyed households believe that the water quality improved after the Project.

Table 2 Planned and Actual Performance of Operation and Effect Indicators

	Baseline	Target	Actual
	2009	2011	2011- 2014
	Year of Ex-Ante Evaluation	Year of Project Completion	0 - 3 Years After Project Completion
<b>Operation Indicators</b>			
Annual number of water cut days due to high turbidity	27 days/year (2006)	0 days/year	0 days/year (2011 - 2014)
Annual number of water cut days due to damages of conduction pipeline by natural phenomena	1 - 2 times/year (number of days of water cut is unknown)	0 days/year	0 days/year (2011 - 2014)
<b>Effect Indicator</b>			
Safe water access rate (access to treated water)	54%	94.5%	96% (2014)

Sources: documents provided by JICA, AAPOS

Note: Prior to the implementation of the Project, the probably maximum number of water cut days was estimated to be 193.9 days a year (at the time of the ex-ante evaluation). Here, the number of actual water cut days is listed in the table.



Source; elaboration by the evaluator based on the data provided by AAPOS

Figure 2 Turbidity of Raw Water and Treated Water of the San Juan Water Treatment Plant

<sup>11</sup> An interview survey using a questionnaire was conducted with 116 benefiting households as part of this ex-post evaluation.

### **3.3.2 Qualitative Effects**

#### **3.3.2.1 Number of Beneficiaries**

The San Juan River System which was the target water distribution system of the Project covers the western half of the municipal area of Potosí and the size of the benefiting population was originally estimated to be approximately 73,000 in 2011. In reality, however, based on the number of connections it is estimated that some 93,000 people were receiving water in this service area in October, 2014. The actual number of beneficiaries in 2011 was approximately 80,000 which already exceeded the original estimate. This increase of the city's population beyond the estimated figure at the time of the ex-ante evaluation was caused by the development of mining in the vicinity of Potosí and other reasons.

#### **3.3.2.2 Increase of Water Production**

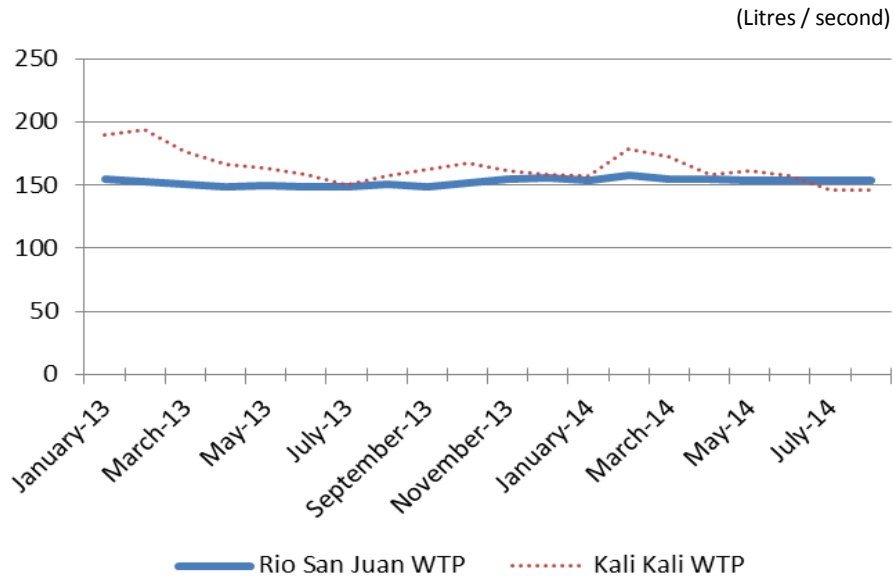
The water production rate of the San Juan River System before the Project was approximately 130 litres/sec. As the Project enabled the adequate removal of dirt from the conduction pipeline, boosting the effective capacity of this pipeline, the water production volume in the post-project period has been steady at approximately 150 litres/sec (115% of the pre-project figure) which is the maximum volume which the conduction pipeline and the new WTP can handle. The combined water production volume in Potosí, including that of the Kali Kali System, is approximately 300 litres/sec.

The estimated water consumption rate of ordinary households in Potosí was 128 litres/person-day in 2010 and 115 litres/person-day in 2013, showing a declining trend. While this trend can be basically attributed to an increased number of connections (households) without a matching increase of the water supply, the progress of water meter installation to encourage water-saving is also a likely contributory factor.<sup>12</sup> The beneficiary survey found that only a small proportion of households located in the city centre received 24 hour water supply (three out of 116 households surveyed) and that the average water supply hours are seven hours a day. 48% of the households surveyed did in fact report that the water supply hours had decreased compared to the pre-project period, indicating a worsening of the water supply situation due to population increase.

Even though the increase of the volume of water production due to the Project has been rather modest, the water supply situation would have been much worse without the Project. As such, it is fair to say that the Project has had a positive effect in terms of improving the water supply situation in Potosí.

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<sup>12</sup> The water meter installation rate increased from 83% in 2010 to 87% in October, 2014.



(Source; elaboration by the evaluator based on the data provided by AAPOS)

Figure 3 Historical Changes of Water Production Volume in Potosí



The dirt removal facility

Operation of the dirt removal facility

### 3.4 Impacts

#### 3.4.1 Intended Impacts

The Project identified its higher goal of improving the living environment for the citizens of Potosí and the indirect effect of lowering the risk of contracting water-borne diseases.

According to the results of the beneficiary survey with the 116 households living in the target area of the Project, 55% of households found that there had been major positive changes in regard to water supply in the post-project period while 33% of households also found that there had been some positive changes. In short, nearly 90% of the households surveyed acknowledged positive impacts of the

Project and most of these impacts were related to improvement of the water quality <sup>13</sup>. Many respondents mentioned that before the Project, the turbid water in the rainy season in particular was unpleasant, especially when it smelled bad and small insects were found in the water. Most households, therefore, found it necessary to boil the supplied water before using it or attached a cloth bag to the tap to filter the water. The ratio of households using these measures has been dramatically reduced today and the level of convenience concerning water was improved greatly. When the survey of beneficiaries was implemented, 74% of beneficiaries responded that they were happy with the water supply service provided by AAPOS.



Cloth filter that was used until some years ago

Table 3 Water Treatment in Household

	Before the Project (2009)	After the Project (2014)
Boil before use	79%	34%
Use a cloth filter	92%	9%

Source; Beneficiary survey

16% of the surveyed households were found to have at least one family member who has suffered from diarrhoea in the past year and there is no confirmation that the occurrence of diarrhoea has fallen in the post-project period. It is difficult to demonstrate the cause and effect relationship with the Project, however, data from the Ministry of Health shows that infant mortalities caused by diarrhoea in Potosí have declined since 2009.

**3.4.2 Other Impacts**

The Project was certified as a project with minor environmental impact (classified in the second least environmental impact category out of four categories) <sup>14</sup>. An environmental permit for the Project was obtained from the competent departmental authority in October, 2008 and it was ruled that an Environmental Impact Assessment (EIA) would not be required. In this ex-post evaluation, no special impacts on the natural environment were found through the field visit.

The Project did not involve the resettlement of local residents. The land use rights for the new WTP site were obtained without difficulty based on an agreement with the neighbouring community.

<sup>13</sup> 73% of the households responded that water quality has been improved since 5 years.

<sup>14</sup> The environmental category is established according to the size of environmental impact of public projects in Bolivia. In categories 1 and 2, which have a large environmental impact, it is necessary to implement an environmental impact survey either in general or for specific fields.

In summary, the Project aimed at achieving “the continual supply of clean water in sufficient quantity” by means of reducing the frequency of water cuts caused by high turbidity water and damage to the conduction pipeline while ensuring the supply of safe, clean water through the adequate treatment of raw water. Such objectives are judged to have been successfully achieved. In addition, the improved water quality has eliminated the feeling of unpleasantness regarding the supplied water among its users and increased convenience related to water. The Project has largely achieved its objectives and, therefore, the effectiveness and impacts of the Project are high.

### **3.5 Sustainability (Rating: ②)**

#### **3.5.1 Institutional Aspect of Operation and Maintenance**

AAPOS has 148 full-time and 17 part-time employees and the operation and maintenance of the WTP and conduction pipeline are handled by the Production Unit and the Treatment and Laboratory Unit of the Technical Department.

The WTP is run without any problems by a director, two operators (one is a live-in operator), water quality inspector and driver. At present, the WTP does not have a security guard but AAPOS has independently erected fencing around the WTP since the completion of the Project as a residential area has been formed nearby. It is planned to install a lighting system in 2015 to strengthen the security arrangements for the WTP.

For the routine operation of the water intake, a local resident has been employed as a caretaker. Because of the remote location of this water intake, a radio is used for communication. As one person is insufficient to 24 hours/day monitoring, some incidents have occurred, including the illegal entry of someone to the facility site to operate the valve. It is difficult to double the number of caretakers because of the remoteness of the site and some concern remains regarding the security of the site. AAPOS is examining methods such as establishing gates or lookout posts in order to limit entry to the access roads leading to intakes, improving the method of communication with intakes and so on.

The conduction pipeline is inspected as well as maintained annually and staff members of other departments are enlisted for this work to boost the number of workers involved.

In summary, there are some minor issues concerning the operation and maintenance setup in the Project.

#### **3.5.2 Technical Aspect of Operation and Maintenance**

AAPOS has been operating two WTPs, one of which was constructed under the Project, without any problems. As it is proceeding with the introduction of a remote monitoring and operating system for the reservoirs and also with the acquisition of an international certification of quality management, it is fair to say that it meets certain technical standards.

In regard to the new WTP, a maintenance plan was prepared based on the operation manual provided under the soft component of the Project and its operation and maintenance system appears to be appropriate, posing no specific problems. Of the 10 staff members trained on operation and



maintenance of WTP under the Soft Component of the Project, only one has so far left AAPOS. As it is essential at this WTP to regulate the amount of flocculent to be injected depending on the turbidity of the raw water, a flocculent injection rate corresponding to the turbidity of the raw water has been established based on past operational experience to ensure an appropriate amount of injected flocculent.

The dirt removal facility and air valve of the conduction pipeline are operated twice a year (before and after the rainy season) while regular inspection for preventive maintenance is conducted once a year. One problem found is that although more than half of the staff members which underwent training under the Soft Component are still working for AAPOS, none of them are involved in the regular inspection of the conduction pipeline. This means that the technical know-how which they learned, including the use of the conduction pipeline monitoring manual, was not being properly utilised (Refer “3.5.4 Current Status of Operation and Maintenance”). Responding to comments made by the evaluator in the first field survey (October-November 2014), AAPOS mobilized the two employees who had received training in November 2014 and had remained in AAPOS and implemented an inspection of the conduction pipeline using the check sheet that had been used in the training. It intends to conduct further inspections when the rainy season ends in May 2015.

In short, while the operation and maintenance of the new WTP do not pose any problems, the practice of the preventive maintenance of the conduction pipeline has not been properly established due to the non-use of the positive outcomes of the Soft Component. Therefore, some minor problems have been observed in terms of Technical Aspect of Operation and Maintenance.

**3.5.3 Financial Aspect of Operation and Maintenance**

Interviews with staff members of AAPOS found that there has been sufficient budgetary appropriation for the employment of the necessary personnel to operate and maintain the WTP and to procure agents and other consumables as well as the necessary equipment, etc.

AAPOS returned a profit in 2011 through 2013. The operating profit ratio has been in the range of 19 ~ 26% for the past three years, suggesting a high level of profitability. The current ratio has exceeded 250% for the past three years and the capital-to-asset ratio has been 65% or higher, indicating sound financial operation.

Table 4 Business Income and Expenditure of AAPOS

(Unit: 1,000BOB)

	2011	2012	2013
Income	18,620	24,846	24,427
- Water Supply	18,550	24,647	24,236
- Sewerage, etc.	70	199	191
Expenditure	14,637	20,157	19,574
Balance	3,983	4,689	4,853

Source; AAPOS

Income from the sale of water for industrial use accounts for some 40% of the total income (in 2013), shoring up the financial health of AAPOS. As it is difficult to increase the water charge for domestic water supply because of strong resistance on the part of residents, the rate has been unchanged since 2000. Meanwhile, the unit price of water for industrial use is set at 6 – 7 times higher than that for domestic use. The water meter installation rate in Potosí increased from 78% in October, 2008 to 87% in October, 2014. According to AAPOS, the background for this increase was that the installation of a water meter became a statutory obligation, making it easier to procure such meters throughout the country. The water charge collection rate improved from 74% in 2010 to 81% in 2013. This improvement is believed to have been achieved by the conscious business efforts of AAPOS, including (i) the strict enforcement of a policy of suspending water supply to water users who have failed to pay the water charge for three months and (ii) an increase of the water charge payment points.

As described above, the necessary budget for the operation and maintenance of the facilities, etc. introduced under the Project has been secured and no specific problems are currently observed in regard to the financial aspect of AAPOS.

**3.5.4 Current Status of Operation and Maintenance**

A defect inspection conducted in 2012 found that all of the facilities were operating normally and that there was no case requiring repair work. The field visit conducted in 2014 as part of the ex-post evaluation confirmed the appropriate maintenance of the WTP and water intake, both of which were found to be adequately functioning.

During this field visit, however, scouring of the basis of some of the conduction pipeline protection facilities by flowing water was discovered. This is a result of a lack of adequate preventive maintenance. It is necessary to urgently deal with this situation as further scouring could damage the conduction pipeline.



Scouring of foundations around the protection work of the conduction

Some minor problems have been observed in terms of the institutional and technical aspects of maintenance. The sustainability of the project effects is, therefore, fair.

**4 Conclusions, Lessons Learned and Recommendations**

**4.1 Conclusions**

The Project was implemented with the aim of realizing continual supply of safe water in sufficient quantity to residents of the service area of the San Juan River System serving the western half of Potosí by means of constructing a new WTP and rehabilitating the existing water intake and conduction pipeline, thereby contributing to improvement of the sanitation and living environment of the project

area. At the time of both the ex-ante evaluation and ex-post evaluation, the Project was found to be highly relevant to the development policy and development needs of Bolivia and also to Japan's ODA policy at the time of the ex-ante evaluation. Therefore, the relevance of the Project is high. The planned outputs were achieved and both the project cost and project period were within the plan. As such, the efficiency of project implementation is high. The construction of conduction pipeline protection facilities has reduced the water cuts caused by damage to the conduction pipeline and the treatment of the raw water at the new WTP has eliminated water cuts due to raw water with high turbidity. The water quality standards, including the turbidity standard, have been met by the supplied water even in the rainy season when the turbidity of the raw water is high, achieving the supply of clean water throughout the year. The improvement of the water quality has increased convenience in using water on the part of users. Therefore, the effectiveness as well as impacts of the Project are high. AAPOS has maintained its profitable operation and does not face any financial problems. While the maintenance of the WTP poses no problems, there is some concern in regard to the security arrangements at the water intake. In regard to the maintenance of the conduction pipeline, adequate maintenance had been lacking because of the fact that the knowhow transferred under the Soft Component have not been fully utilised. Therefore, the sustainability of the Project is fair. In the light of the above, the Project is evaluated as highly satisfactory.

## **4.2 Recommendations**

### **4.2.1 Recommendations to the Implementing Agency**

AAPOS should implement the following measures concerning the maintenance of the water intake and conduction pipeline so that water supply in the San Juan River System can continue without disruption.

- As the security arrangements at the water intake require strengthening, the relevant possible measures should be examined, including the deployment of an additional caretaker, restriction of entry to the access road, erection of protective fencing at the water intake, and introduction of a reliable communication system.
- In regard to the preventive maintenance of the conduction pipeline protection facilities, the maintenance system should be rebuilt, focusing on those staff members who underwent training for the transfer of skills under the soft component of the Project. On that basis, the total inspection of these facilities (scouring of foundations around the protection work, etc.) from the view point of preventive maintenance should be conducted as soon as possible so that the necessary protective measures can be employed before the arrival of the next rainy season.

#### **4.2.2 Recommendations to the JICA**

The possibility of providing technical assistance through the dispatch of an expert and other means should be examined in relation to establish the practice of preventive maintenance of the conduction pipeline by AAPOS.

#### **4.3 Lessons Learned**

##### Importance of Follow-Up for the Soft Component for Preventive Maintenance

As the necessity for preventive maintenance is generally not easily recognised, a short training session may fail to sufficiently teach the relevant skills or ensure the proper application of the skills learned. Accordingly, it is very important to secure a long period for practical training when the transfer of preventive maintenance-related skills is intended. In the case of a soft component of a grant aid project where it is difficult to secure a sufficiently long practical training period, it is essential to check the state of utilisation, etc. of such skills at the time of defect inspection or any other opportunity after project completion so that additional technical assistance by means of the dispatch of an expert can be conducted if necessary.

Plurinational State of Bolivia

Ex-Post Evaluation of Japanese Grant Aid Project

“Project for Improvement of Potable Water System in Southeast of the City of Cochabamba”

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

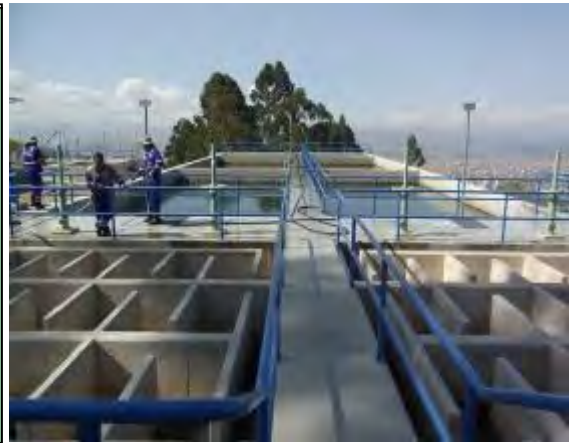
## **0. Summary**

The Project was implemented in the City of Cochabamba, Plurinational State of Bolivia (hereinafter simply referred to as “Bolivia”) with the aim of continually supplying clean water in sufficient quantity for residents of the south-eastern zone of the city by means of expanding the existing water treatment plant and constructing new water transmission and distribution pipelines, thereby contributing to improvement of the sanitation and living environment of the project area. At the time of both the ex-ante evaluation and ex-post evaluation, the Project was found to be highly relevant to the development policies of Bolivia and compatible with the need for the development of the water supply system in Cochabamba City in general and the project area in particular. It was also in line with the Japan’s aid policy at the time of ex-ante evaluation. However, due to the somewhat insufficient information gathering/examination and verification of very important preconditions prior to the commencement of the Project, the relevance of the Project is fair. The Project mostly achieved its planned outputs and the actual project cost was within the plan. Meanwhile, the actual project period exceeded the plan. As such, the efficiency of the Project is fair. As a result of project implementation, local residents have benefited from improved water pressure and quality, increased use of water, reduction of water use-related expenditure and improved sanitation. However, because of failure to materialise associated projects and time consuming construction of water distribution networks by the residents’ organizations, the benefiting population was only half of the plan, the water supply volume was only 10% of the plan and the water supply hours were only 2.7 hours/week compared to the planned continual water supply for 24 hours/day. Because of these shortcomings, the effectiveness/impact of the Project are low. No major problems were observed with SEMAPA or residents’ organizations relating to the institutional, technical and financial aspects of the operation and maintenance of the facilities which are functioning well, making the sustainability of the Project high. In light of the above, this project is evaluated to be unsatisfactory.

## 1. Project Description



Project Location



Aranjuez Water Treatment Plant

### 1.1 Background

In 2009, the Government of Bolivia had the National Basic Sanitation Plan (2000 - 2010) which focused on improvement of the water supply and sewerage facilities with the target of improving the national coverage of water supply to 90% by 2010.

The City of Cochabamba (with a population of approximately 600,000 in 2006) is the third largest city in Bolivia and is the capital of Cochabamba Department. At the time of the ex-ante evaluation in 2009, the water supply situation in the city was extremely tight. The municipal access rate to water supply was as low as 48% and the development of the water supply and sewerage facilities was urgently required in the light of an impending increase of the water demand. The development and operation of these facilities in the city was the responsibility of the Municipal Water and Sewerage Service in Cochabamba (hereinafter simply referred to as “SEMAPA”) of which the business plan envisaged an increase of the water access rate among the citizens of the city to 83% in 2012 and 95% in 2027. As SEMAPA did not have a water supply network in the south-eastern zone of the city despite the rapid urbanization of this zone, local residents were forced to rely on piped water supply from wells or other sources run by residents’ organizations or the purchase of water from water tank trucks operated by private vendors.<sup>1</sup> Water from these sources did not have a quality guarantee, the water supply volume was limited and the cost was much higher than the cost of water supplied by SEMAPA.

Under these circumstances, the Government of Bolivia made a request to the Government of Japan for the provision of grant aid for improvement of the water supply facilities in the south-eastern zone of Cochabamba City. In response, the Japan International Cooperation Agency (JICA) conducted

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<sup>1</sup> The residents’ organizations referred to in this report are locally called “basic territorial organizations”, most of which have corporate status. While the organizational structure and financial sources widely differ from one organization to another, they are entitled to conduct wide-ranging public works, including water supply. They also participate in the planning and monitoring / evaluation of public works conducted by the municipal government so that the latter can implement public works which correspond to the needs of basic territorial organizations.

the Basic Design Study in 2007 and the Implementation Review Studies in 2008 and implemented the Project from 2009 to 2011.

## 1.2 Project Outline

The objective of the Project was to realize continual supply of clean water in sufficient quantity for residents of the south-eastern zone of Cochabamba City in Bolivia by means of expanding the existing WTP and constructing new water transmission and distribution pipelines, thereby contributing to improvement of the sanitation and living environment of the project area.

Grant Limit/Actual Grant Amount	1,215 million yen/1,092 million yen
Exchange of Notes Date/Grant Agreement Date	May, 2009/May, 2009
Implementing Agency	Municipal Water and Sewerage Service in Cochabamba (SEMAPA)
Project Completion Date	April, 2011
Main Contractor	Hazama Corporation
Main Consultant	Tokyo Engineering Consultants Co., Ltd.
Basic Design	August, 2007
Detailed Design	September, 2009
Related Projects	Andes Development Corporation (CAF), “Sinergia-Barrilete Project” (2004-2013); Misicuni Company, “Misicuni Multipurpose Project” (1998- in implementation)

## 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: November 11<sup>th</sup> to 26<sup>th</sup>, 2014, and  
 April 15<sup>th</sup> to 17<sup>th</sup>, 2015

### **3. Results of Evaluation (Overall Rating: D<sup>2</sup>)**

#### **3.1 Relevance (Rating: ②<sup>3</sup>)**

##### **3.1.1 Relevance to Development Plan of Bolivia**

As already mentioned in “1.1 Background”, at the time of the ex-ante evaluation, the Government of Bolivia emphasised improvement of the water supply and sewerage services throughout the country. The National Basic Sanitation Plan (2011-2015) which is in force at the time of this ex-post evaluation upholds the notion that access to water supply and sanitation services is a basic human right. While stressing the role to be played by the public sector, this plan adopts a target access rate to water supply of 90% (95% in urban areas and 80% in rural areas) in 2015, focusing on the improvement of water supply and sewerage facilities. As such, the Project is highly relevant to the development policies of Bolivia at the time of both the ex-ante evaluation and ex-post evaluation.

##### **3.1.2 Relevance to the Development Needs of Bolivia**

As already mentioned in “1.1 Background”, at the time of the ex-ante evaluation, there was an urgent need in Cochabamba City for improvement of the water supply in the south-eastern zone. As Cochabamba City has hardly any water sources within its municipal boundaries, it is forced to rely on water sources located in the areas of neighbouring municipalities. However, the SEMAPA’s water production volume has not increased, partly because of the delay of Phase I of the Misicuni Project <sup>4</sup> which is expected to significantly improve the water supply situation in Cochabamba City and beyond and partly because of the unwillingness of neighbouring municipalities to allow their water sources to be used for water supply to Cochabamba City. The water supply situation in Cochabamba City has worsened by the time of the ex-post evaluation and water supply has not improved in the project area as described in more detail in 3.3 Effectiveness. In effect, there is still a strong need for the development of the water supply system in Cochabamba City at the time of the ex-post evaluation.

##### **3.1.3 Relevance to Japan’s ODA Policies**

This Project falls under “Water and Sanitation” in “Social Development” which is one of the priority sectors identified by Japan’s Country Assistance Program for Bolivia (2007) and is, therefore, relevant to Japan’s ODA policies.

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<sup>2</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>3</sup> ③: High; ②: Fair; ①: Low

<sup>4</sup> The Misicuni Project is, in fact, a multipurpose dam construction project undertaken by Misicuni Company which was established in 1987 based on a special law introduced by the Government. At the time of the ex-ante evaluation, the original plan was to complete the Phase I construction work by 2009. However, the actual construction work substantially fell behind schedule due to an increase of the project scale, default of the contractor and other reasons. At the time of the ex-post evaluation, the completion of Phase I is expected in February, 2016.



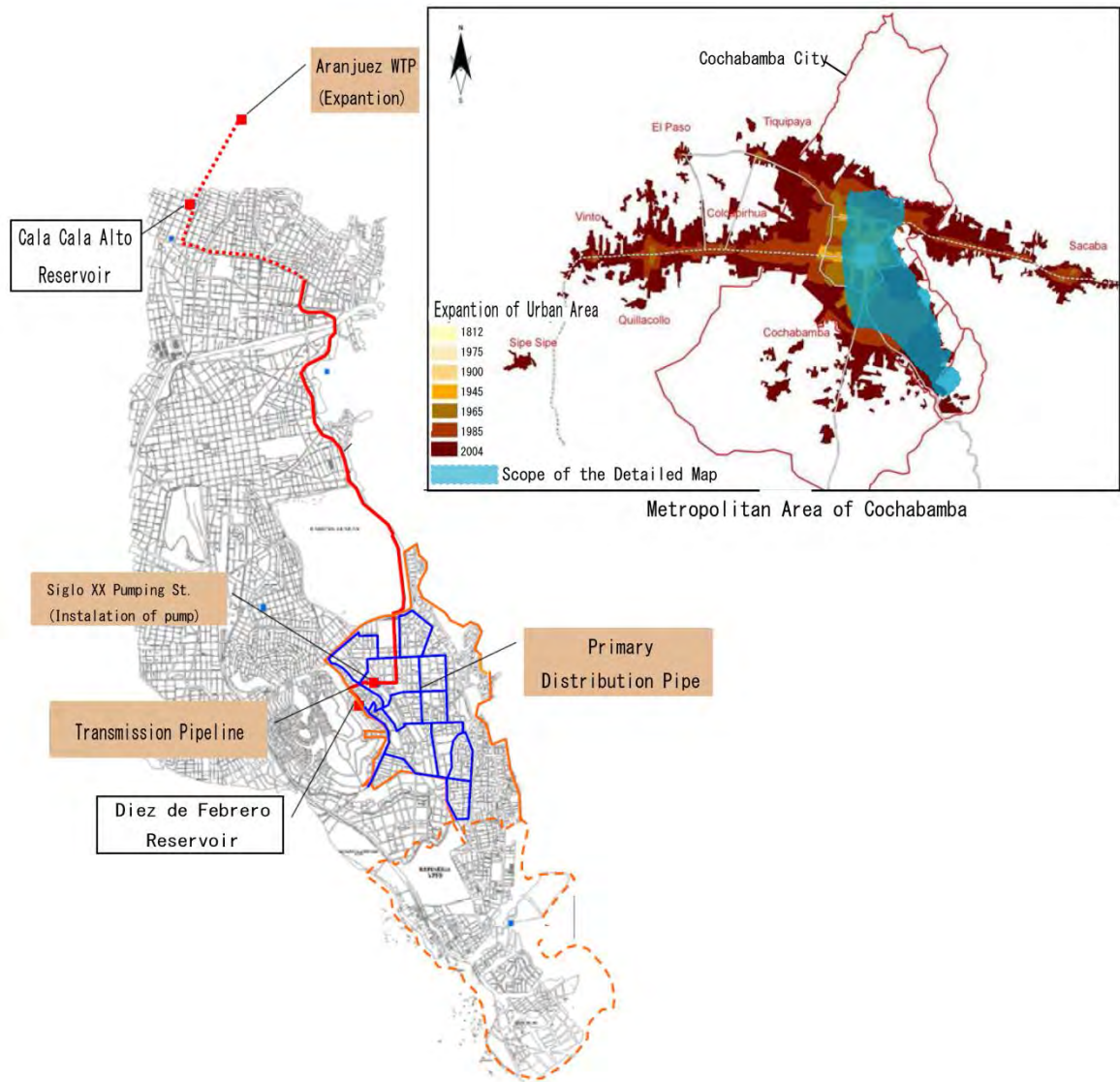


Fig. 1. Water Supply Facilities under the Project

### 3.1.4 Appropriateness of the Project Plan and Approach

As will be explained in “3.3 Effectiveness”, the effectiveness of the Project was judged to be low. As the factors for this, there were following shortcomings in relation to information gathering/examination and the confirmation of very important preconditions at the planning stage prior to the commencement of the Project.

- (1) The Project planned to utilise the water distribution networks owned by most of the 21 residents’ organizations in the project area as they were, and to only construct a secondary distribution network for areas covered by two residents’ organizations which did not have a water distribution network. However, it was found that these existing networks could not be used to distribute water supplied by SEMAPA because of their old age, absence of pipeline maps and/or prohibition of mixing water from existing water sources with water supplied by SEMAPA. These points were not recognised at the time of the ex-ante evaluation, and construction of new distribution network

was planned only for two residents' organizations. Because of this, it was necessary for 15 among the 19 remaining residents' organizations to construct a new network separately from the Project, and the prolonged time period for their construction constitutes one cause of the delayed manifestation of the project effects.<sup>5</sup> In addition, the fact that much information provided by the residents' organizations was not correct caused major delays in construction of the secondary distribution network under the Project.

- (2) The Project entailed expanding Aranjuez Water Treatment Plant (WTP) and constructing new water transmission and distribution pipelines with the aim of supplying water for residents of the south-eastern zone of the city where the SEMAPA water supply network has not yet reached. However, in order for water supply to this district to be realized, it is necessary for the following two associated projects to be implemented by SEMAPA (expansion of Wara Wara water source, Sinergia-Barrilete Project; see Figures 1 and 2). The implementation of these related projects was considered to be a precondition for the commencement of the Project. The Japanese side implemented the Study for Implementation and signed the Exchange of Note to commence the Project based on its own judgement that the precondition would be met on the ground of the commencement of study for the project, the firm promise for its implementation, etc. However, the Project actually started without the said precondition being met due to the objections by local communities and related municipalities. In fact, these preconditions had still not been met at the time of the ex-post evaluation.
- The expansion of the Wara Wara water source in the neighbouring city of Sacaba from which raw water was supplied to the Aranjuez WTP was a precondition for the expansion of this WTP. The Japanese side judged that this precondition would be met on the grounds that SEMAPA had begun a study on the proposed expansion of the Wara Wara water source with a firm promise of subsequently implementing the necessary work and that the then Ministry of Water had promised to support the smooth implementation of this expansion project. However, after commencement of the study by SEMAPA, the local community of this water source area and the Sacaba municipal authority opposed the proposed water source development which would only benefit another city, forcing SEMAPA to suspend the study.<sup>6</sup> Unfortunately, this fact was not relayed to the Japanese side and the Exchange of Note was signed to commence the Project. With the mediation of the Ministry of Water, SEMAPA subsequently tried to

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<sup>5</sup> A new water distribution network was constructed for areas served by 20 of the 21 residents' organizations in the project area, including the 2 residents' organizations for which construction of distribution network was originally planned. However, some facilities were still undergoing construction and were not yet complete in some residents' organizations at the time of the ex-post evaluation. The funding sources for this work were the Project (with Japan providing pipes and other materials and the Bolivian side conducting the pipe laying work), the Cochabamba Municipal Authority and NGOs.

<sup>6</sup> JICA conducted the Implementation Review Study twice in 2008 (the work was limited in Japan). Meanwhile, after the commencement of the SEMAPA's study, the Sacaba municipal authority and affected local community expressed their opposition to the water source development which would only benefit another city (May, 2008) and submitted a letter rejecting the extension project to SEMAPA in February, 2009.

obtain the necessary consent of the Sacaba municipal authority and local community concerned but negotiations were unsuccessful. SEMAPA eventually terminated the study and the proposed expansion work did not take place.

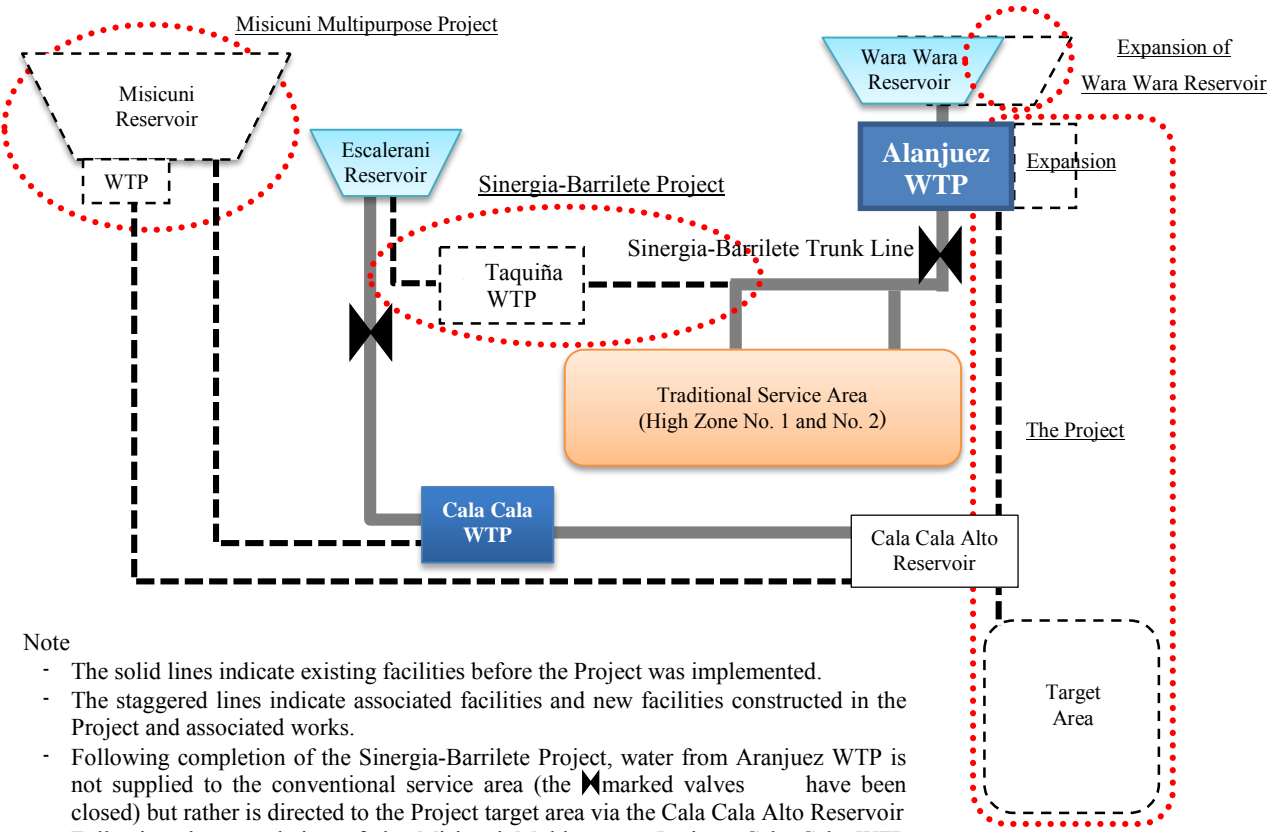
- The implementation of the Sinergia-Barrilete Project was a precondition for the reliable conveyance of water from the Aranjuez WTP to the project area (refer Figure 2). In other words, in order to convey water from Aranjuez WTP to the Project target area, it was necessary for Taquiña WTP, which was to be constructed in the Sinergia-Barrilete Project, to supply water to the conventional service area (High Zone No. 1 and High Zone No. 2) of Aranjuez WTP. As the municipal authority of Tiquipaya (a neighbouring municipality of Cochabamba) which is located in the subject area of this Sinergia-Barrilete Project and SEMAPA had agreed on the implementation of the project in question, JICA judged that this precondition was met and commenced the Study for Implementation of the Project. However, the actual construction work was much delayed because the residents in areas of Tiquipaya and Cochabamba opposed to the Project on the grounds that the work to lay the conduction pipeline through the areas was of no advantage to them. In the end, the pipeline was finally completed in 2013. Moreover, the conveyance of water using the new pipeline has been delayed because of a shortage of raw water at the Taquiña WTP which is assigned to produce the necessary treated water and is now expected to commence in February, 2016 or later when a sufficient water source is made available under the Misicuni Multipurpose Project.

The direct cause for the non-fulfilment of the required precondition has been opposition by other municipalities and their citizens. The New Constitution introduced in Bolivia in January, 2009 has increased the scope of local autonomy, leading to a nationwide movement to oppose various national projects by local municipalities and their citizens. It is, however, difficult to retrospectively assess the degree of predictability of such opposition (risk to the Project) during the preparatory planning period of the Project from 2006 to 2008.

It should be noted that no socio-political risks associated with the two projects considered as preconditions were mentioned in the preparatory studies for the Project, meaning that such risks would have not been investigated in these studies. As for the expansion of Wara Wara water source, there might have been some measures to further confirm its implementation, for example, requesting SEMAPA periodical report on the progress of the study, collecting information on site as a part of the implementation review studies, etc. As well, it should have been recognized that the Misicuni Multipurpose Project, which had been in reality one of the preconditions for the Sinergia-Barrilete Project, was also one of the preconditions for the Project.

In short, while the Project was compatible with the development needs of Bolivia due to its high level of relevance of the country's development policy at the time of both the ex-ante evaluation and ex-post evaluation, there were some shortcomings in relation to information

gathering/examination and confirmation of the important preconditions prior to the commencement of the Project. Accordingly, the overall relevance of the Project is fair.



- Note
- The solid lines indicate existing facilities before the Project was implemented.
  - The staggered lines indicate associated facilities and new facilities constructed in the Project and associated works.
  - Following completion of the Sinergia-Barrilete Project, water from Aranjuez WTP is not supplied to the conventional service area (the X marked valves have been closed) but rather is directed to the Project target area via the Cala Cala Alto Reservoir
  - Following the completion of the Misicuni Multipurpose Project, Cala Cala WTP obtains raw water from Misicuni reservoir, while Taquiña WTP obtains raw water from Escalerani Reservoir. The completion of Misicuni Multipurpose Project is also a condition for Taquiña WTP to obtain ample raw water.

Fig. 2. Relationship between the Project and the Other Related Projects

**3.2 Efficiency (Rating: ②)**

**3.2.1 Project Outputs**

The planned and actual outputs of the Project are shown in Table 1. As far as secondary distribution pipelines are concerned, the need to lay such pipelines in areas not included in the original plan at the time of ex-ante evaluation was verified and SEMAPA procured and laid additional pipelines with a total length of 1,595m and total length reached to some 120% of the original plan. Other than this, other outputs were produced generally as planned. The work to be conducted by the Bolivian side (provision of temporary yards and work to install secondary pipelines and water supply equipment) was completed as planned. According to SEMAPA, the quality level of the project design and construction work was very high.

Table 1 Planned and Actual Project Outputs

	Planned	Actual
Expansion of the Aranjuez WTP	120 litres/sec	As planned
Rehabilitation of transmission (conveyance) pipelines		
• Cala Cala Reservoir to Siglo XX Pumping Station	8,156 m	8,111 m
• Siglo XX Pumping Station to Diez de Febrero Reservoir	667 m	As planned
Installation of conveying pump (at Siglo XX Pumping Station)	Two units	As planned
Laying of primary distribution pipelines	18,852 m	As planned
Procurement of materials, etc.		
• Secondary distribution pipes	7,943 m	9,538 m
• Water supply equipment (500 units of snap taps and meters, etc.; to be installed by SEMAPA)		As planned
• Water quality measuring instruments (pH meters; conductance meters; turbidity meters)		As planned

Sources: documents provided by JICA; SEMAPA



Siglo XX Pumping Station



Diez de Febrero Reservoir

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The planned and actual project costs are shown in Table 2. The project cost was lower than planned as the actual cost was 95% of the planned cost. The actual cost of laying the secondary distribution network (including the additional length) by the Bolivian side was much lower than the original plan because of competition<sup>7</sup>.

Table 2 Planned and Actual Project Costs

	Planned	Actual
Japanese portion	1,159 million yen	1,092 million yen
Bolivian portion	65 million yen	12 million yen

<sup>7</sup> In the Project study, the cost of installing secondary distribution pipes was estimated as 4,180,000 BOB (526 BOB per meter), however, in reality it came to 1,052,000 BOB (134 BOB per meter). Since the cost is around 100 BOB per meter in similar projects implemented by SEMAPA in 2015 and it is not known why the unit cost estimate for the Project was so large, there is a good likelihood that the cost was overestimated in the study.

Total	1,224 million yen	1,104 million yen
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Sources: documents provided by JICA, SEMAPA

### 3.2.2.2 Project Period

The planned project period was one year and 10 months (22 months) from the date of the signing of the Exchange of Note. The actual project period was two years and four months (28 months) from the signing of the Exchange of Note in May, 2009 to completion in August, 2011. The actual project period was, therefore, 127% of the planned project period. The principal reason for the delayed completion of the Project was that the work of the Bolivian side to lay the secondary water distribution lines took eight months (double the planned period of four months).<sup>8</sup> According to the responsible staff member in SEMAPA, much of the information provided by the residents' organizations was found to be inaccurate; for example, when digging up roads for laying the planned 7,943 meters of secondary distribution pipes, distribution pipes were discovered in places where they were not supposed to exist. Accordingly, the plans were reviewed upon asking the residents' organizations to once more provide information; and as a result the length of distribution pipes was increased to 9,538 meters before restarting the works. The actual implementation of the works itself didn't experience major problems.

Even if the increase of the work period due to the increase of the total length of secondary pipelines (a 20% increase compared to the original plan) is taken into consideration, the project period is longer than planned.

Although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

## 3.3 Effectiveness<sup>9</sup> (Rating: Ⓞ)

### 3.3.1 Quantitative Effects (Operation and Effect Indicators)

The Project was implemented with the aim of continually supplying clean water in sufficient quantity to some 50,000 residents in the project area in the south-eastern zone of Cochabamba City. For the purpose of evaluating the effectiveness of the Project, the evaluator evaluated the water production volume at the Aranjuez WTP, water distribution volume to the project area, benefited population in the project area, water supply hours and water supply pressure. (Refer Table 3. for planned and actual figures of operation and effect indicators)

Table 3 Planned and Actual Performance of Operation and Effect Indicators

	Baseline	Target	Actual
	2006	2011	2011~2014

<sup>8</sup> The work by the Japanese side was completed in 22 months in April, 2011 as planned (28<sup>th</sup> May, 2009 to 8<sup>th</sup> April, 2011).

<sup>9</sup> The effectiveness is rated in consideration of not only the effects but also the impacts.

	Year of Ex-Ante Evaluation	Year of Project Completion	0-3 Years after Project Completion
<b>Operation Indicators</b>			
Water Production at the Aranjuez WTP	50 - 70 l/sec	120 l/sec	74.7 l/sec (average during July, 2011 - June, 2014)
Water quality at the Aranjuez WTP	Unknown	<ul style="list-style-type: none"> <li>●Turbidity <math>\leq</math> 5NTU</li> <li>●No detection of colon bacilli</li> <li>●Residual chlorine: 0.2-0.5mg/l</li> </ul>	All targets were achieved after the completion of the Project.
Clean Water Supply in the Project Ares	0 l/sec	81 l/sec	9 l/sec(November, 2014)
<b>Effect Indicators</b>			
Size of Benefiting Population in the Project Area	0	Approx. 50,000	Approx. 24,000 (November, 2014)
Water Supply Hours in the Project Area	Irregular for a few hours	24 hours a day	Weekly 1 – 2 times for 2.7 hours (2014)
Water Supply Pressure in the Project Area	Sometimes insufficient to supply water to even the ground floor	Water supply on the first floor through a tap	5% of users are dissatisfied with the water pressure (2014)

Sources: documents provided by JICA; SEMAPA, the beneficiary survey

Note: To determine the actual water pressure level, the beneficiary survey examined the degree of satisfaction on the part of residents with the water pressure in view of the fact that not all houses in the project area have 2 stories.

### 3.3.1.1 Water Production at the Aranjuez WTP and Quality of Water Produced

Although the design maximum production capacity of the Aranjuez WTP prior to the Project was 100 litres/sec, the actual production was 60 – 70 litres/sec because of technical issues relating to the structure of this WTP. The average production for the period from 1994 to 2010 before the completion of the Project was 55.7 litres/sec. After the completion of the Project, the Aranjuez WTP has been operating without any stoppages and the average production for the 36 month period from July, 2011 to June, 2014 was 74.7 litres/sec or 134% of the pre-project level. In 20 of these 36 months, the monthly average production exceeded the pre-project monthly average maximum production of 70 litres/sec and the monthly average maximum production was 97 litres/sec.

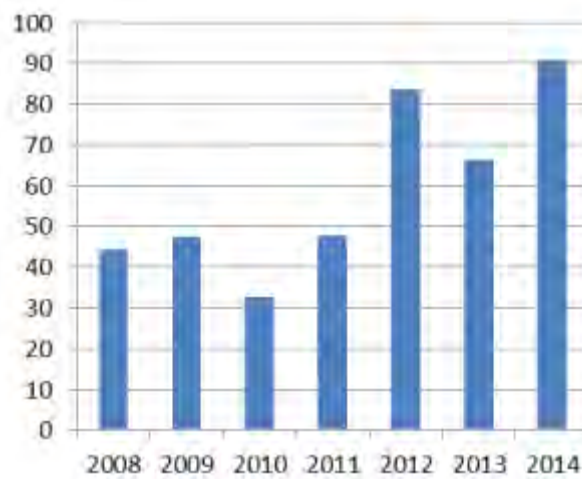


Fig. 3 Annual Average Production at the Aranjuez WTP (litres/sec)

In this way, while effects of the expansion of the Aranjuez WTP can be recognized, the water production at the Aranjuez WTP is restricted by the available raw water supply capacity and is primarily dependent on the level of rainfall in the water source area and water level at the Wara Wara Reservoir. In 2013 for example, the production was kept low by the low water level of the said reservoir, in turn caused by the low rainfall level. If the planned increase of the raw water supply of 30 litres/sec which is a precondition for expansion of the WTP had been met, the actual production would have been greater. It must be noted, however, that the level of contribution of the Aranjuez WTP to Cochabamba City is not particularly large as its water production volume accounts for only 7% of the total water production volume of SEMAPA.

The quality of the water supplied by the Aranjuez WTP meets the entire water quality standards. The issue of chromaticity which was considered to pose a problem at the time of the ex-ante evaluation has improved to meet the relevant standard.<sup>10</sup> At the time of the ex-ante evaluation, since the pH of raw water was below the standard level during the rainy season, a pH regulator injection pump was installed at the WTP. However, no adjustment has been required since the completion of the Project as the raw water quality meets the relevant standard.

### 3.3.1.2 Water Distribution Volume of the Project Area

Originally it was planned for water to be supplied to the target area via Cala Cala Alto Reservoir following completion of the Project. The water produced at the Aranjuez WTP is mostly conveyed to the Sinergia – Barrilete Trunk Line as previously was the case for its distribution to High Zone No. 1 and No. 2.<sup>11</sup> This is because of the non-operational status of the Taquiña WTP from which water was going to be distributed to these zones through the said trunk line due to the raw water shortage caused by non-completion of Misicuni Multipurpose Project as explained in 3.1 Relevance.

<sup>10</sup> At the Aranjuez WTP, the residual chlorine is measured twice daily while the sampling and inspection of the water quality at the headquarters' laboratory are conducted daily.

<sup>11</sup> No accurate data on the water distribution volume to the Barrilete Trunk Line was obtained.



The remaining water of the Aranjuez WTP is conveyed to the Cala Cala Alto Reservoir. This reservoir receives water also from other water sources (groundwater and the Cala Cala WTP) and distributes water to many areas, including the project area.

According to operation records at the Siglo XX Pump Station, water distribution from the Cala Cala Alto Reservoir to the project area began in January, 2012 at an average flow of 3.9 litres/sec for a 35 month period up to November, 2014. This was only 5% of the planned flow (81 litres/sec.) As shown in Figure 4, the water distribution, in fact, showed a gradually increasing trend reflecting the increased number of users in the project area to 7.5 litres/sec in November, 2014 or 9% of the planned level<sup>12</sup>.

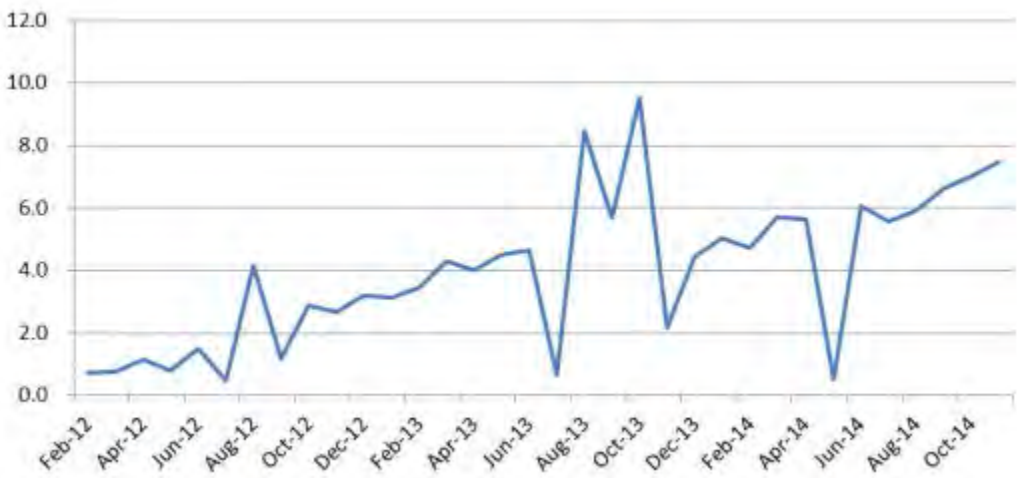


Fig. 4 Monthly Average Water Distribution to the Project Area (litres/sec)

**3.3.1.3 Benefiting Population in the Project Area**

There is a total of 21 residents’ organizations in the project area, each of which was traditionally engaged in its own water supply service using groundwater or other water sources. The Project intended the replacement of the entire water supply by these residents’ organizations with water produced at the SEMAPA’s Aranjuez WTP. At the end of November, 2014, 11 residents’ organizations had completed a water supply agreement with SEMAPA, of which 10 were receiving actual water supply through the connected water distribution pipeline. At that point, the total number of connected users was approximately 24,000 of some 3,900 households, i.e. 49% of the planned figure or 43% of the local population. Among the remaining 10 residents’ organizations, 7 have reached agreements with SEMAPA as of March 2015, and the benefiting population it expected to increase in future.

The main reasons for the slow progress of the commencement of water supply to residents’ organizations due to the absence of agreement with SEMAPA were ① time-consuming work to

<sup>12</sup> However, until the Misicuni Multipurpose Project is finished and SEMAPA obtains sufficient raw water, it will not be able to greatly increase water supply even if the number of users increases.

construct a secondary distribution network independently by each BTO (several years are required to complete the work with the budget size annually allocated by the municipal authority), ② slow process for a BTO to prepare the necessary documentation and ③ time-consuming procedure to eliminate potential overlapping between the permit for water supply service to be issued to some residents' organizations and similar permit to be issued to SEMAPA which was discovered in 2011. In cases where water supply cannot be started even though agreement has been reached with SEMAPA, this is because the secondary water distribution testing has not been completed.

#### **3.3.1.4 Water Supply Hours and Water Pressure in the Project Area**

Even though the original plan was to supply water for 24 hours a day to the project area, according to the beneficiary survey,<sup>13</sup> those residents receiving water from SEMAPA (hereinafter referred to as "beneficiaries") actually receive water only twice a week (the first 2 residents' organizations that got agreement with SEMAPA) or once a week (other residents' organizations), and the beneficiaries receive water supply once a week for an average of 2.7 hours which is far below the planned service level. This very short water supply duration reflects the severe water shortage faced by SEMAPA.<sup>14</sup> Some 60% of beneficiary residents own water tanks so that they can store the SEMAPA water for later use, however, they still do not have enough. Therefore, the beneficiaries supplement their water need with the supply of well water by existing residents' organizations or by the direct purchase of well water from water tank trucks operated by private vendors.

The evaluator assessed the degree of satisfaction with the water pressure on the part of those residents using water supplied by SEMAPA. Only 5% of those surveyed expressed dissatisfaction with the water pressure, suggesting a reasonably high water pressure in the project area.

#### **3.3.2 Qualitative Effects (Other Effects)**

According to the findings of the beneficiary survey, the degree of satisfaction with the water quality and water pressure is high among users but is modest in regard to the water supply hours, water charge and maintenance of the distribution network (Fig.5). Most of the beneficiaries would like to see an increase of the water supply frequency and duration. Meanwhile, most of non-beneficiaries (those local residents of the project area who do not yet receive water supply by SEMAPA) would like to see the start of water supply by SEMAPA.

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<sup>13</sup> As part of this ex-post evaluation, a beneficiary survey using a questionnaire was conducted. 100 households of five residents' organizations receiving water from SEMAPA and 50 households of three residents' organizations not receiving water from SEMAPA in the project area were interviewed. In addition, a representative of each of the 21 residents' organizations in the project area was interviewed.

<sup>14</sup> As SEMAPA cannot secure a sufficient quantity of water, it does not provide a 24 hour/day water supply service to any part of Cochabamba City. The actual frequency of water supply is once or twice a week for only several hours each time.

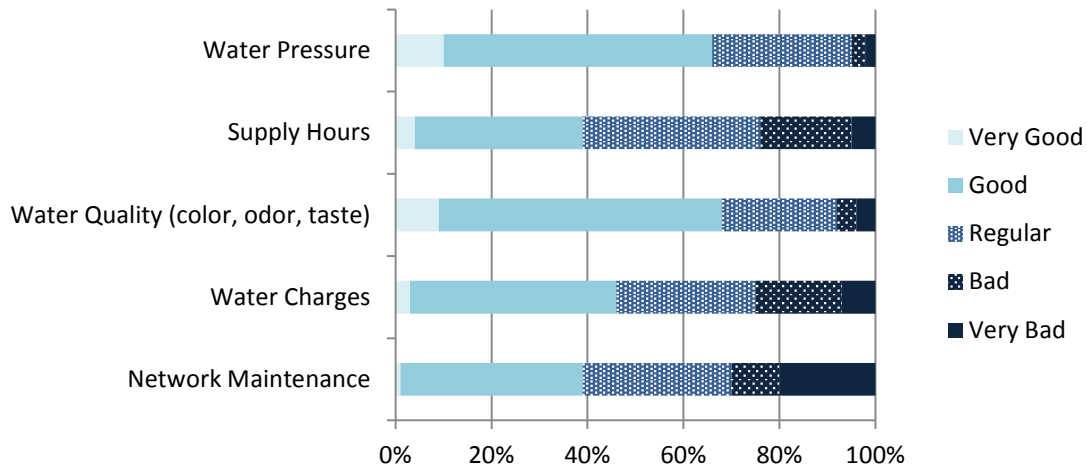


Fig. 5 Degree of Satisfaction with Water Supply Service of SEMAPA

### 3.4 Impacts

#### 3.4.1 Intended Impacts

At the time of the ex-ante evaluation, the Project identified the overall goal of improving the living environment for residents of the project area and such indirect effects as improved convenience of water use, lower financial burden associated with water use and lower risk of contracting water-borne diseases. According to the findings of the beneficiary survey, the beneficiaries of SEMAPA's water supply enjoy a higher level of improvement in terms of the quantity of water use, convenience of water use, cost of water use and sanitation compared to non-beneficiaries as described in more detail below.

##### (1) Increased Use of Water

The volume of water use by beneficiaries is 12% higher than that by non-beneficiaries and has increased by approximately 2.5 times compared to five years ago. During the same period, the volume of water use by non-beneficiaries has increased by 1.7 times. Thus, the level of increase among beneficiaries over the same period was higher. Upon asking such households why their water use increased, 66% pointed to higher needs and 27% said that it was because water had become more readily available. Therefore, improvement in the convenience of water use has been more conspicuous among beneficiaries rather than non-beneficiaries.

Water supplied by SEMAPA accounts for some 80% of the total volume of water use by beneficiaries. The remaining 20% consists of well water purchased from water tank trucks operated by private vendors and/or water (well water) supplied by residents' organizations. Water supplied by SEMAPA is used for multiple purposes, including drinking, cooking, cleaning, washing and toilet flushing. While water purchased from private vendors is also used for multiple purposes, water supplied by residents' organizations is used for purposes other than drinking or cooking because of its low quality. On the other hand, non-beneficiaries rely 70% of their water consumption on the water supplied by residents' organization (underground water) and 30% on the water purchased from private

vendors. Water from the both sources is used for multi-purposes, while more water of private vendor are used for drinking and cooking purposes.

#### (2) Improved Convenience of Water Use

75% of beneficiaries replied to the questionnaire that the situation relating to the convenience of water use has “slightly improved” in the past five years. Only 7% replied that the situation has “greatly improved”, presumably because of the fact that the increase of the water supply volume and water supply hours as a result of the Project is modest. Among non-beneficiaries, 34% replied that the situation has either “slightly improved” or “greatly improved”. Their proportion is less than half of that among beneficiaries. Thus, improved convenience of water use is observed more for the beneficiaries than the non-beneficiaries.

#### (3) Reduced Cost of Water Use

According to the beneficiary survey, SEMAPA charges an average of 4.4 Bs per cubic meter of water supply. Although this is only slightly higher than the cost of water supplied by the Residents’ organizations (3.1 Bs), it is one-fifth of the cost of water purchased from water tank trucks operated by private vendors (22.8 Bs). The monthly average expenditure of beneficiaries for water is some 82 Bs which is more or less the same as it was before the Project (2009), however, since the quantity of water use has increased by 2.5 times, the average unit rate of water is 40% of what it was before the Project. Beneficiaries use 12% more water than non-beneficiaries, however, their expenditure on water is only 76% that of non-beneficiaries.

#### (4) Improved Sanitation

As shown in Table 4, a higher proportion of beneficiaries replied that both personal / household hygiene practices (hand-washing, bathing, washing, cleaning and toilet flushing) and household sanitation have improved compared to non-beneficiaries. According to SEMAPA, when starting water distribution to the residents’ organizations, explanations on water conservation methods, the importance of sanitary management, methods of conducting effective sanitary management with little water and so on are given in residents’ assemblies. It is surmised that the effects of such education efforts have manifested in line with the improvement of water supply services.

In the period from 2010 to 2014, the frequency of the occurrence of water-borne diseases, including diarrhoea, tends to be lower among beneficiaries compared to non-beneficiaries.<sup>15</sup> However, the earliest start of water supply by SEMAPA to the project area in 2011 means that such a difference cannot be immediately described as a beneficial impact of the Project.

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<sup>15</sup> 10% of beneficiaries and 20% of non-beneficiaries replied that one or more family members had experienced diarrhoea in the past five years.

Table 4 Findings on Improved Sanitation

Compared to Five Years Ago	Beneficiaries	Non-Beneficiaries
• Washing hands and bathing more often	56%	44%
• Washing (clothes, etc.) more often	57%	38%
• Cleaning more often using water	49%	34%
• Flushing the toilet more often	53%	36%
• Improvement of household sanitation	68%	46%

Source: Beneficiary survey

### 3.4.2 Other Impacts

The Project was certified as a project with minor environmental impact (classified in the second least environmental impact category out of four categories) and it was judged that an EIA would not be required<sup>16</sup>. An environmental permit for the Project was obtained in October, 2007 and trees were planted in a former yard introduced in the western part of the Aranjuez WTP premises as part of environmental management. In this ex-post evaluation, no notable negative impacts on the natural environment were found.

SEMAPA acquired the right to use the land required for expansion of the Aranjuez WTP through negotiations with the landowner. Although some time was required to acquire this right, there were no special problems. The Project did not involve any resettlement of residents.

In implementing the construction work, SEMAPA and consultant jointly coordinated with the road cooperation as well as electricity, telephone and gas service providers while publicly disclosing information on the work progress through periodic newsletters to local residents and the SEMAPA's website. Some residents in areas where the conducting pipeline passed through were opposed to the work which would be of no benefit to them but the quick completion of the work meant that their opposition did not develop into a social problem. According to SEMAPA, such experience under the Project has been very helpful for the implementation of similar projects thereafter.

In summary, the Project resulted in such benefits as improved water quality and water pressure, increased water use, reduced cost of water use and improved sanitation for the beneficiaries. However, as the preconditions of implementing the related projects were not met and construction of water distribution networks by the residents' organizations is taking time, the actual benefiting population was only half of that planned, the water supply volume was only 10% of the planned volume and the water supply hours were only 2.7 hours average per week compared to the planned 24 hours a day. While the Project achieved its objectives at a limited level, the effectiveness and impact of the Project are low.

When the first phase of Misicuni Multipurpose Project is completed in February 2016, since raw water will be secured for Taquiña WTP, it will become possible for Aranjuez WTP to supply water to the Project target area as originally planned. In order to realize the early effect of the Project,

<sup>16</sup> The environmental category is established according to the size of environmental impact of public projects in Bolivia. In categories 1 and 2, which have a large environmental impact, it is necessary to implement an environmental impact survey either in general or for specific fields.

SEMAPA plans to construct a conducting pipeline from Misicuni Multipurpose Project to Cala Cala WTP, implement expansion of the said WTP, and construct a new water transmission pipe to the Project target area<sup>17</sup>.

### **3.5 Sustainability (Rating: ③)**

#### **3.5.1 Institutional Aspects of Operation and Maintenance**

##### **3.5.1.1 Operation and Maintenance System of SEMAPA**

SEMAPA has 357 permanent and 8 to 10 contract employees. The operation and maintenance of the facilities constructed or improved under the Project are handled by the Operations Department, Treatment Department and Water Supply Maintenance Department of the Operations Bureau. Organizations for operation and maintenance of the facilities constructed by the Project are as follows. The operation and maintenance system of SEMAPA is adequate with the deployment of the necessary personnel.

The Aranjuez WTP has six operators and one shift with three operators work for 24 hours. This WTP is located at some 15 minute drive from SEMAPA's headquarters and staff members of the Treatment Department can quickly reach the WTP to assist operation in the case of an emergency.

The Siglo XX Pumping Station is run by two operators with each operator working a 24 hour shift. The Diez de Febrero Reservoir is run by two operators with each operator also working a 24 hour shift. One vehicle is deployed at this reservoir.

The transmission pipelines and distribution network directly managed by SEMAPA are maintained by the Distribution Network Management Section of the Water Supply Maintenance Department. There are two teams to maintain the trunk lines and five teams to maintain the secondary water distribution networks. Each team is composed of four personnel including a driver, an engineer, two technicians and owns a vehicle and equipment. These teams mainly go into action in response to reports by residents and the necessary repairs are basically completed in 48 hours. Along with repair work, the Distribution Network Management Section has been replacing old distribution pipelines. As a result, there has been a declining trend of the number of leakage repairs.

##### **3.5.1.2 Operation and Maintenance System in the Project Area**

As of the end of November, 2014, SEMAPA directly manages the distribution network in the areas of six residents' organizations out of 11 residents' organizations receiving water supply using facilities constructed under the Project. In these areas, SEMAPA exchanges a contract with each user, collects the water charge based on meter reading and maintains the local distribution network. In the remaining five areas, SEMAPA supplies water based on a large user contract with each residents'

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<sup>17</sup> Cala Cala WTP is the main WTP in Cochabamba. When this plant becomes able to obtain raw water from the Misicuni Multipurpose Project, it is planned for the water of Escalerani Reservoir that was conventionally conveyed to Cala Cala WTP to be used as the raw water for Taquiña WTP. Moreover, because it has become difficult to control water flow due to installation of a branch on the section where Cala Cala Alto Reservoir is linked by the water transmission pipe newly constructed in the Project, construction of a new dedicated water transmission pipe (1,200m) that doesn't pass through Cala Cala Alto Reservoir is being advanced.

organization which exchanges a contract with each user, collects the water charge based on meter reading and maintains the local distribution network. In some cases, the existing residents' organization directly operates the water supply system. In other cases, a water committee is specifically established. In either cases, several officers and staff members are appointed to ensure a reliable operation and maintenance.

SEMAPA advises residents' organizations in the project area on distribution network construction in relation to the managerial and technical aspects. The Customer Service Department of the Customer Service Bureau of SEMAPA is responsible for negotiations and contracting issues with residents' organizations. Various departments of SEMAPA also provide advice on distribution network development by a residents' organization and the transfer of the water supply service to SEMAPA. The operators of the reservoir in the project area also provide a consultation service for residents' organizations.

### **3.5.2 Technical Aspects of Operation and Maintenance**

#### **3.5.2.1 SEMAPA**

SEMAPA has been operating several WTPs in the city without any problems. At the Aranjuez WTP, the operation procedure has been firmly established, including backwashing of the filtration basin and the injection of chemicals.<sup>18</sup> The Treatment Department evaluates the operation and maintenance work every three months in relation to the injection of chemicals, cleaning and inspection at each WTP. Consequently, the operation and maintenance of the Aranjuez WTP is found to be adequate. So is the operation of the pumping stations. In the light of the above, SEMAPA is judged to possess the necessary technical competence.

#### **3.5.2.2 Residents' organizations**

Those residents' organizations which distribute water based on a large user contract with SEMAPA are responsible for the repair of the secondary distribution networks in their respective areas. According to the results of interviews with residents' organizations, they have built up experience and possess some repair equipment of their own. As such, residents' organizations appear to have a certain level of technical competence. As no technical problems are found with those residents' organizations with a large user contract, it is reasonable to conclude that they have the necessary skills to conduct the operation and maintenance of the secondary distribution networks.

### **3.5.3 Financial Aspects of Operation and Maintenance**

#### **3.5.3.1 SEMAPA**

Interviews with staff members of SEMAPA found that SEMAPA has sufficient budget to maintain manpower to operate and maintain the WTPs and purchase chemicals and other consumables as well as equipment.

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<sup>18</sup> However, the operation and maintenance plan is not documented. While there are operation records for facilities and equipment, there are no complete records of maintenance or repair work carried out.

SEMAPA's income from the water charge increased by 13% in the three year period from 2010 to 2013.<sup>19</sup> (Table 5) In recent years, many meter readers who were the main reason for an increasing personnel cost were made redundant and their jobs were replaced by outsourcing. Other management efforts to slim down the costs included the purchase of heavy machinery and vehicles instead of leasing them. As a result, the business income and expenditure of SEMAPA has been in the black since 2010.<sup>20</sup> The operating profit margin has been around 60% for the last three years, maintaining a high level of profitability. The current ratio in the last three years exceeds 500% and the capital-to-asset ratio of 85% or more is sufficiently high, indicating the generally healthy finance of SEMAPA.

Table 5 Business Income and Expenditure of SEMAPA

	2010	2011	2012	2013
Total Income	112,276	108,907	125,889	127,426
Water Charge	106,490	103,190	118,967	120,356
Other Income	5,786	5,717	6,922	7,070
Total Expenditure	44,265	43,171	48,955	56,245
Personnel Cost	20,236	18,895	23,263	26,657
Other Costs	24,029	24,276	25,692	29,588
Balance	68,011	65,736	76,934	71,181

Source: SEMAPA

### 3.5.3.2 Residents' Organizations

A residents' organization which distributes water based on a large user contract collects the water charge set by itself to cover the cost of the raw water supplied by SEMAPA and the cost of operating and maintaining its own secondary distribution network. No residents' organization has so far experienced any difficulty in terms of operation and maintenance due to financial problems. However, some residents' organizations are in the midst of the process of cancelling their large user contracts in the hope of shifting to direct water supply by SEMAPA because of financial worry caused by insufficient water charge collection and difficulty of increasing the water charge.

### 3.5.4 Current Status of Operation and Maintenance

Defect inspection confirmed that the operating status of the facilities is very good and that facility inspection and cleaning, including the work to remove algae, are conducted on a daily basis. The field survey conducted as part of this ex-post evaluation also confirmed that both the WTP and distribution facilities are adequately maintained to perform their functions in full.

<sup>19</sup> SEMAPA reviews the level of its water charge in consideration of inflation. The water meter installation rate improved from 81.2% in 2005 to 86.7% in 2013. The water charge collection rate exceeds 90%.

<sup>20</sup> The depreciation amount in individual years does not reflect the actual income and expenditure because it is adjusted based on managerial judgement. It is not, therefore, considered in this report.



Since the completion of its expansion work, the Aranjuez WTP has been operating without interruption. However, a leakage incident occurred in April, 2014 involving a pipe connection section with the filtration basin, presumably because of sudden valve operation. Urgent repair work was conducted with the cooperation of staff members of SEMAPA's headquarters and pipe function was restored 18 hours later with little adverse impact on water production operation.



The pipe repaired at the Aranjuez WTP

The transmission pipeline from the WTP to the pumping station suffered dislocated pipes at the end of 2013 due to subsidence caused by an unknown reason. In regard to the secondary distribution networks, several incidents of damage by a contractor engaged in sewerage pipe laying work occurred in 2014. In each case, the damage was quickly repaired by staff members of the Distribution Network Management Section of SEMAPA.

There was also an incident of water leakage from the distribution network laid by a residents' organization due to gas work but the damage was promptly repaired.

Thus, it is deemed that the project facilities receive appropriate operation and maintenance.

Based on the above, no major problems have been observed in regard to the institutional, technical and financial aspects of the operation and maintenance system of SEMAPA or residents' organizations. Therefore, the sustainability of the project effects is high.

## **4 Conclusions, Lessons Learned and Recommendations**

### **4.1 Conclusions**

The Project was implemented in the City of Cochabamba with the aim of continually supplying clean water in sufficient quantity for residents of the south-eastern zone of the city by means of expanding the existing water treatment plant and constructing new water transmission and distribution pipelines, thereby contributing to improvement of the sanitation and living environment of the project area. At the time of both the ex-ante evaluation and ex-post evaluation, the Project was found to be highly relevant to the development policies of Bolivia and compatible with the need for the development of the water supply system in Cochabamba City in general and the project area in particular. It was also in line with the Japan's aid policy at the time of ex-ante evaluation. However, due to the somewhat insufficient information gathering/examination and verification of very important preconditions prior to the commencement of the Project, the relevance of the Project is fair. The Project mostly achieved its planned outputs and the actual project cost was within the plan. Meanwhile, the actual project period exceeded the plan. As such, the efficiency of the Project is fair. As a result of project implementation, local residents have benefited from improved water pressure and quality,

increased use of water, reduction of water use-related expenditure and improved sanitation. However, because of failure to materialise associated projects and time consuming construction of water distribution networks by the residents' organizations, the benefiting population was only half of the plan, the water supply volume was only 10% of the plan and the water supply hours were only 2.7 hours/week compared to the planned continual water supply for 24 hours/day. Because of these shortcomings, the effectiveness/impact of the Project are low. No major problems were observed with SEMAPA or residents' organizations relating to the institutional, technical and financial aspects of the operation and maintenance of the facilities which are functioning well, making the sustainability of the Project high. In light of the above, this project is evaluated to be unsatisfactory.

## **4.2 Recommendations**

### **4.2.1 Recommendations to the Implementing Agency**

- SEMAPA should continually provide technical assistance for some residents' organizations with a view to assisting their efforts to complete the construction of secondary distribution networks and to concluding large user contracts so that these residents' organizations can commence the distribution of water produced by SEMAPA as soon as possible.
- It is essential for SEMAPA to construct water transmission and distribution facilities, including the conducting pipeline from the Misicuni Project to Cochabamba City so that a sufficient volume of water can be supplied to the project area in line with scheduled completion of the Misicuni Multipurpose Project Phase I in 2016.

### **4.2.2 Recommendations to JICA**

None.

## **4.3 Lessons Learned**

### Appropriate analysis and confirmation of preconditions for Project commencement:

Since commencement of the Project was conditional on the definite implementation of two associated projects (expansion of the Wara Wara water source and the Sinergia-Barrilete Project), the Project was started after confirming implementation of these. However, because one of these projects was cancelled and start of the other was greatly delayed due to the opposition of residents and impacted public authorities which could have not been predicted and delays in another major undertaking (the Misicuni Multipurpose Project) that could have not been clearly recognized as a precondition, manifestation of the Project effects was greatly impeded.

Therefore, in cases where project commencement is conditional on associated projects, it is necessary to conduct wide-ranging analysis of the technical, financial, social and political risks and so on that affect the implementation of such projects. In social aspect, it is important to fully grasp potential stakeholders including local residents and public authorities, and to specifically and continuously monitor the views of each party, trust relations with the project implementer,

progress in negotiations and so on. Also, it is necessary to analyse not only projects that are directly related but also projects that can indirectly have a major impact. Concerning the specific milestone events that determine the start of the project, it is necessary to set contents (associated projects) that have a high likelihood of being implemented without delay.

Plurinational State of Bolivia

Ex-Post Evaluation of Japanese Technical Cooperation Project  
“The Project for Capacity Development of Road Disaster Prevention  
and Bridge Management and Maintenance”

External evaluator: Takeshi Yoshida, Global Group21 Japan, Inc.

## 0. Summary

The Project for Capacity Development of Road Disaster Prevention and Bridge Management and Maintenance (hereinafter, referred to as “the Project”) was implemented with the objective of improving the road disaster prevention and bridge maintenance and management capacity of the Bolivian Road Administration (ABC) through strengthening the organizational basis of the Disaster Prevention Unit (UPD) that has been established in the ABC and improving the technical and information basis related to roads and bridges, and thereby reducing the closure of national roads caused by natural phenomena<sup>1</sup>. Being a landlocked nation with high demand for road transportation and harsh natural conditions, Bolivia has a high need for road disaster prevention, and the Project had a high degree of relevance to the development policy and development needs both at the time of ex-ante evaluation and the time of completion. Since it was also consistent with Japan’s aid policy at the time of ex-ante evaluation, it had a high degree of relevance. The project purpose of improving the road disaster prevention and bridge maintenance and management capacity of ABC has largely been achieved; moreover, because the Project’s contribution towards the overall goal of reducing the number of days of closure on national roads has been confirmed and effects have been observed as planned, the Project has had high effectiveness and impact. Due to the effects of the organizational reform which were being advanced by ABC and delays in the pilot projects and so on, the Project period was extended by six months, and the Project cost exceeded the planned amount due to additional dispatch of experts and supply of equipment. Accordingly, efficiency of the Project was low. The UPD was disbanded following completion of the Project. Moreover, because there have been issues regarding the utilization of rainfall observation data and technical dissemination to all of ABC, the Project’s sustainability is moderate. Summing up, the Project is evaluated to be partially satisfactory.

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<sup>1</sup> “Disaster prevention” in wide sense includes various preventive measures, such as construction of civil structures for mitigation (including restoration of structures with improvement), disaster prevention planning, strengthening of risk management organization, education and awareness raising, improvement of warning and communication system and other measures to be taken at the time of disaster (emergency response, relief, etc.) and post-disaster period (rehabilitation, restoration). The Project mainly focused on the preventive measures to be taken in pre-disaster period. In this report, unless otherwise specified, “disaster prevention” and “road disaster prevention” refers to those preventive measures.

## 1. Project Description



Project Location



Slope Protection Works on National Road 1 in Variante, Tarija Department (Pilot Project)

### 1.1 Background

Bolivia has 60,000 km of roads, but less than 30% of national highways are paved. As maintenance is inadequate, so many of the roads are old and deteriorated with damaged road surface, shoulders, lost traffic signs, etc. Moreover, because Bolivia is a mountainous country with a harsh climate and rough terrain, it suffers substantial damage from major landslides, falling rocks and washed-out bridges during its rainy season lasting from November through March. However, the technology to restore roads is inadequate even when emergency measures are taken, resulting in similar and repeated damage in the same areas.

Given this situation, JICA carried out the development study titled Survey on Prevention of Disasters on Major National Highways and Roads from 2005 through 2007 to encourage drastic improvements in disaster prevention on Bolivia's national roads. As part of this, JICA proposed a capacity development plan that laid out the issues that Bolivia should address and the measures that should be taken to prevent disasters, and also recommended the establishment of an organizational structure to handle these measures. In response to this plan, Bolivia made the decision to set up the Disaster Prevention Unit (UPD) in ABC and to promote capacity strengthening on an organized basis. However, since ABC was lacking in experience and expertise regarding disaster prevention measures, it was unable to independently carry out this work.

Bridges, just like roads, were being affected by natural disasters in different parts of the country, being destroyed by undermining and erosion of riversides and riverbeds. Although many of the deteriorated bridges were in need of maintenance, ABC was unable to take fundamental improvement measures. In order to continue using the existing bridges within the limit of the available budget, it became necessary to perform routine inspections and rational management based on the results of such inspections. However, because there was no updated and complete inventory of the bridges of Bolivia, the measures that were taken were mainly corrective and limited to the repair of destroyed structures.

Within this context and in response to the request presented by the Government of Bolivia, the

Government of Japan decided to perform technical cooperation on the subject of management of roads and bridges based on the approach of preventive maintenance. So, JICA sent a team for a preliminary study in December of 2007 and an agreement with the Bolivian authorities was established about the profile and the basic policy of the Project. The Record of Discussions (R/D) was signed and the Project was commenced in December of 2008.

**1.2 Project Outline**

Overall Goal		To enable constant travel on national roads
Project Purpose		To improve ABC's capacity to prevent road disasters and maintain and manage bridges
Outputs	Output 1	Activity policies for the UPD are established.
	Output 2	A road disaster prevention system is established.
	Output 3	The road disaster prevention management capacity within ABC is improved.
	Output 4	A bridge maintenance and management system is established.
	Output 5	Bridge maintenance and management capacity is improved.
Total cost (Japanese Side)		519 million yen
Period of Cooperation		March 2009 ~ September 2012 (including extension from April to September 2012)
Implementing Agency		Bolivian Road Administration (ABC)
Other Relevant Agencies / Organizations		None
Supporting Agency/Organization in Japan		Joint venture (JV) of Earth System Science Co., Ltd. and Central Consultant Inc.
Related projects		Development study: Survey for Prevention of Road Disasters on Major National Roads (JICA, 2005~2007) Dispatch of individual experts (JICA) Subject of guidance: Road management, January 2010 ~ March 2012 Subject of guidance: Advisor on road disaster prevention measures, October 2014 ~ September 2015 Grant aid: Project for Road Disaster Countermeasures for National Highway No. 7 (JICA, scheduled for 2015~2017)

**1.3 Outline of the Terminal Evaluation**

1.3.1 Achievement Status of Project Purpose at the time of the Terminal Evaluation

With the establishment of concepts on disaster prevention within ABC, construction of the institutional base and technical base of the UPD, and technical capacity building of employees in the UPD and regional offices, progress was made on the Project goals. However, due to the influence of organizational reform in ABC and so on, it appears that some of the outputs and Project purpose have not been achieved.

1.3.2 Achievement Status of Overall Goal at the time of the Terminal Evaluation (Including Other Impacts)

Multiple disaster prevention projects that benefited from advice from the UPD and team of

Japanese experts were confirmed. Therefore, the impact was extremely large and the overall goal was on course to being attained. No negative impacts were recognized.

### 1.3.3 Recommendations at the time of the Terminal Evaluation

- Promptly begin collection of baseline data regarding the indicator for the overall goal, i.e. to reduce road closures on arterial roads in terms of number and duration.
- Appropriately modify the indicators for the Project purpose.
- Build an appropriate management system for self-recording rain gauges by the end of the Project. ABC should conduct appropriate maintenance and management of these and other equipment.
- Quickly finalize the contents of manuals and guides prepared in the Project; distribute them to regional offices, and take steps to improve the understanding of ABC employees.
- When the organizational setup has been finalized, ABC should review and revise the UPD activity guidelines and operational plans.
- ABC should utilize the disaster prevention database, manuals and guides prepared by the Project and promptly initiate initiatives for disseminating technology and strengthening capacity in headquarters and regional offices.
- JICA should consider extending the Project period concerning those activities for which it is likely that outputs can be achieved through making additional inputs.

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Takeshi Yoshida<sup>2</sup> (Global Group21 Japan, Inc.)

### 2.2 Duration of Evaluation Study

Study was implemented as follows for the ex-post evaluation:

Duration of the Study: September 2014 -July 2015

Duration of the Field Study: November 9-November 28, 2014, April 20-April 25, 2015

## 3. Results of the Evaluation (Overall Rating: C<sup>3</sup>)

### 3.1 Relevance (Rating: ③<sup>4</sup>)

#### 3.1.1 Relevance to Development Policies of Bolivia

At the time of the ex-ante evaluation, roads were regarded as vital for maintaining the unity of national land, promoting domestic passenger and freight transport, economic activities and industry, and integrating local economies; in particular, concerning the strengthening of productivity and competitiveness, which are regarded as priorities of economic policy, there were plans to give priority to investing in the

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<sup>2</sup> Affiliated with Trea Co., Ltd. (reinforcement)

<sup>3</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>4</sup> ③: High, ② Fair, ① Low

construction of infrastructure for physical distribution, etc. The Project aims to support the construction of infrastructure for physical distribution, etc. including the arterial road network (national roads) in respect to the policy issue of “strengthening productivity and competitiveness” within the core theme of “improvement of production capacity” in the National Development Plan of Bolivia (2006-2011). In the strategic road plan at that time, in addition to development of the national road network, it was anticipated that the implementation of public works for road construction and maintenance would lead to an employment creation effect and generate cash income for impoverished people in the short term. The national development policy and strategic road plans of the Government of Bolivia were continued unchanged between the start and the end of the Project.

Accordingly, the Project retained high consistency with development policy from the time of ex-ante evaluation to its completion.

### 3.1.2 Relevance to the Development Needs of Bolivia

As was already mentioned in 1.1 Background, at the time of the ex-ante evaluation, Bolivia was suffering from repeated road closures due to harsh natural conditions and the promotion of preventive maintenance on roads and bridges was an extremely important development issue. By the time of Project completion, although the number of days of road closure caused by natural phenomena was decreasing (see the section on Impact), repeated national road closures were still occurring with major impacts on physical distribution, and the promotion of disaster prevention was an important issue for ABC.

Therefore, relevance of the Project to development needs was high both at the time of ex-ante evaluation and the time of Project completion.

### 3.1.3 Relevance to Japan’s ODA Policies

Japan’s ODA policy with respect to Bolivia at the time of the ex-ante evaluation comprised the two pillars of “supporting social development for reduction of poverty” and “supporting sustainable economic growth,” and it intended to support infrastructure development and human resources development regarding the latter of these. Priority sectors were “Social development,” “Improvement of productivity” and “Strengthening of governance,” and development of economic infrastructure was identified as the means for improving productivity.

Therefore, the Project had high relevance to Japan’s ODA policies.

To sum up, the Project was highly relevant to the Bolivia’s development plan and development needs, as well as Japan’s ODA policy. Therefore, its relevance is high.



## 3.2 Effectiveness and Impact<sup>5</sup> (Rating: ③)

### 3.2.1 Effectiveness

The Project purpose was to “improve ABC’s capacity to prevent road disasters and maintain and manage bridges.” In order to achieve this, activities were conducted over the Project duration of three and a half years with respect to five full-time employees of UPD (the counterparts) with a view to establishing the organizational basis of UPD, which is the core agency for promoting road and bridge disaster prevention in ABC (Output 1), establishing the technical and information basis for promoting road disaster prevention (Output 2) and improving the technical capacity of employees of ABC in this regard (Output 3), establishing the technical and information basis for promoting bridge disaster prevention (Output 4) and improving the technical capacity of ABC in this regard (Output 5). The following sections summarize the results of the joint work conducted by the team of Japanese experts and UPD and analyze the degree of attainment of the Project purpose in the fields of UPD organizational strengthening, road disaster prevention, and bridge disaster prevention.

#### 3.2.1.1 Attainment of the Outputs

##### (1) Establishing the organizational basis of UPD (Output 1)

In response to the recommendations of the JICA development study, the UPD was established in order to promote disaster prevention within ABC, however, at the time of the ex-ante evaluation, its recognition within ABC was low and its activities were sluggish because there were no policies, operational plans nor its own budget. In the Project, the UPD’s policies and operational plans were compiled and a budget for activities was secured with the approval of the ABC president.<sup>6</sup> The following four responsibilities were specified in the UPD’s policy approved in 2011.

- Establishment of policies, principles and systems concerning disaster prevention in ABC.
- Training for road disaster prevention and bridge maintenance and management inside and outside of ABC
- Operation of technical mechanism and work systems for disaster prevention
- Support for ABC employees in emergencies

ABC has rapid turnover of employees; in particular, turnover is high among road and bridge management engineers at local sites because they are recruited on short-term contracts. It was thus proposed that a qualification system be introduced whereby engineers who receive road disaster prevention and bridge maintenance and management training in the UPD are given a completion certificate and recognized qualification by ABC and this is taken into account when ABC recruits engineers<sup>7</sup>. It was anticipated that this would enable ABC to maintain technical levels in spite of the high turnover of engineers. However, the Project finished before all the arrangements for

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<sup>5</sup> When assessing effectiveness, rating is given upon also taking impact into account.

<sup>6</sup> This output was added following the revision of plans after the start of the Project.

<sup>7</sup> According to the Project Design Matrix (PDM), the qualification system is included in Output 3 and Output 5, however, here it is described together with Output 1 for easier understanding.

securing an approval of ABC's board of directors could be obtained, so the system did not come to fruition.

(2) Road disaster prevention (Outputs 2, 3)

In the development study that preceded the Project, a manual for road disaster prevention (Manual de Gestión y Prevención de Desastres en Carreteras, 2007) was compiled and widely used in ABC. This was an introductory level manual introducing the concept and outlining the technologies of road disaster prevention. In the Project, more detailed technical guidelines were prepared concerning design of road disaster prevention measures, diagnosis and evaluation of hazard spots and so on, and these were used as the basis for conducting training with employees of ABC headquarters and regional offices. The UPD counterparts worked as lecturers during the training for regional engineers. Also, in addition to various indoor training and on-site training for UPD, pilot projects were implemented under the ABC's budget at two locations, making it possible to conduct practical training on a wide range of tasks from the planning and design of road disaster prevention works to procurement, execution management, and handover.

In order to pertinently advance road disaster prevention while utilizing limited resources, it is important to establish an information basis for determining what kinds of measures should be adopted, where and when. In the Project, in order to identify, diagnose and verify the risk locations within the arterial road network, survey formats and a database for recording road disasters and diagnosing hazard spots (slopes) were created. Moreover, a start was made on gathering rainfall observation data through installing a rainfall observation network comprising self-recording rain gauges and simple rain gauges (approximately 120 locations in total), while a landslide observation device using slope gauge (1 location) was installed and operated on a model basis. Also, based on the ABC database, a road pass-ability database open to the public via the internet was prepared through linking with the disaster ledger and gathering information on road closures on arterial roads. Furthermore, precise topographical information was gathered using aerial laser on sections that were previously regarded as difficult to conduct road disaster prevention. The technology transfer to UPD was implemented via these activities, indoor training and site training. On the other hand, for employees of ABC regional offices engaged in the collection of data, the manuals were introduced and training on data collection was conducted..

(3) Bridge disaster prevention (Outputs 4, 5)

There are approximately 800 bridges under ABC management on arterial roads throughout Bolivia. However, when the Project was started, there was no proper inventory of bridges, and bridge works completion drawings were scattered and lost. Moreover, because ABC had so few bridge engineers, it had no choice but to assign its road engineers to work on bridge maintenance and management. Accordingly, at the time of the preliminary survey (May 2008), it was deemed effective to introduce a Bridge Management System (BMS) that included bridge inventory functions and to

simultaneously promote the improvement of bridge inspection and diagnosis technologies, and these contents were included in the activity plan of the Project<sup>8</sup>.

However, following the start of the Project, it was discovered that ABC had already made a beginning on developing its own bridge maintenance system, namely Sistema Gestion de Puentes (SGP). Therefore, introduction of the planned BMS was omitted from the scope of assistance in order to avoid redundancy. Therefore, in the Project, activities were limited to monitoring and evaluating the system autonomously being developed by ABC and offering recommendations on its utilization<sup>9</sup>.

By the end of the Project, an inventory of bridge works completion drawings (a database including digital image drawings) had been compiled. Also, a bridge disaster prevention and reinforcement guide, simplified bridge inspection guide and routine inspection guide, etc. that could even be used by road engineers were prepared and used in conducting training for employees of ABC headquarters and regional offices. The UPD counterparts worked as lecturers during the training for regional engineers.

In addition to various indoor training and on-site training for the UPD, pilot works were implemented under the ABC budget at two locations, making it possible to conduct practical training on a wide range of tasks from the planning and design of bridge disaster prevention works to procurement, execution management, and handover.

### 3.2.1.2 Achievement of Project Purpose

Looking at the situation regarding achievement of eight indicators for the project purpose following the period of extension, as is shown in Table 1, five of the indicators (①, ③, ④, ⑤, ⑦) were achieved, two (②, ⑧) were mostly achieved, and one (⑥) was partially not achieved, and it is deemed

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<sup>8</sup> The Bridge Management System referred to here is a system for assisting the gathering of data on bridge inspection results and repair works and compiling optimum maintenance and management plans according to budget, and it intends to extend the service life of bridges with limited investment. In this system, field inspections of bridges are implemented, the soundness of bridges is determined from the results, the necessary repair contents are presented, and the order of priority of repairs is calculated for multiple bridges. Moreover, the future degradation over time of bridges is forecast, and maintenance and management plans are compiled for the coming years. So long as the field inspection structure can be established, such a system can be operated by a small number of engineers. The preliminary study report stated the following: "It is necessary to augment staff shortages through gathering and integrating general bridge information and routine inspection and diagnostic information in the bridge management system and adding a function for calculating the degree of urgency and rough cost of bridge repair works.

<sup>9</sup> The bridge maintenance system autonomously developed by ABC includes many of the functions of the aforementioned Bridge Management System, but it does not possess the function for forecasting the future degradation over time of bridges and compiling maintenance and management plans for the coming years. As a result of evaluation, the ABC system was found to be difficult to use because it contains very many inspection items, some of which are hard to understand even for bridge experts, it has no expandability and lacks integrity. Accordingly, it was proposed that this system be limited in function to a bridge database. Subsequently, the idea of introducing the Bridge Management System that was initially planned in the Project was considered, however, negotiations between ABC and JICA were too time-consuming and this idea was abandoned due to a lack of time in the Project. As a result, the Project activity did not include a Bridge Management System. The detailed background about how it had been initially planned to introduce a Bridge Management System in the Project but it was revealed that ABC had already started introduction of its own system just before the start of the Project did not come to light. Moreover, ABC, facing to a difficulty to utilize the bridge maintenance system simply as a database due to restriction of programming language, and having desire to re-introduce the Bridge Management System that couldn't be implemented in the Project, was considering making a request to JICA for cooperation in this respect at the time of the ex-post evaluation

that the general degree of achievement was high (Table 1)<sup>10</sup>.

Table 1 Achievement of Project Goals

Project Purpose	To improve ABC's capacity to prevent road disasters and maintain and manage bridges	
	Indicator	Performance
①	Establishment of the ABC road disaster prevention and bridge maintenance and management systems and clarification of the role of UPD	(Achieved) The UPD activity guidelines and operational plans were prepared, and the central and regional work structures were established.
②	Operating conditions of the rainfall observation network and form of transmission of rainfall information	(Mostly achieved) The rainfall observation network was established. However, there are maintenance and management issues with some of the self-recording rain gauges.
③	Listed contents of risk locations on priority sections, and inspection locations in the road disaster ledger	(Achieved) The risk points on arterial roads were confirmed and slope risks were assessed.
④	Quantity of modules and data in the road disaster prevention information database system	(Achieved) Data gathering was commenced on the four modules of pass-ability, disaster ledger, rainfall hydrology, and slope risk.
⑤	Quantity and contents of manuals required for road disaster prevention and bridge maintenance and management	(Achieved) Seven road disaster prevention manuals and five bridge maintenance and management manuals were prepared.
⑥	Establishment of the training completion certification system and certification of completing trainees	(Partially not achieved) Completion certificates were issued, but the qualification system wasn't realized.
⑦	Training contents of engineers in UPD and regional offices and level of understanding of trainees	(Achieved) 86% of trainees adequately understood road disaster prevention, and the figure was 90% for bridge maintenance and management.
⑧	Contents of works leading to the pilot projects, and quality of the completed works	(Mostly achieved) Due to delays in the pilot projects, some of the practical training was conducted at other sites.

Source: Prepared by the evaluator based on materials provided by JICA.

In the terminal evaluation, specific goals of the Project separate from the indicators were arranged as shown below. The conditions regarding achievement of those goals at the time of Project completion are also described, and it is thought that the degree of achievement was generally high.

- To promote the concept of disaster prevention within ABC: The concept of disaster prevention was permeated widely owing to the existence of UPD, the wide-ranging training for ABC engineers, public information activities based on the issue of “engineering handbooks” and the implementation of pilot projects. (Achieved)

<sup>10</sup> The indicators of Project goals are based on the PDM that was used at the time of the terminal evaluation. Because the terminal evaluation pointed out that “these indicators are a different way of saying the five outputs and their indicators,” the indicators were revised just before the end of the Project. However, because many of the new indicators were undoubtedly set at achievable levels judging from the state of progress at that time, they were not well recognized among Project officials, and no performance data concerning the indicators could be gathered by the end of the Project, they were deemed to be inappropriate as indicators for the ex-post evaluation and have not been adopted here.

- To build the institutional base of UPD, which will be the core agency of disaster prevention in practice: UPD's role was clarified and its own budget was secured, while the certification system for persons completing the training was not realized. (Mostly achieved)
- To prepare the basic technical tools for disaster prevention: The planned technical tools (manuals, database, etc.) were all prepared. (Achieved)
- Through strengthening the technical capacity of individual UPD members, to prepare the foundation for disseminating road disaster prevention and bridge maintenance and management technologies within UPD: The UPD members acquired sufficient capability to implement training for engineers in regional offices. (Achieved)

When the ABC engineers who were involved in the Project were asked about the degree of achievement of the Project goal (to improve the road disaster prevention and bridge maintenance and management capacity of ABC) by questionnaire, 39% responded that the Project had been successful and 33% responded that it had been rather successful<sup>11</sup>.

To sum up, it is deemed that the Project largely achieved its purpose.

### 3.2.2 Impact

#### 3.2.2.1 Achievement of Overall Goal

The overall goal of the Project was to “enable constant travel on national roads” and the indicator for that was the “reduction of road closures on arterial roads in terms of number and duration.” In order to improve the pass-ability of national roads, it is necessary to speed up emergency responses when disasters occur, and also to advance disaster prevention through implementing road projects geared to preventing disasters before they happen or reducing the scale of disasters when they do occur. The Project primarily consisted of technical cooperation geared to the promotion of disaster prevention, but it also included contents that could make a contribution to improving emergency responses, for example, the clarification of disaster risk sections and so on. Investment in road works is also needed for achieving disaster prevention, while, this is an external condition beyond the scope of the Project assistance. Moreover, in order to fully achieve the overall goal, disaster prevention investment needs to be conducted over the entire national road network, and such efforts will need to be implemented over an extended period. Therefore, at the time of the ex-post evaluation, the degree of achievement of the overall goal was judged from the viewpoints of whether the pass-ability of national roads was improved, and whether the contribution of the Project could be confirmed.

As is shown in Table 2, the number of days of road closure on national roads has decreased following the end of the Project. Therefore, since the indicator of the overall goal has been realized, it is

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<sup>11</sup> As part of the ex-post evaluation, a questionnaire survey was implemented targeting 50 engineers in the four ABC regional offices in La Paz, Cochabamba, Santa Cruz and Tarija.

judged that the overall goal has been achieved.

According to the questionnaire survey of ABC engineers, 84% think that the number of days of road closure decreased following the Project; moreover, 44% believe that the Project was successful in achieving the overall goal (to enable constant travel on national roads), while 44% believe that it was successful to a degree.

Table 2 Degree of Achievement of the Overall Goal

Overall Goal	To enable constant travel on national roads.
Indicator	Performance
Reduction of road closures on arterial roads in terms of number and duration	(Achieved) The total number of days of closure on the national road network (total number of days of closure of national roads in a year): 2011: 1,062 days 2012: 589 days 2013: 636 days

Source: Prepared by the evaluator based on materials provided by ABC.

Note: No reliable data was available concerning the number of national road closure locations.

It can be thus seen that the pass-ability of national roads has been improved, with faster responses to emergencies and promotion of disaster prevention being the factors behind that. These factors are described in detail in the following paragraphs.

#### Faster responses to emergencies

According to hearing survey of ABC engineers, transport operators, and regional governments, citizens living along national roads and so on<sup>12</sup>, ABC's response to emergencies has recently become much faster than before, and this is thought to be greatly contributing to the reduction in the number of days lost to road closures. According to the hearing with ABC, the following reasons are given for the improved speed of responses.

- a) Because the disaster risk sections on national roads were clarified, the necessity of budget for emergency responses was clarified and it became easier to secure funds<sup>13</sup>.
- b) Previously it was necessary to apply for the budget to respond to emergencies to ABC headquarters every time an emergency happened, however, it is now possible to immediately mobilize the budgets that have been allocated to the regional offices.
- c) Because the budget for road maintenance has been increased in size, ABC is now able to sign contracts with construction firms that have larger heavy equipment. (ABC binds three-year contracts with construction companies for conducting road maintenance and management, and these firms are the first to respond when emergencies occur).

<sup>12</sup> See the box on <National road closures caused by disasters, and their impacts>.

<sup>13</sup> Before, a uniform budget amount was allocated based on the length of road.

- d) When disasters occur, because drivers and the micro-enterprises that conduct road maintenance provide information by mobile telephones, it has become easier to obtain information on disasters<sup>14</sup>. Mobile phones have also made it easier for ABC employees to communicate with each other.

#### Promotion of disaster prevention

Except for some road sections, the awareness that the number of disasters had declined could not be recognized<sup>15</sup>, however, according to ABC, the frequency of disaster occurrence is thought to have declined for the following reasons.

- e) On important roads, landslide observation instruments (slope gauges) modeled on the Project have been installed and monitor for signs of disasters, thereby enabling measures to be taken in advance.
- f) ABC's investment in road maintenance increased fivefold over the seven years between 2008 and 2013, and some of this has been investment in disaster prevention. Owing to the technology transfer in the Project, the available scope of disaster prevention methods and disaster prevention works has become wider and it has also become possible to conduct more pertinent survey and design<sup>16</sup>.

Concerning the items a), e), and f) above, it is thought that the Project has made a technical contribution as described below.

- a) In the Project, in order to identify, diagnose and verify the risk locations within the arterial road network, survey formats and a database for recording road disasters and diagnosing hazard spots (slopes) were created. Through collecting information in this database, important disaster risk sections for preparing emergency responses were made clear.
- e) On important roads, ABC has installed multiple landslide observation instruments (slope gauges) modeled on the slope gauges installed in the Project, thereby enabling measures to be taken in advance.
- f) In the Project, indoor training on disaster prevention, field training, and practical training via

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<sup>14</sup> Micro-enterprises have no more than 10 roadside residents as employees and they conduct routine maintenance activities such as grass cutting, drainage ditch cleaning and so on. These micro-enterprises also monitor the daily measurements by the simple rain gauges installed in the Project.

<sup>15</sup> According to the ABC Cochabamba office, the El Sijar section, which is the most challenging section on the vital National Route 4, previously experienced prolonged closure due to major disasters every two years or so, however, there was no such incident over the four years between 2011 and 2014. According to the office manager, this is because the risk sections were clarified and pertinent disaster prevention works were implemented.

<sup>16</sup> Road maintenance not only includes road maintenance and management and repair works but also various disaster prevention works, however, data couldn't be obtained on the separate investment amounts in each activity. Concerning methods of disaster prevention, for example, locations that had been prone to frequent damage despite repeated works were improved through making major investments into changing bridges or road alignment and so on.

pilot works were implemented for UPD; and the counterparts participated in the creation of manuals and acted as lecturers in the training of regional engineers. In doing so, they acquired a high level of technical capacity for surveying, planning, designing and implementing disaster prevention activities. In the disaster prevention activities of ABC, the headquarters prepares and implements a lot of large-scale and technically difficult works, and in the course of such work the Project counterparts who now belong to the engineering headquarters and road maintenance department offer technical instruction. Moreover, in the disaster prevention activities that are independently conducted by regional offices, the Project counterparts sometimes offer technical guidance in response to the requests by regional offices.

Furthermore, a number of road maintenance works were planned and designed during the Project with the help of the UPD and the team of Japanese experts, and it is thought that these also contributed to the reduction in road closures. Moreover, the pilot works (on two locations for road, two bridges) that were implemented under ABC as part of the Project activities, although small in scale, directly contributed to reducing disaster damage on the roads and bridges in question<sup>17</sup>.

It is thus confirmed that the overall goal of improving the pass-ability of national roads was achieved and that the Project made a contribution towards this. However, landslides and other disasters still occur and impart a major impact on society and economy (see the boxed section). The Project aimed to achieve the overall goal mainly through promoting road disaster prevention works and conducting proper maintenance and management of bridges, however, in order for the impact of these efforts to be fully realized, ABC will need to make ongoing investment and more time will be required.

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<sup>17</sup> According to the hearings of roadside residents, there were voices that said that the pilot works had contributed to preventing disasters.



<National road closures caused by disasters, and their impacts>

In order to gather information on the trends in recent five years on road closures and other issues of national road utilization, as well as their socio-economic impacts, a questionnaire survey targeting bus and transportation companies (40 companies) across the country and bus and truck drivers (64) in four locations; hearings at four local governments along arterial roads; and group interviews with residents in six locations were conducted.

Main results of the questionnaire survey of transportation companies and drivers

- Although closures of arterial national roads have declined since the Project, landslides are still a major problem, and poor road conditions and accidents on certain sections are still regarded as major issues.
- Roughly 70% of the bus and transportation companies and half of the drivers responded that closures of arterial national roads had decreased.
- Half of the bus companies and approximately 85% of the transportation companies point to landslides as one of the main current problems. Landslides, together with poor road surface conditions (83% of bus companies and 65% of transportation companies) are viewed as one of the main problems on arterial roads. In contrast, 69% of drivers pointed to poor road surface conditions, and 55% cited landslides as problems.
- In view of the high frequency of accidents caused by overtaking, etc. on sections with heavy traffic volume (Cochabamba City - Santa Cruz City), there are numerous calls for construction of additional traffic lanes (increase from two to four). Meanwhile, road closures caused by landslides on such sections have been greatly reduced.

Main results of hearings with local governments and residents

- Road closures still occur in various places, however, it was reported that the time taken for roads to re-open has been greatly shortened. Some voices said that the reduced closure times have been achieved thanks to better responses to emergencies by ABC and the road maintenance inspections by micro-enterprises that started around 2007.
- Previously, long-term road closures meant that farm products were ruined because they could not be shipped. Moreover, whenever roads were closed, prices in villages would rise and place a burden on residents; however, it was reported that these conditions have also been largely improved.
- However, the old road between Cochabamba City - Santa Cruz City still sometimes becomes impassable during the rainy season.
- In addition, numerous voices called for the improvement of road signs on curves and at landslide risk points.

### 3.2.2.2 Other Impacts

#### (1) Environmental and social impacts

Through stabilizing slopes, the pilot works in the Project have had a positive impact on the natural environment, for example, conservation of vegetation and soil. According to ABC and local residents, there have been no negative environmental impacts in particular. Moreover, the pilot projects did not entail any relocation of residents or expropriation of land.

#### (2) Other socioeconomic impacts

It is thought that the decline in road closures has contributed to reduction of losses and prices rises in isolated areas caused by delayed shipments of farm products (see the boxed section).

Implementation of the Project largely achieved the Project purpose of improving the road disaster prevention and bridge maintenance and management capacity of ABC. Moreover, since the Project's contribution towards realizing the overall goal of reducing days of closure on national roads was also confirmed, the effectiveness and impact of the Project are high.



Site of slope failure on National Road 4  
Due to the extensive slope failure, the road width is much larger than usual.



Repair of Popo Bridge on National Road 7  
Cracks in the main girders and floor plates were repaired, giving the bridge the strength to withstand the weight of large vehicles. (Pilot project)

## 3.3 Efficiency (Rating: ①)

### 3.3.1 Inputs

Table 3 shows the planned and actual inputs (based on terminal evaluation) to the Project at the time of ex-ante evaluation.

Table 3 Planned and Actual Inputs

<b>Input Element</b>	<b>Plan</b> (based on ex-ante evaluation)	<b>Actual</b> (based on terminal evaluation)
(1) Experts	Planned number of experts: unknown Planned man-months: unknown (Dispatches for Project management / organizational strengthening, road disaster prevention management, geology, road design, database / information and telecommunications, bridge management system, bridge inspection/ diagnosis / repair, bridge design, and other necessary fields)	13 persons 112.8 man-months (Project management / organizational strengthening, Deputy Project management / road disaster prevention management, geology 2 experts, road design, road disaster prevention database / information and telecommunications, bridge management system, bridge design 2 experts, work coordination / GIS 2 experts, work coordination)
(2) Trainees received	Planned number of trainees: unknown (road disaster prevention and bridge maintenance and management)	12 trainees (road disaster prevention and bridge maintenance and management)
(3) Equipment	Planned amount: unknown Investigation equipment, monitoring equipment, bridge inspection equipment, etc.	11.9 million yen Investigation equipment, monitoring equipment, bridge inspection equipment, software, vehicles, PCs, etc.
(4) External works strengthening cost	unknown	6.1 million yen
Grant from the Japanese side	Total approximately 300 million yen	Total 519 million yen
Inputs by the Government of Bolivia	Assignment of counterparts Project field activity expenses Office for experts	Assignment of 8 counterparts (including 5 UPD members) Project field activity expenses US\$1,453,000 (as of October 2011) Office for experts

Source: Prepared by the evaluator based on materials provided by JICA.

### 3.3.1.1 Elements of Inputs

The quantity of input of Japanese experts was increased due to the addition of Output 1 and extension of the Project period. Experts in numerous fields were dispatched over a short period in order to conduct wide-ranging cooperation concerning roads and bridges, however, according to the Experts and the counterparts, it seems that the quantity of inputs and Project duration were not enough in order to carefully implement the capacity building activities.

It took time at the start of the Project to form consensus on the approach to activities between the team of Japanese experts, the counterparts, JICA and ABC, and there were repeated miss-communications

regarding the coordination of activities. Accordingly, the team of Japanese experts and counterparts were unable to build an adequate trust relationship and this impeded the smooth implementation of activities. As the background to this, at the start of the Project, it seems there was poor understanding among the Bolivian side regarding the JICA's approach of transferring technology via joint work; the ABC side believed that the experts should be like consultants and take responsibility for all the output; and there were no core experts on long-term dispatches who could coordinate the technical and operational affairs.

The organizational reform and personnel changes in ABC headquarters that were conducted in tandem with the Project exerted a major impact on the Project activities<sup>18</sup>. At the start of the Project, ample inputs were made with the assignment of five full-time employees to UPD. However, the organizational reforms brought about serious personnel shortages in ABC headquarters, meaning that the counterparts were gradually assigned to unrelated work away from the UPD, and this hindered the Project activities.

#### 3.3.1.2 Project Cost

The Project cost was originally planned as approximately 300 million yen, but it eventually increased to 520 million yen or 173% of the planned total. The main reasons for this were the addition of Output 1, the additional input of experts and the addition of observation instruments and aerial laser when the Project was extended.

#### 3.3.1.3 Period of Cooperation

The Project period was originally planned as 36 months, however, it was eventually extended to 42 months (117% of the original period). In addition to the various factors described in the section on Input Elements, delays in the pilot projects (four locations) were the direct cause for the delay of the Project.

The pilot projects were implemented under the budget of ABC. ABC conducted the budget application, survey design, procurement and execution management. However, the organizational reform slowed the ABC side down in each stage of work and procedures. Moreover, in some of the works, delays were also caused by disaster damage occurring in nearby areas, renewed procurement due to non-performance of contracts by operators, renewed tender caused by the absence of bidders, time lags made necessary by the need to synchronize works periods with the dry season and so on.

Therefore, because the Project cost and Project period both exceeded the plan. Therefore, efficiency of the Project is low.

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<sup>18</sup> Around the start of the Project, ABC embarked on organizational reform aimed at improving efficiency through decentralizing work. This intended to establish around three regional headquarters and evenly spread personnel and resources among these, and it initially entailed redeploying numerous engineers from the central headquarters to the regional offices. However, it took ABC a long time to decide the respective locations of the regional headquarters and the issue was still not resolved when the Project was finished in September 2012, meaning that the organizational reform couldn't be fully effected. As a result, the number of engineers in ABC headquarters was greatly reduced, and the remaining personnel including the counterparts became inundated with work. Moreover, the repeated organizational and personnel changes that took place between headquarters and the regional offices impeded the efficiency of clerical processing in ABC.

### **3.4 Sustainability (Rating: ②)**

In the Project, with the objective of strengthening the road disaster prevention and bridge maintenance and management capacity of ABC, the organizational basis of UPD and technology and information basis for road disaster prevention and bridge maintenance and management were established and the technical capacity of ABC employees was improved. Here, sustainability of the Project is analyzed while confirming conditions regarding the maintenance and utilization of such results.

#### **3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects**

According to ABC, its policy of emphasizing road disaster prevention has remained the same since the end of the Project. Bolivia enacted the Risk Management Law in November 2014, marking the start of a national effort to establish systems and build capacity with emphasis on disaster prevention. It is anticipated that ABC's disaster prevention efforts will be further strengthened in accordance with this law. Accordingly, the sustainability of the Project's policies and systems is deemed to be high.

#### **3.4.2 Organizational Aspects of the Implementing Agency for the Sustainability of Project Effects**

Following completion of the Project, the UPD was disbanded in 2012 and the counterparts were redeployed to the engineering headquarters and the road maintenance department of ABC. According to ABC, disaster prevention should be absorbed into the engineering headquarters and the road maintenance department because it is a part of road maintenance, however, this thinking is underpinned by a critical shortage of personnel in headquarters<sup>19</sup>. As a result, due to the disbanding of ABC, the amount of time that counterparts can spend on disaster prevention-related work has been reduced and the system for sustaining the Project effects has been weakened. On the other hand, according to the counterparts, it has become easier in some respects to work on disaster prevention through treating it as part of road maintenance as opposed to a separate activity, and it is necessary to monitor conditions a little more to see how the dissolution of the UPD affects the sustainability of the Project effects. In any case, disbanding of the UPD has meant that the organizational setup for disaster prevention that was constructed in the Project was not maintained.

To sum up, there are deemed to remain some uncertainty regarding the organizational setup for sustaining the effects that were manifested in the Project.

#### **3.4.3 Technical Aspects of the Implementing Agency for the Sustainability of Project Effects**

This section sorts the conditions following Project completion and examines sustainability concerning utilization of the various databases that were improved and expanded in the Project, utilization of manuals and guides, retention of engineers, continuation of technical training, and operation of supplied equipment.

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<sup>19</sup> As was explained in the section on Efficiency, in the second half of the Project, counterparts who were supposed to be full-time UPD personnel started to be assigned to work other than disaster prevention in order to make up for the critical manpower shortage in ABC headquarters.

(1) Utilization of databases

The disaster ledger and databases of risk spots and slope diagnoses are successively updated and have been utilized for preparing disaster prevention master plan in ABC headquarters and road maintenance plans in regional offices.

The observation data from simple rain gauges is recorded everyday by the micro-enterprises that implement road maintenance, and it is then compiled and sent to the regional offices and provided to ABC headquarters and the Bolivia National Meteorological & Hydrological Service once per month. The rain gauge observation network that was installed in the Project was mainly intended to analyze the relationship with disaster occurrence. However, no such analysis has been carried out. Moreover, because rainfall data is only reported once per month, it is not utilized for determining warnings on heavy rainfall or road closures and so on.

Data on pass-ability (road closures, warnings, etc. due to natural phenomena and other reasons) is constantly updated via the website by engineers (supervisors) assigned to each road section and it is provided to the general public as road traffic information<sup>20</sup>. Moreover, ABC periodically holds press conferences to convey road information and advisories for the newspapers, TV, etc.

The inventory of bridge works completion drawings is utilized for examining the maintenance, management and repair of bridges. The Bridge Maintenance System that was independently introduced by ABC is used as a bridge database according to the recommendation made in the Project.

(2) Utilization of manuals and guides

Based on the questionnaire survey of ABC engineers, roughly half of those who received training in the Project responded that they possess manuals and guides, while around 40% said they used them. In contrast, ownership and utilization rates are low among engineers who didn't receive training (Table 4)<sup>21</sup>. Incidentally, hard copies of manuals and guides were not distributed to engineers in regional offices. In this way, distribution of manuals and guides has not been adequately conducted throughout the entire organization of ABC.

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<sup>20</sup> According to the questionnaire survey of bus and transportation companies and drivers, not many people use the website to directly obtain information.

<sup>21</sup> Bridge inspection guides were initially prepared in consideration of the bridge management system that was planned for introduction, however, because ABC introduced a different system, the information acquired from inspections has not been utilized to the fullest extent.

Table 4 Ownership and Frequency of Use of Manuals and Guides

	Road disaster prevention		Bridge maintenance and management	
	Trainees	Non-trainees	Trainees	Non-trainees
Owned	49%	13%	43%	15%
Not owned	51%	87%	57%	85%
Frequently used	21%	6%	17%	5%
Sometimes used	27%	10%	25%	8%
Not used	51%	84%	58%	87%

Source: Questionnaire survey of ABC engineers

(3) Maintenance of technical capacity

It is thought that the five counterparts who belonged to the UPD acquired sufficient technical capacity to act as training lecturers (see the section on Effectiveness), however, since two of these retired after 2014, only three members were still working for ABC at the time of the ex-post evaluation.

Supervisors and chief engineers who are responsible for specific road sections are assigned to the ABC regional offices. When supervisors discover abnormalities in their daily road inspections, they report to chief engineers and update road information on the website. However, since they work on one-year contracts, their turnover rate is very high<sup>22</sup>. According to the questionnaire survey, roughly 60% of the engineers in employment at the time of the ex-post evaluation had not received training by the Project, and it is thought that they were employed following completion of the Project. Moreover, In the Project, whereas the counterparts in headquarters received On-the-Job-Training and other technical training, the engineers in regional offices only received a few days of seminars.

Opportunities for ABC employees to receive training are limited; the only training available is that conducted in relation to various investment projects. In particular, supervisors on short-term contracts have hardly any opportunities for technical training. The only confirmed disaster prevention training conducted following completion of the Project has been the training on operation and management of slope gauges newly installed by ABC. Only the three counterparts who have stayed with ABC are able to serve as lecturers, however, they are so busy that it isn't easy to provide training opportunities.

In this way, training for engineers is not conducted fully over the entire organization of ABC and the dissemination of technology to the entire organization of ABC had not progressed.

(4) Operation of supplied equipment

The road maintenance department owns and uses survey equipment, road disaster prevention equipment, bridge inspection equipment, vehicles, software and so on. However, according to ABC, concerning the rainfall observation network that was installed in the Project, engineers in regional offices are too busy to conduct the proper operation, maintenance and management of

<sup>22</sup> From June 2015 onwards, it is scheduled to shift to three-year contracts.

self-recording rain gauges, so these are not fully functioning.

To sum up, there are issues regarding the operation, maintenance and management of self-recording rain gauges, utilization of rainfall observation data, and dissemination of technology throughout the entire organization of ABC, and it is deemed that there are some problems regarding the technology that is needed for sustaining the effects manifested by the Project.

#### 3.4.4 Financial Aspects of the Implementing Agency for the Sustainability of Project Effects

The Project was implemented with the aim of enabling constant travel on national roads through utilizing the technical capacity that ABC acquired via the Project. However, in order to realize this, it is necessary for ongoing investment to be made in disaster prevention activities. Moreover, the repeated implementation of various disaster prevention works will lead to the maintenance and furtherance of ABC's road disaster prevention and bridge maintenance and management that was improved in the Project.

In the terminal evaluation, it was found that ABC was allocating more budget to disaster prevention works than to disaster recovery following the start of the Project. In reality, ABC itself is securing more budget because it realizes the importance of the Project pilot works.

Looking at ABC's road maintenance budget before and after the Project, the budget increased fivefold over seven years from 160 million Boliviano in 2008 to 830 million Boliviano in 2013. Road maintenance works include road maintenance and management, improvements other than increase in the number of lanes, disaster works such as slope protection and stabilization, rerouting around landslide zones and debris flow zones, bridge repair works and so on, and it is surmised that the amount of investment in disaster prevention has increased greatly in recent years<sup>23</sup>.

Accordingly, there are deemed to be no problems in particular regarding the finances for sustaining the effects that were manifested in the Project.

Summing up, there are some minor issues in terms of the institutional and technical aspects. However, as there are no particular problems in terms of finance, the sustainability of the effects manifested in the Project is fair.

## **4. Conclusion, Lessons Learned, and Recommendations**

### **4.1 Conclusion**

The Project was implemented with the objective of improving the road disaster prevention and bridge maintenance and management capacity of ABC through strengthening the organizational basis of the UPD that has been established in the ABC and improving the technical and information basis related to roads and bridges, and thereby reducing the closure of national roads caused by natural phenomena. Being

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<sup>23</sup> No detailed information indicating the breakdown of spending on disaster prevention within the road maintenance budget was available.



a landlocked nation with high demand for road transportation and harsh natural conditions, Bolivia has a high need for road disaster prevention, and the Project had a high degree of relevance to the development policy and development needs both at the time of ex-ante evaluation and the time of completion. Since it was also consistent with Japan's aid policy at the time of ex-ante evaluation, it had a high degree of relevance. The project purpose of improving the road disaster prevention and bridge maintenance and management capacity of ABC has largely been achieved; moreover, because the Project's contribution towards the overall goal of reducing the number of days of closure on national roads has been confirmed and effects have been observed as planned, the Project has had high effectiveness and impact. Due to the effects of the organizational reform which were being advanced by ABC and delays in the pilot projects and so on, the Project period was extended by six months, and the Project cost exceeded the planned amount due to additional dispatch of experts and supply of equipment. Accordingly, efficiency of the Project was low. The UPD was disbanded following completion of the Project. Moreover, because there have been issues regarding the utilization of rainfall observation data and technical dissemination to all of ABC, the Project's sustainability is moderate. Summing up, the Project is evaluated to be partially satisfactory.

## **4.2 Recommendations**

### **4.2.1 Recommendations to ABC**

- Capacity building of the ABC engineers in regional offices: In order for ABC to pertinently advance road and bridge disaster prevention, it is important to strengthen the capacity of regional engineers for whose turnover rates are high. Therefore, it is desirable to make use of the Project outputs to continue implementing disaster prevention training for new and existing engineers. Considering the busy schedules of the three counterparts who received training in the Project, it is necessary for ABC to compile an interim disaster prevention training plan that includes the training of trainers and secure the necessary budget and human resources for putting it into effect.
- Utilization of rainfall observation data: The rainfall observation data that is collected by micro-enterprises is delivered to the regional offices once per month, however, this does not allow it to be used for issuing early warnings or preventing damage at times of heavy rainfall. At least on the most important road sections, rainfall observation data should be utilized through coordinating and cooperating with related agencies to immediately go on alert when rainfall exceeds standard levels or conduct road closures in order to avoid risk when the need arises. At the same time, it is important to clarify the relationship between rainfall and disaster occurrence through conducting statistical analysis. It is also necessary to reconstruct the setup for conducting the operation, maintenance and management of self-recording rain gauges.

### **4.2.2 Recommendations to JICA**

- In the Project for Road Disaster Prevention Measures on National Route 7, which is planned as a grant aid undertaking to start in 2015, a soft component targeting the ABC engineers is planned. In

this, it will be desirable to conduct technology transfer by making full use of the manuals and guides and other outputs of this Project.

- At the time of the ex-post evaluation, based on the history that the bridge maintenance system autonomously developed by ABC could not be fully utilized, ABC was seeking Japanese cooperation for introduction of the Bridge Management System that could not be implemented in the Project. Through introducing such a system, with a view to enabling ABC to further enhance bridge maintenance and management while utilizing the bridge inspection manuals prepared in the Project, it is desirable for JICA to consider ABC's request and examine possible cooperation regarding the introduction of the Bridge Management System and the training of ABC employees for its operation.

### **4.3 Lessons Learned**

#### Preliminary Explanations and Consensus Building regarding the Approach to Advancing the Technical Cooperation Project

In the Project, the activities did not start smoothly because there were differences of opinion between the ABC employees and the team of Japanese experts concerning how to advance the technical cooperation. JICA technical cooperation projects are intended to transfer technology based on joint work between the experts and counterparts, however, in this case the ABC side seemed to think that the team of Japanese experts are consultants contracted by JICA and all they need was that the consultants would produce the outputs. The team of Japanese experts and JICA explained the situation on numerous occasions, however, the initial misunderstanding was hard to rectify and made it difficult to secure ABC's cooperation when conducting joint activities for a long time after the Project started. Such misunderstanding could have been prevented if sufficient explanations and preliminary consensus building had been conducted in the preparatory stage. Therefore, before dispatching the team of Japanese experts, it is important for JICA to conduct adequate explanations and consensus building concerning the approach to advancing the technical cooperation project. Also, after the start of activities, it is important for the team of Japanese experts and counterparts to jointly advance work while maintaining communications on a daily basis.

#### Long-term Dispatch of Core Experts

In the Project, one of the factors that impeded communication between the team of Japanese experts and the counterparts was the fact that the experts were responsible for numerous fields of guidance and they were only dispatched for short periods. In technical cooperation projects such as this, which require numerous fields of expertise, it is important to smoothly conduct routine technical and operational liaison with counterparts based on long-term dispatches of experts who are knowledgeable in a wide range of technical fields and have good communication and coordination ability. In fields such as disaster prevention where there is not much history of international cooperation and it is hard to find experienced personnel on the Japanese side, it is necessary to avoid over-reaching through taking steps such as limiting the scope of cooperation and allowing plenty of time for the Project duration.

### Technology Dissemination Activities

The intended flow of technology transfer in the Project was from the team of Japanese experts to the UPD engineers, and then from the UPD to the other engineers of ABC. However, due to the frequent turnover of engineers and fact that hard copies of manuals and guides were not widely distributed to them, the extent of technology dissemination to other engineers was not sufficient. Therefore, in order to make the technology dissemination following the end of the Project more certain, it is considered important to print and distribute copies of manuals and guides within the Project, and after the Project to jointly examine with counterparts specific plans for disseminating technology within organizations. Also, in order to complement this flow, it is important for projects to take initiative in conducting more frequent technical training, seminars, etc. for engineers before the end of the projects.

Central America and the Caribbean

Ex-Post Evaluation of Technical Cooperation Project

“The Project for Strengthening Nursing Education and In-service Training in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic”

External Evaluator: Akiko Hirano, Global Group 21 Japan, Inc.

## **0. Summary**

The project was implemented in the area of basic nursing education and continuous training in Central America and the Dominican Republic. It aimed to improve continuous nursing education in midwifery for El Salvador as bilateral cooperation, and to improve the capacity of nursing teachers and clinical instructors in Guatemala, Honduras, Nicaragua and the Dominican Republic as regional cooperation. The purpose of this project was consistent with the health policies and development needs of those countries as well as Japan’s ODA policy, thus its relevance is high. In terms of the regional cooperation, while the standardization of nursing education and the establishment of training, and monitoring and evaluation system had been in progress, the sustainability of the training system had been observed half-way and the achievement level of the project purpose by the indicator measurement could have not been confirmed. Therefore, the project had achieved its purpose at a moderate level at the time of the project completion. Subsequently, the project achievement level was found to be high at the time of ex-post evaluation with the progress of standardization of nursing education and establishment of fairly good self-sustainable training system in a few countries/local areas, and the positive impact on the improvement of the regional nursing network and nursing services was also observed. For the bilateral cooperation, the project largely achieved its purpose at the time of the project completion, and the positive impact on the strengthening of the continuous education training system in Santa Ana Department, the increase of institutional delivery and the improvement of nursing services in the western region including Sonsonate and Ahuachapan Departments was observed. Thus, the effectiveness and impact of the project are high. Although the project cost was within the planned, the project period was extended by one year. Therefore, the efficiency of the project is fair. In terms of the sustainability, while the situation varied among the countries, the models and manuals developed through the project were officially approved and the activities were integrated into the national plans in some countries. Therefore, the sustainability of the project is high.

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

## 1. Project Description



Project Locations



Health promotion session to mothers by a nurse

### 1.1 Background

It has become one of the most important issues in Central America and the Caribbean to ensure the quality improvement of basic education of nurses responsible for the health care services, and to carry out continuing in-service education. As no standard curriculum had been established for basic nursing education, some of the educational institutions in these countries had no mechanism to ensure the quality of nursing education. In addition, gaps between basic education and on-site training reported.

Under these circumstances, the Japan International Cooperation Agency (JICA) implemented the technical cooperation project entitled “Project for Strengthening Nursing Education” for El Salvador from 1997–2002, and the third-country training program on Nursing Education in El Salvador from 2002–2006, which was provided to the neighboring countries. Subsequently, Japan received the request for cooperation in the area of nursing education from five countries in the region, namely El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic. To respond to this request efficiently and effectively, JICA decided to implement a “Project for Strengthening Nursing Education and In-service Training in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic” (hereafter referred to as “project”) as regional cooperation in the area of nursing education. It was headquartered in El Salvador since August 2007 for a term of three years.

### 1.2 Project Outline

This project was implemented with two components to improve the quality of nursing education: (i) regional cooperation in the area of basic nursing education targeting the five countries; and (ii) bilateral cooperation in the area of continuous nursing education targeting El Salvador. For the regional cooperation, the El Salvadorian experts who had been trained by the previous JICA cooperation conducted capacity

development of other countries' personnel together with the Japanese experts (it is called "triangular cooperation<sup>1</sup>"). For the bilateral cooperation, while the improvement of basic nursing education had been achieved in El Salvador through the above-mentioned JICA cooperation, the system to maintain and improve the skills and knowledge of nurses by the continuous education had yet to be established. In addition, the maternal mortality level was still high. Therefore, the project was conducted to improve the quality of human resource in nursing services in the area of reproductive health, particularly with a focus on midwifery.

Overall Goal		<ul style="list-style-type: none"> <li>• Regional Cooperation: Quality of nursing education in Central American and the Caribbean region is improved.</li> <li>• Bilateral Cooperation: Nursing service in the area of midwifery is improved in Santa Ana, Sonsonate, and Ahuachapan Departments<sup>2</sup>.</li> </ul>
Project Purpose		<ul style="list-style-type: none"> <li>• Regional Cooperation: Capacity of nursing teachers and clinical instructors in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic is strengthened.</li> <li>• Bilateral Cooperation: Quality of in-service training for nurses in the area of midwifery is improved in Santa Ana Department.</li> </ul>
Output(s)	Regional Cooperation	<ol style="list-style-type: none"> <li>1. Education for nursing teachers and clinical instructors is improved.</li> <li>2. Activities for standardizing nursing education are planned and implemented.</li> <li>3. Cooperation between basic education and on-site training is strengthened.</li> <li>4. Activities for sustainable development of nursing education are promoted.</li> </ol>
	Bilateral Cooperation	<ol style="list-style-type: none"> <li>1. The process of in-service training for nurses in the area of midwifery is established and implemented in Santa Ana.</li> <li>2. The method of monitoring and evaluation of in-service training for nurses in the area of midwifery is established and implemented in Santa Ana Department.</li> <li>3. Management and administration system of in-service training for nurses in the area of midwifery is improved in Santa Ana Department.</li> <li>4. Activities for sustainable development of nursing education are promoted.</li> </ol>

<sup>1</sup> The triangular cooperation is generally defined as the cooperation between developing countries. Triangular cooperation conducted by JICA is mainly third country training and dispatch of third country experts. (source: ODA evaluation on Triangular Cooperation in 2012)

<sup>2</sup> Western region is comprised of Santa Ana, Sonsonate and Ahuachapan departments.

Total cost (Japanese Side)	267 million yen
Period of Cooperation	August, 2007–August, 2010, Regional cooperation was extended from September 2010 to August 2011
Implementing Agency	Ministries of Health in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic
Other Relevant Agencies / Organizations	Nursing associations and nursing schools in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic
Supporting Agency/Organization in Japan	None
Related Projects	<ul style="list-style-type: none"> <li>• Technical cooperation “Project for Strengthening Nursing Education in El Salvador 1997–2002”</li> <li>• Third-country training program “Nursing Education 2002–2006”</li> </ul>

### 1.3 Outline of the Terminal Evaluation

#### 1.3.1 Achievement Status of the Project Purpose at the time of the Terminal Evaluation

##### <Regional Cooperation>

The cascade training system was established through committees in each country and the capacity of nursing teachers and clinical instructors in the areas of nursing process<sup>3</sup> and collaboration between basic education and on-site training had been improved. It was concluded that when the training management cycle was completed and the evaluation of basic nursing education by students was conducted, the project purpose would be achieved.

##### <Bilateral Cooperation>

The trained nurses utilized the knowledge and skills obtained through the training in checking up at the clinic site and their quality of nursing services was highly evaluated. The training program and monitoring criteria were approved by the Ministry of Health as a model and the system to operate training based on the training management cycle was established. Thus, it was concluded that the project purpose was achieved.

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<sup>3</sup> Nursing process is a series of organized thought and steps designed for nurses to plan and provide holistic and patient-focused care, considering to identify the intervention for the best possible care for the each patient requiring nursing care.

### **1.3.2 Achievement Status of Overall Goal at the time of the Terminal Evaluation**

#### <Regional Cooperation>

The network among the five countries was established and the achievement of each country was shared among them for the improvement of nursing education. The project influenced beyond the five countries through opportunities such as meetings of Health Ministers at the Council of Ministers of Health of Central America (hereafter referred to as COMISCA)<sup>4</sup> and nursing conferences. It was concluded that the quality of nursing education in Central America and the Caribbean was expected to improve by presenting the outputs of this project at academic conferences and so on.

#### <Bilateral Cooperation>

The improvement of the nursing services in the area of midwifery was observed in Santa Ana Department. It was also reported by the pregnant women that the care received from nurses was upgraded. Thus, it was concluded that if the facilitators in Sonsonate and Ahuachapan Departments trained by the project can securely conduct the training, it is possible that the nursing service in midwifery will be improved in the western region of El Salvador.

### **1.3.3 Recommendations at the time of the Terminal Evaluation**

#### <Regional Cooperation>

The recommendations included the formulation of activity plans on training and monitoring and evaluation in each country, the implementation of training through regional committees, the support for the preparation of training manuals and guidelines and the standardization of models, the integration of each element in health policies, the continuation of activities towards the standardization of curricula, the mobilization of internal and external resources for self-sustaining activities in each country, the support for information exchange among each country through continuous video conferences, the diffusion of effects on nursing teachers and instructors in the neighboring countries and the consideration of utilizing regional entities and south-south cooperation, and the expansion of the nursing network to non-nursing areas in the region.

#### <Bilateral Cooperation>

The recommendations included the formation and implementation of plans by the Nursing Department of the Ministry of Health for continuous education training and monitoring and evaluation in the area of midwifery in the western region with prospects

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<sup>4</sup> COMISCA (Council of Ministers of Health of Central America) is the political arm of the System for Central American Integration (SICA), comprised of the health ministers from 8 member countries.



of nationwide implementation, the resource mobilization for continuous implementation of training and monitoring and evaluation in the western region, the preparation of the operational and management manual for continuous education by the Continuous Nursing Education Steering Committee in the western region, and the capacity development of instructors in reproductive health through regional cooperation and the reinforcement of their role to promote information sharing.

## **2. Outline of the Evaluation Study**

### **2.1 External Evaluator**

Akiko Hirano, Global Group 21 Japan, Inc.<sup>5</sup>

### **2.2 Duration of Evaluation Study**

Duration of the Study: September, 2014 – July, 2015

Duration of the Field Study: October 12, 2014 – November 11, 2014 and February 22  
2015 – March 6, 2015

## **3. Results of the Evaluation (Overall Rating: A<sup>6</sup>)**

### **3.1 Relevance (Rating:③<sup>7</sup>)**

#### **3.1.1 Relevance to the Development Plan of El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic**

The El Salvador National Development Plan “*Pais Seguro* 2004-2009” at the time of the project planning emphasized to improve health services, and the “National Health Program 2004-2009” aimed to ensure that all women receive reproductive health care from pregnancy, delivery, to postnatal care by high quality health personnel. The national development plans and health policies of Guatemala, Honduras, Nicaragua and the Dominican Republic<sup>8</sup> aimed to improve health care and provide quality care to the people through the development and strengthening of human resources for health as a priority area.

At the time of the project completion, the newly-developed National Health Policy Strategy of El Salvador included a strategic focus on maternal and child health and prioritized the detection of abnormalities and care in the area of reproductive health

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<sup>5</sup> Evaluator participated in the study from Global Link Management Inc.

<sup>6</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>7</sup> ③: High, ② Fair, ① Low

<sup>8</sup> Relevant national policies are followings: Guatemala “National Development Plan 2004-2008”, “National Health Program 2004-2008”, Honduras: “Poverty Alleviation Strategy Paper 2001-2015”, “National Health Plan towards 2021 (2006-2021)”, Nicaragua: “National Development Plan 2005-2009”, “National Health Plan 2004-2015”, Dominican Republic: “Poverty Alleviation Strategy Paper 2003-2015”, “Health Policy 2001”.

during the pre-pregnancy, prenatal and perinatal stages. Among the other four countries, the same national policies were being implemented in Honduras, Nicaragua and the Dominican Republic as at the time of the project planning. The New Health Policy of Guatemala also prioritized the development of human resources for the provision of quality health care.

The COMISCA expressed its willingness to extend full support for the project at the time of the project planning. The COMISCA's health policy "Health Agenda (2009-2018)" and its operational instrument "Health Plan (2010-2015)", whose development began around the time of the project planning, prioritized the development of human resources for health as one of the objectives.

Thus, the development of human resources for health was one of the major priorities both at the time of the project planning and completion and the project was consistent with the development plans of these countries.

### **3.1.2 Relevance to the Development Needs of El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic**

At the time of the project planning, as mentioned in the background, the improvement of basic nursing education and continuous education was one of the most important issues and the lack of standard curriculum and mechanism for quality nursing education was reported in the region. In El Salvador, the quality improvement of nurses as front line health workers was regarded as an urgent issue. While it aimed to reduce the maternal mortality rate by one-third from 1990 to 2015, the maternal mortality rate increased from 1993 to 2003 instead, according to the survey by the Ministry of Health.

At the time of the project completion, while the continuous nursing education was institutionalized and its quality improved, the need to improve reproductive health care remained high in El Salvador. In the other four countries, the needs for development of nurses and reinforcement of nursing specialization were high in order to achieve major policies such as the provision of quality health care to the people, strengthening of community health, and emergency response concerning the disease outbreak. Therefore, the project was relevant to the development needs of the countries at the time of both the project planning and completion.

### **3.1.3 Relevance to Japan's ODA Policy**

The Tokyo Declaration "Japan and Central America: Friends United Towards the Future" developed on the occasion of the Japan-Central America Year 2005 included poverty reduction, sustainable development and strengthening regional integration as cooperation areas. The Assistance Strategy for Latin and Central America in 2005

prioritized the support for the health sector leading to poverty reduction and, considering the regional commonality in history, culture and language, the promotion of regional cooperation aiming at human resource development and technical transfer to tackle the regional challenges. In addition, the Country Assistance Strategy for each country also prioritized the quality improvement of health care and strengthening of public health.

As mentioned above, this project was highly relevant to the five countries' development plans and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

### 3.2 Effectiveness and Impact<sup>9</sup> (Rating: ③)

#### 3.2.1 Effectiveness

##### 3.2.1.1 Achievement of Project Purpose

<Regional Cooperation>

Project Purpose: Capacity of nursing teachers and clinical instructors in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic is strengthened.

As El Salvador was in a position to support other countries in the regional cooperation, other four countries, excluding El Salvador, were evaluated for the achievement of the project purpose.

Since the indicators set for the project purpose were not measured at all as shown below, the achievement level was unknown. Therefore, the level of capacity strengthening of nursing teachers and clinical instructors was assessed based on the following qualitative points, taking into consideration the achievements of planned activities and outputs.

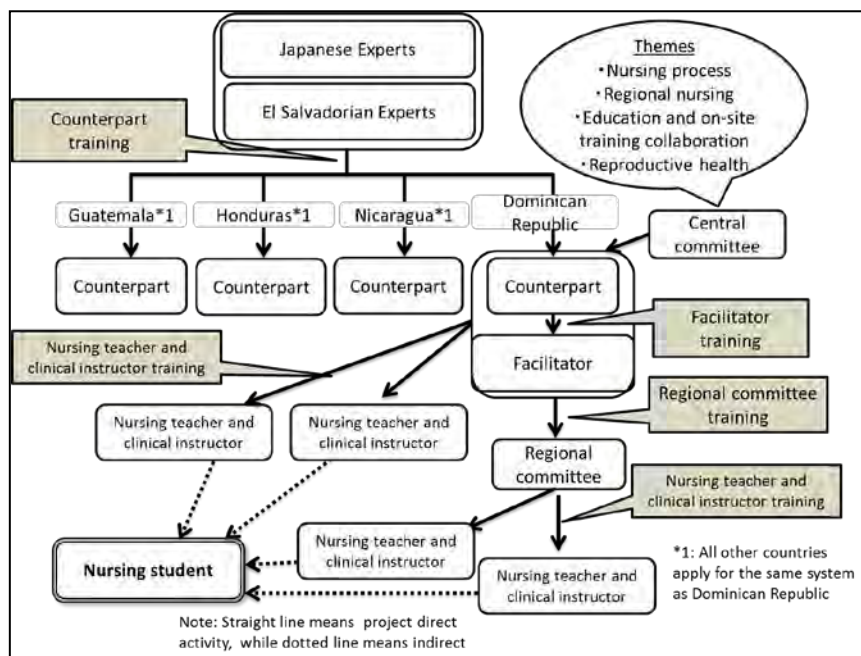
Achievement of Project Purpose

Project Purpose	Indicator	Actual
Capacity of nursing teachers and clinical instructors in El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic is strengthened.	1. In nursing schools and health facilities where 80% of all teacher and clinical instructors participate in training courses, the performance of teachers and clinical instructors is rated more than 3.5 on average on a scale of 1-5 by students	The indicator was not measured. The evaluation criteria were not developed as the activities had not progressed to the level to conduct the evaluation by the students.
	2. Students are rated more than 3.5 on average on a scale of 1-5 by clinical instructors	The indicator was not measured due to the same reason as above.

<sup>9</sup> Sub-rating for Effectiveness is to be put with consideration of Impact.

1) Establishment of the cascade training system through committee

The project introduced the cascade<sup>10</sup> training system through committees as an approach to develop capacity of nursing teachers and clinical instructors.



Source: The Evaluator formulated based on the “Project terminal evaluation report 2010”

Figure 1 Cascade training system through committee in regional cooperation

Through the activities under Output 1 (to improve education for nursing teachers and clinical instructors), the training program and materials were developed on the themes of “Nursing Process”, “Regional Nursing<sup>11</sup>”, “Cooperation between basic education and on-site training”, “Reproductive Health”, and “Curriculum”. Based on the program, trainings for the counterparts<sup>12</sup> from each country were conducted in El Salvador. Counterparts then trained the facilitators in their respective country and set up the central committee on each theme. Subsequently, the regional committees were established and the trainings of nursing teachers and clinical instructors were conducted by the regional committee members. As such, the cascade training system was established as illustrated in figure 1, improving the capacity of nursing teachers and clinical instructors. According to the project terminal evaluation report, the interviews with nurses, health facilities workers and pregnant women revealed that the trained nurses became aware of not only the

<sup>10</sup> Cascade is the method in which the person receives the training then trains others in the same manner.

<sup>11</sup> Regional nursing is focused on the prevention, promotion and maintenance of the health status of all individuals, families and communities.

<sup>12</sup> Counterparts and facilitators were comprised of teachers from nursing schools and nursing instructors for the students from the health facilities.

assistance to doctors but also the significance of nursing care, and acquired and practiced the skills to provide the quality care to the patients.

The activities under Output 4 (to promote sustainable development of nursing education) were implemented to ensure the sustainability of this training system through accelerating and regularizing the function of central and regional committees in each thematic area. While the committees had started their operation and monitoring and evaluation of the training was initiated in three out of four countries, the number of committees conducting the monitoring was limited. Moreover, it could not be confirmed whether the monitoring results were utilized to solve the problems as set in the output indicator. Thus, it was observed that the establishment of the sustainable training system was half way at the time of the project completion.

## 2) Cooperation between basic education and on-site training

Output 3 aimed to strengthen the cooperation between basic education and on-site training, which was one of the main challenges in the region, by developing the model. However, while the final draft models were developed in all countries, only Nicaragua and the Dominican Republic officially approved the models through the Ministry of Health and the other countries have yet to approve them by the time of the project completion. In those countries where the model was approved, the implementation of the model was initiated and the improvement of on-site training for students and nursing care by clinical instructors was reported.

## 3) Standardization of nursing education

Guatemala and Nicaragua implemented the development of a standardized curriculum for the nursing diploma courses under Output 2. At the time of the project completion, the draft curriculum was developed and presented to the nursing council as a process of standardization in Guatemala. In Nicaragua, 90% of the course contents were complete by that time. Therefore, while it was at the final stage in both countries, the process was incomplete.

In this manner, education for the nursing teachers and clinical instructors was improved by the establishment of the cascade training system. On the other hand, the sustainability of the training system, the coordination between basic education and on-site training and the development of the standardized curricula were yet to complete at the time of the project completion. Therefore, the benefits of the project for the nursing teachers and clinical instructors on the ground and students seemed to be limited. This was the major reason why the project could not measure the student evaluation as the indicators for the project purpose. The period of the regional coordination component was

extended by one year due to the external factors such as political changes and disease outbreaks. While the progress was made during the extended period, the project purpose was not achieved fully. Therefore, the project achieved its project purpose at a moderate level.

<Bilateral Cooperation>

Project Purpose: Quality of in-service training for nurses in the area of midwifery is improved in Santa Ana Department

Achievement of Project Purpose

Project Purpose	Indicator	Actual
Quality of in-service training for nurses in the area of midwifery is improved in Santa Ana prefecture.	1. Facilitators are rated more than 3.5 on average on a scale of 1-5 by trainees	Achieved. All the facilitators were rated 4 or 5.
	2. The quality of care of trainers is rated more than 3.5 on average on a scale of 1-5 by other health personnel	Not measured. The evaluation was not conducted as the evaluation criteria were not developed.
	3. A training program and training implementation plan are approved as a model for nursing in-service training by the Ministry of Health	Achieved. The training program and implementation plan were approved as planned.
	4. Standard of monitoring and evaluation of training is approved as a model by the Ministry of Health	Achieved. The standard of monitoring and evaluation was approved as planned.

1) Establishment of the continuous education training and monitoring and evaluation processes

Through the activities under Output 1 (to improve the continuous education training process), the training program, materials and implementation plan were developed and facilitators were trained. Those facilitators conducted the trainings on midwifery for the nurses and assistant nurses at the primary facility level through the cascade training system. The number of trainings was achieved as planned, and the quality of the facilitators was high as measured in the indicator 1. Moreover, under Output 2 (to improve the training monitoring and evaluation system), the standard of monitoring and evaluation was developed and the monitoring was done in the majority of the health facilities where the trained nurses belonged. According to the health office in the western region, the results of the monitoring were utilized to revise and improve the training program. The training program and the monitoring and evaluation standard were approved by the Ministry of Health as measured in the indicator 3 and 4. Thus, it was considered that the continuous education training process and the monitoring and

evaluation system were established.

## 2) Strengthening of the health office in the western region on continuous education training implementation and management system

The health administration of Santa Ana was under jurisdiction of the health office in the western region. It was reported that through Output 3 (to improve the operational and management system of continuous education training), the regional and departmental committees on reproductive health were established and functioned, the management system of the health office in the western region was strengthened, and the implementation of the trainings and monitoring and evaluation was managed as planned. At the same time, the Continuous Nursing Education Steering Committee, which was planned to be established under Output 4 (to promote sustainability of activities), was once established but not operational due to the changes of the government. However, the terminal evaluation report observed that the continuous education training could be well managed by the health office in the western region together with the regional and departmental committees. With the facilitators in Sonsonate and Ahuachapan Departments trained by the project, it was considered that the basis for training expansion in the western region was set.

As mentioned above, the project largely achieved its purpose, which was to improve the quality of continuous education training for nurses in the area of midwifery in Santa Ana.

### **3.2.2 Impact**

#### 3.2.2.1 Achievement of Overall Goal

<Regional Cooperation>

Overall Goal: Quality of nursing education in Central American and the Caribbean region is improved.

As the target year of the indicators was not set in the regional cooperation component, the achievement level was assessed at the time of the ex-post evaluation. In this section, first, 1) the achievement level of the project purpose at the time of ex-post evaluation was assessed, and subsequently, 2) the establishment and expansion of regional nursing network and 3) the improvement of nursing care were discussed to review how the quality of nursing education in each country progressed. In addition, 4) the promoting factors to realize the project efforts were mentioned.

### Achievement of Overall Goal

Overall Goal	Indicator	Actual
Quality of nursing education in Central American and the Caribbean region is improved.	1. The network among nursing leaders in Central America and the Caribbean is established and the information is exchanged periodically.	The regional network was established and expanded and the effective information sharing was conducted regularly among the counties, through regular video conferences and the annual regional nursing conferences in 2013 and 2014 led by El Salvador as the project headquarters.
	2. The results of the nursing educational research are presented at national and international conferences.	The achievement of the project was presented at the national nursing congress in each country and also shared at regional and international conferences, benefitting more than the five target countries. It was reported that the research needs and activities were promoted with the understanding of the importance of evidence-based nursing care.

#### 1) Achievement level of the project purpose at the time of the ex-post evaluation

The activities of the regional cooperation component have been continuously implemented after the project completion. The project coordinator has been assigned within the Nursing Department of the Ministry of Health in each country and El Salvador has been showing strong leadership as project headquarters. The achievement level of the project purpose, which was partial at the time of the project completion, was considered high at the time of the ex-post evaluation.

The cascade trainings have been continuously conducted by the central and regional committees on each theme. The joint activities by other JICA projects were also exercised in Guatemala and the Dominican Republic<sup>13</sup>.

While the situation appeared to vary among the countries and committees in the area of monitoring and evaluation after the training, there were cases among some active committees where the monitoring and follow up of the training has been institutionalized in their organizations, thus the sustainability of the activities was ensured. Also the models or standards on the cooperation between basic education and on-site training, the nursing process and the community nursing have been approved by the Ministry of Health

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<sup>13</sup> Joint trainings on nursing education was done in collaboration with the project coordinators/Nursing Departments and JICA projects in Guatemala: “Project for Maternal and Child Health in Quetzaltenango, Totonicapan, and Solola in the Republic of Guatemala 2011-2015” and Dominican Republic: “The Project for Strengthening Primary Health Care for Pregnant Women and Newborns in Health Region III 2013-2017”.



in Nicaragua and the Dominican Republic. Therefore, the nationwide rollout has been initiated as a government agenda. At the same time, the geographical limitation was reported by the two-step cascade training system in some of the countries. It was mentioned by some of the project coordinators that it would be better to first concentrate on the establishment of a workable system in selected capital areas, and then gradually expand to other areas in order to diffuse the benefits more effectively.

In terms of the cooperation between basic education and on-site training, while not all the countries have obtained the official approval for the model, all have started the implementation of the model. It was reported at the ex-post evaluation that, with the model in place, the roles and activities for the on-site training for both schools and health facilities were clearly documented at the time of the ex-post evaluation. Thus, the students' learning environment for the on-site training was improved by setting the optimal number and timing of students to be sent to the facility, the better instruction to the students at the facility, and the proactive cooperation of both organizations. According to the beneficiary survey<sup>14</sup> conducted at the ex-post evaluation, 70% or more of the students in all target countries were satisfied with the teachers and clinical instructors at the on-site training.

In Guatemala and Nicaragua, the standardized curriculum for the nursing diploma courses has been approved by their respective schools/universities and adopted in the courses. The private schools/universities also adopted the curriculum. The above-mentioned beneficiary survey for the students revealed that the overall satisfaction score of the students for the education courses was more than 4 on a scale of 1-5 in all target countries. Therefore, the satisfaction level was considered high.

## 2) Establishment of the regional nursing network

The information sharing among the countries has been continuously conducted after the project completion through the regional video conferences and annual regional conferences. Thus, it was considered that the network among the nursing leaders was strengthened as aimed by the overall goal. Through this process, in addition to the cases of problem solving through concrete advice<sup>15</sup>, it was reported the concerned officers and personnel were more motivated to continue and expand the activities through learning other countries' progress and the friendly competition.

The Nursing Department of El Salvador utilized the JICA follow up scheme in 2013

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<sup>14</sup> Beneficiary survey was conducted with 15 nursing teachers who received the training and 35 students who were at the last academic year in the schools where the trained teachers belong in each country from October to November 2014.

<sup>15</sup> The information sharing and discussion have been done on the activity progress. Even after the project completion, for instance, Dominican Republic in collaboration with El Salvadorian experts was in the process of developing the new training manuals on ethics and emergency response.

and 2014 as well as other resources to organize the regional nursing conference in El Salvador. The project effects have also been presented in the COMISCA and *Grupo de Profesionales de Enfermería de Centroamérica y del Caribe* (hereafter referred as GPECC<sup>16</sup>), and the project achievement was reported in the COMISCA health plan. As a result, the project achievement was widely shared with more than the five target countries in the region. Also, it was observed that the existing regional mechanism has been strengthened through the resource provision by COMISCA to organize the above-mentioned regional conference (2014) and accelerating the implementation of the GPECC activity plan on nursing education.

It was mentioned by several stakeholders that the nursing sector traditionally tended to receive limited resources. Therefore, effective promotion of technical and institutional advancement in nursing through utilization of the existing regional mechanism can be one of the useful measures to keep the motivation and the sustainability.

### 3) Improvement of nursing care

The project provided the training for nurses as clinical instructors. This training aimed to improve nursing care on different themes such as nursing process, and therefore the training actually played as continuous education for the nurses in service. It was reported by the nurses and health facility personnel at the ex-post evaluation that the development and introduction of practical models<sup>17</sup>, tools and formats, and the technical enhancement in the area of nursing process, regional nursing, and reproductive health by the project contributed to the improvement of their knowledge and attitudes towards the patients and their families, and ultimately the quality of nursing care. It was also mentioned that the research on various areas of nursing has been promoted by the nurses and teachers as the project contributed to increasing their attention to the importance of evidence-based nursing care.

### 4) Promoting factors to realize the project effects

The major promoting factors included the adoption of regional cooperation and triangular cooperation approach. This made possible the continuous provision of regionally-appropriate technical assistance from El Salvadorian experts. It was occasionally mentioned that the El Salvadorian experts also gained confidence and were motivated to do better in their own work by guiding other countries. The utilization of

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<sup>16</sup> *Grupo de Profesionales de Enfermería de Centroamérica y del Caribe* (GPECC) is the forum to promote nursing profession in Central America and the Dominican Republic by member country nursing association.

<sup>17</sup> In Nicaragua and the Dominican Republic, in addition to the model for cooperation between basic education and on-site training, standards for nursing process and regional nursing have been developed and approved and implementation has been initiated nationwide.

existing regional mechanism such as COMISCA and GPECC contributed to the realization of the project effects and its sustainability. The approach to involve the key actors, namely the Ministry of Health, Nursing Association and Nursing School, as members of the project advisory committee was considered to be effective. These actors used to have less opportunity to work together due to the different ruling authorities. The joint action of the three actors made it possible to collaborate in the area of policy, institutional, technical and finance aspects necessary for the improvement of basic and continuous nursing education.

Thus, the achievement of the project purpose has contributed to the improvement of nursing education in Central America and the Caribbean and the project has largely achieved the overall goal.

<Bilateral Cooperation>

Overall Goal: Nursing service in the area of midwifery is improved in Santa Ana, Sonsonate and Ahuachapan.

As the indicators in the bilateral cooperation were targeted to 2015, the expected level of achievement was assumed by the progress level at the ex-post evaluation.

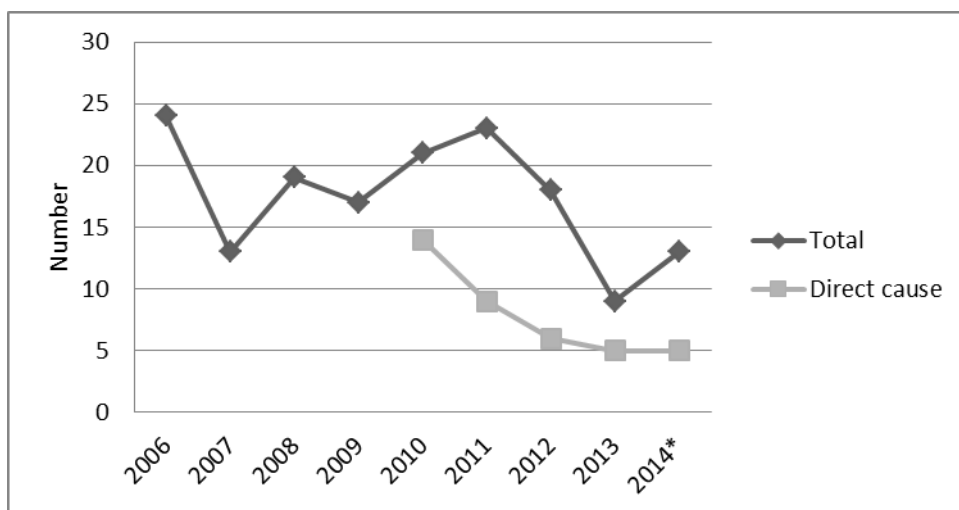
Achievement of Overall Goal

Overall Goal	Indicator	Actual
Nursing service in the area of midwifery is improved in Santa Ana, Sosoate, and Ahuachapan	1. The number of the deliveries at home and deliveries attended by traditional birth attendants are reduced and the number of institutional deliveries is increased by 2015	The number of deliveries by traditional birth attendants was reduced from 2010 to 2014 and the institutional deliveries were increased (97% in 2010, 99.9% in 2014)
	2. Health service in midwifery area by nurses is highly rated by clients by 2015 (rated more than 6 on scale of 1-10)	The client survey conducted by the health office in the western region in 2011 and the beneficiary survey conducted in the ex-post evaluation showed the high satisfaction rate for the midwifery service by nurses. (over 60%)
	3. Maternity mortality rate is reduced to 70% by 2015	The number of maternal deaths in the western region was in declining since 2006 (see figure 2). Maternal mortality ratio (death /100,000 live births) was also reduced from 53.8 (2012) to 30.3 (2013) (Ministry of Health data).

As mentioned above, the targets of all the indicators have largely been achieved.

The activities under the bilateral cooperation component have also continued after the project completion. The trainings in Sonsonate and Ahuachapan Departments have been conducted by the facilitators nurtured by the project. The financial and technical collaboration with the Spanish organization, *Fundacion para el Desarrollo de la Emfermeria*<sup>18</sup> (hereafter referred as FUDEN), was utilized to conduct the nursing training.

The regional committees, regional management committee<sup>19</sup> and three departmental committees on reproductive health have been established and functioned based on the organizational norms and annual plans under the leadership of the health office in the western region. The project initially planned to set up the Continuous Nursing Education Steering Committee. However, the Nursing Director confirmed that the component of continuous education was covered by all 13 existing nursing committees in their respective areas, and therefore the specific committee was not necessary.



Source: Health office in the western region, El Salvador

(\* 2014 reflects only up to September)

Figure 2 Trend of the Annual Number of Maternal Deaths<sup>20</sup> in the Western Region

<sup>18</sup> FUDEN: *Fundacion para el Desarrollo de la Emfermeria*

<sup>19</sup> Regional committee is in charge of the implementation and management of training, whereas regional management committee deals with the wider promotion of nursing activities in reproductive health in the region.

<sup>20</sup> The maternal death was categorized into three: (1) direct cause- death caused by pregnancy and delivery related symptoms, (2) indirect cause- death caused by the chronic diseases or pregnancy related suicide, (3) unrelated – death caused by the accident and others.

The beneficiary survey<sup>21</sup> with postnatal women was conducted at the ex-post evaluation. The satisfaction level of antenatal care provided by the nurses<sup>22</sup> was measured and the comparison was also done between the current and previous births (2-7 years ago) of the respondents. The satisfaction rate for the current antenatal care provided by the nurses was very high with 97%, which was higher than the satisfaction rate (90%) for the previous antenatal care. The main reasons cited by respondents were that the nurses' attention and attitude was better and they were committed to provide better care.

The ex-post evaluation found that one of the outstanding project achievements was the strengthened collaboration between the nurses of primary and secondary facilities. It was reported that, through the joint participation in the project training, the nurses from the different levels now gained respect for each other's roles and collaborated to provide comprehensive continuum care for pregnant and lactating women. In practice, the primary level nurses monitored the pregnant women within their catchment community, and referred the high risk cases to the secondary nurses as soon as they were identified. After the delivery, the primary nurses followed up with the postnatal care of those mothers.

It was also confirmed that the synergetic effect was attained by the project and El Salvadorian policy on community health. The health team comprised of doctors and nurses conducted the outreach service to communities regularly and provided preventive and health promotion services as well as advocacy in collaboration with community organizations, health promoters and traditional birth attendants<sup>23</sup>. The health officers in the western region and nurses strengthened by the project have been training the health promoters and traditional birth attendants, utilizing the training program developed by the project.

Institutional deliveries and maternal deaths are in general influenced by multiple factors and it cannot be proven that the project alone brought about the progress. However, given the above-mentioned circumstances, the efforts made by the government officers, nurses and other stakeholders nurtured through the project are believed to have contributed to the achievement of the overall goal<sup>24</sup>.

Thus, the project has largely achieved overall goal.

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<sup>21</sup> Beneficiary survey was conducted with postnatal women at the primary health facility – 30 women in Santa Ana, 15 in Sonsonate, and 15 in Ahuachapan in October 2014.

<sup>22</sup> In general, antenatal and postnatal care is provided by nurses at the primary level and delivery is carried out in the secondary hospital.

<sup>23</sup> In El Salvador, the training and advocacy activities are provided to traditional birth attendants in collaboration with health facilities and health workers to promote institution delivery instead of conducting birth assistance by themselves.

<sup>24</sup> It was reported that the community activity includes the sensitization to the police with the provision of emergency delivery kits, and there was a case in which police assisted the delivery in emergency case.

### 3.2.2.2 Other Impacts

#### <Regional Cooperation>

In Nicaragua and Guatemala, the network among major public and private universities was established through the curriculum development activity, and the activities continued for the development/revision of other curricula and education program and the improvement of teaching techniques<sup>25</sup>. Moreover, while the Dominican Republic was not covered for the output of nursing education standardization, the project personnel contributed to the process of curriculum revision led by the Ministry of Higher Education.

#### <Bilateral Cooperation>

The training has been extended to the eastern, central and metropolitan regions through the Ministry of Health and FUDEN based on the training program developed by the project. The facilitators from the western region were utilized for the training. Moreover, it was reported that when the clinical policy was revised in 2014, the officers and nurses who participated in the project contributed to the process and realization of expanding the nursing responsibility<sup>26</sup>.

According to the officers from the Nursing Department and the health office in the western region, the training program developed by the project was considered to be highly effective for the improvement of nursing care as well as the health outcomes. Therefore, they were planning to expand it to other areas outside the western region.

While the project purpose for the regional cooperation which was to improve the capacity of nursing teachers and clinical instructors was achieved only partially at the time of project the completion, the achievement level was high at the ex-post evaluation. The project purpose of the bilateral cooperation was achieved at the time of the project completion. The project has largely achieved or expected to achieve the overall goal for both cooperation components. Therefore, the effectiveness and impact of the project are high.

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<sup>25</sup> In Nicaragua, the university network established through the project was in preparation to organize the nursing education congress for the first time in 2015 and hold the pre-congress meeting in 2014. It was planned for all the nursing schools to present their research results in this congress. Also the study plan of the diploma nursing course was homogenized.

<sup>26</sup> The previous clinical policy in 1993 ruled that the nurse could conduct delivery assistance only when the doctor was not available. Whereas, the revised policy in 2014 stated the nurse can conduct all the services in relation to the pregnancy including delivery assistance unconditionally. Nursing Department in El Salvador mentioned that the project contributed to some extent to the realization of policy change through the development of guideline and manuals and training/capacity development of nurses by the project.

### 3.3 Efficiency (Rating: ②)

#### 3.3.1 Inputs

Inputs	Plan	Actual
(1) Experts	<ul style="list-style-type: none"> <li>• Long-Term 3 (Chief advisor/nursing education, project coordinator, nursing education/project coordinator)</li> <li>• Short-Term (Regional nursing, reproductive health etc)</li> </ul>	<ul style="list-style-type: none"> <li>• Long-Term 4 (Chief advisor<sup>27</sup>, project coordinator, nursing education/project coordinator, reproductive health)<sup>28</sup></li> <li>• Short-Term 1 (Reproductive health)</li> <li>• Third country 9 (reproductive health, nursing management)</li> </ul>
(2) Trainees received	Not mentioned	None
(3) Equipment	Delivery simulator etc	Medical and training equipment on midwifery, video conference equipment, computer and other office equipment
(4) Local cost	Facilitator training cost, material development cost etc	192 million yen/ <sup>29</sup>
Japanese side Total Project Cost	290 million yen	267 million yen
El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic side Operational Expenses	<p>&lt;El Salvador&gt; Counterpart, nursing education expert, project office, training facility/equipment, local cost (utility cost, fuel)</p> <p>&lt; Guatemala, Honduras, Nicaragua and the Dominican Republic &gt; Counterpart, facilitator, project office, training facility/equipment, local cost (training cost, monitoring and evaluation cost, utility cost)</p>	<p>&lt;El Salvador&gt; Counterpart, nursing education expert, project office, training facility/equipment, training activity cost (655,200USD), utility cost</p> <p>&lt; Guatemala, Honduras, Nicaragua and the Dominican Republic &gt; Counterpart, facilitator, project office, training facility/equipment, local cost (training cost, utility cost)</p>

<sup>27</sup> Chief advisor was a short-term expert during the extension period (September 2010-August 2011).

<sup>28</sup> Chief advisor and project coordinator were assigned for both regional and bilateral cooperation.

<sup>29</sup> Approx. 1,940,000 USD. Expenditure of each fiscal year was converted with JICA exchange rate in April of each year from 2007-2011.

#### 3.3.1.1 Elements of Inputs

The Japanese experts were dispatched almost as planned with an addition of one long-term expert on reproductive health. The equipment provided was utilized for the implementation of training and the committees' activities and the inputs from the counterpart countries were mostly provided as planned.

The project contained two components of regional and bilateral cooperation for the five countries. It was reported by the project experts and relevant officers that this approach made it possible to extend the project effects to wider areas with limited inputs and conduct the project monitoring efficiently. At the same time, the counterparts from the regional cooperation countries admitted that the number of visits and the duration of visit of the Japanese and El Salvadorian experts tended to be insufficient, and it was sometimes difficult to obtain the effective assistance in a timely manner. This could be one of the factors that the progress was slower than planned. It was observed that the additional dispatch of the long-term expert on reproductive health was necessary because the effective technical transfer required more personnel than planned. In addition, the workload for the project management such as accounting was reported to be heavy.

Under these circumstances, the project made various efforts to promote efficiency and solidarity among countries with limited time and inputs, such as utilization of third country experts within the region, regional video conferencing, focus on the practical sessions in the training program in order for each country to conduct cascade training effectively, setting the learning objectives to also address the mental aspect of the participants for their empowerment, production of a project anthem etc.

Overall, it was considered that the inputs were appropriate with the project efforts to maximize the limited resources and the financial inputs by the counterpart countries.

#### 3.3.1.2 Project Cost

The actual project cost was 267 million yen against the planned cost of 290 million. Thus, the actual cost (92%) was lower than planned.

#### 3.3.1.3 Period of Cooperation

The actual project period for the bilateral cooperation was three years as planned, whereas the period of the regional cooperation was four years with one year extension, which was longer than planned. Some project personnel reported that it was difficult to grasp each country's situation timely and provide necessary direct support to all the countries. In particular, it took a longer time than expected for the situation analysis and the setup of the central and regional committees in each country. Although it is difficult to simply compare its appropriateness with other projects, for instance, the duration of



similar bilateral technical cooperation projects on nursing education<sup>30</sup> was mostly five years and the project purpose was largely achieved in those projects as planned. It can be argued that three years were not enough to achieve the expected purpose considering the regional cooperation approach and the high achievement level of the project purpose at the ex-post evaluation.

As mentioned above, although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

### **3.4 Sustainability (Rating: ③)**

The project brought about the effects on the establishment of the nursing education training system, improvement of nursing care, and strengthening of the regional nursing network under the regional cooperation component, and on the improvement of the continuous education system and nursing services on midwifery under the bilateral cooperation component. In this section, the sustainability of the above-mentioned effects is discussed.

#### **3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects**

##### **<Regional Cooperation>**

The national development plans and health plans in all the countries<sup>31</sup> at the time of the ex-post evaluation aimed at the provision of quality health care services to all, development of human resources for health, strengthening of cooperation between academic institutions and health facilities, and regional reinforcement as priorities. Improvement of nursing education and services was crucial to achieve these goals. The new COMISCA Health Policy (2015-2022) mentioned human resource development as one of the priority objectives and aimed to strengthen the regional cooperation in the health sector. Therefore, it is expected that the regional nursing network established through this project could further accelerate the collaboration with COMISCA<sup>32</sup>.

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<sup>30</sup> “Project for Strengthening Nursing Education in El Salvador 1997–2002”, “ Strengthening Continuing Education in Nursing and Midwifery in the South of the Republic of Paraguay 2001-2006”, “ Nursing Education Improvement Project in Uzbekistan 2004-2009”.

<sup>31</sup> Relevant national policies are followings: Guatemala “National Development Plan Agenda 2012-2016”, “National Health Plan 2014-2019”, Honduras: “Poverty alleviation strategy paper 2001-2015”, “National Health Plan towards 2021 (2006-2021)”, Nicaragua: “National Human Development Plan 2012-2016”, “National Health Plan 2004-2015”, Dominican Republic: “Poverty Alleviation Strategy Paper 2003-2015”, “National Health Plan 2006-2015”.

<sup>32</sup> In order to institutionalize the collaboration with COMISCA, Nursing Department in El Salvador initiated the discussion with COMISCA to integrate regional nursing network into COMISCA technical commissions.

The models and guidelines developed through the project were approved by the Ministry of Health and the standardized curriculum was officially adopted. Therefore, the sustainability on the policy and institutional aspect is high.

<Bilateral Cooperation>

El Salvador's "National Development 5 Year Plan 2010-2014" and "National Health Policy 2014-2019" aimed to provide quality health services to all. There is a particular focus on strengthening primary health care for the women of childbearing age and children who tend to have less access to the services. The human resource development for health was regarded as an indispensable approach to achieve the goal. As the roles of nurses for pregnancy and delivery related care have been expanded in the new policy as mentioned above, the improvement of nursing services would remain one of the key objectives. In terms of the training system, the manuals and standards were approved by the Ministry of Health.

Overall, the sustainability on the policy and institutional aspect is high.

### **3.4.2 Organizational Aspects of the Implementing Agency for the Sustainability of Project Effects**

<Regional Cooperation>

Even at the time of the ex-post evaluation, the project coordinator was posted in the Nursing Department<sup>33</sup> in all the countries and El Salvador showed strong leadership as project headquarters. The so-called project name "Angel Project" was still in use. While the project coordinators kept implementing the activities introduced by the project, those activities were mostly considered as part of the routine work. In this sense, the sustainability is and will be secured. Also the collaboration between the Ministry of Health, Nursing Association and Nursing School remained active.

In terms of human resources in the Nursing Department, while the situation varied among the countries, it appeared to be more or less appropriate to maintain the activities. However, in Honduras, the Nursing Department ceased to exist after the health ministry reform in 2014 and nursing education became under the jurisdiction of the Human Resource Development Department. According to the Director of the Nursing Research and Training Center who was assigned as the project coordinator, the current government placed importance on the progress of the project and nursing education and provided the funding support, however on an ad-hoc basis. The President of the Nursing Association and Nursing Director of the National University were of the strong opinion that the

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<sup>33</sup> In Honduras, the coordinator was posted in the human resource development department which in charge of nursing education.

restoration of the Nursing Department was essential for the strengthening of nursing education and services. It was mentioned that they will continue to advocate to the government by demonstrating the concrete achievement of the project.

In terms of the committee training system, it was mostly regarded as the official activity of the Ministry in all the countries. There were some comments from the committee members on the obstacles due to the delay of the permit from the Ministry to participate in the activities and the competing tasks along with their regular work. However, the Nursing Departments were committed to reinforce the support system for the committee activities.

Based on the above, while not all the Nursing Departments have the perfect situation, overall it was regarded that the organizational status of the concerned countries was appropriate to continue the activities and maintain the benefits brought about by the project through collaboration between the project coordinator, committee members, and representatives of the nursing association and schools. Thus, the sustainability is high.

<Bilateral Cooperation>

The activities of the regional and departmental committees on reproductive health were integrated in the official regional and departmental annual plans. Therefore the committee members were able to implement the activities for the improvement of continuous education and nursing care on midwifery as part of the routine work. The training centers equipped by the project functioned properly at the time of the ex-post evaluation. Thus, the sustainability is high in this sense.

### **3.4.3 Technical Aspects of the Implementing Agency for the Sustainability of Project Effects**

<Regional Cooperation>

It was concluded through the interviews and beneficiary survey during the ex-post evaluation that the project coordinator and main members of the central and regional committees in each country understood the technical contents sufficiently and they customized the components according to their contexts. The manuals and standards on different themes have been developed and revised and the El Salvador headquarters was committed to provide necessary assistance when required. Therefore, the technical sustainability is high.

<Bilateral Cooperation>

According to the interviews and beneficiary survey during the ex-post evaluation, the capacity and commitment to maintain the activities by the regional and departmental

committee members were regarded to be high, backed up by the Nursing Department and the health office of the western region. Thus the technical sustainability is high.

#### **3.4.4 Financial Aspects of the Implementing Agency for the Sustainability of Project Effects**

##### <Regional Cooperation>

In Nicaragua and the Dominican Republic, the activities on nursing education were included in the annual plan of the Nursing Department in 2015 and the major activities have been budgeted by the Ministry of Health, development partners, university or nursing association. The annual plan including the nursing education activities for 2015 in Guatemala was still in the appraisal process, but the Nursing Director estimated that around half of the proposed budget would be approved. Considering the fact that there was no specific budget allocated for nursing education before, the possibility of implementing the plan seemed high under the current government. In Honduras, the activity plan by each committee will be submitted to the Human Resource Development Department after its compilation. While there were no specific budgets allocated for nursing education until the previous year, the project coordinator was instructed by the current Vice Minister to apply for the activity budget when necessary. In fact, the funds were provided for the training activities in one region in late 2014. In addition, in all the countries, the project coordinators incorporate the concerned activities into the routine occasions such as regular annual meetings or inspections<sup>34</sup>. During those occasions, the sensitization or monitoring of the activities has been done. The budgets of the nursing association and schools have also been utilized occasionally.

As above, it was considered that each country would manage to allocate certain financial resources to sustain the benefits brought about by the project. Thus, the financial sustainability is high in general.

##### <Bilateral Cooperation>

The Nursing Department's 5 year Strategic Plan included the activity plan for nursing education including reproductive health, but the budget for 2015 was still under the appraisal process. The activities of the 13 nursing committees including on reproductive health were regarded as the official work of the Ministry and it was the case also in the western region. The opportunity of the routine hospital inspection or regular meeting was used to provide technical assistance or monitoring for the relevant staff. The materials

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<sup>34</sup> For instance, in Nicaragua, national meeting with directors of district offices and hospitals are organized three times a year. Nursing Department was planning to utilize this opportunity to orient them on the standards for nursing process. In Guatemala, the monitoring and follow up of the regional committees' activities was conducted during the regular inspections in the regions.

necessary for the training were prepared by the health offices. As there was an agreement of not providing daily allowance for the nursing in-service trainees, the organization of the training could be managed with relatively low cost.

Thus, the financial sustainability is relatively high.

As mentioned above, no major problems have been observed in the policy background and the organizational, technical, financial aspects of the implementing agencies. Therefore, the sustainability of the project effects is high.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

The project was implemented in the area of basic nursing education and continuous training in Central America and the Dominican Republic. It aimed to improve continuous nursing education in midwifery for El Salvador as bilateral cooperation, and to improve the capacity of nursing teachers and clinical instructors in Guatemala, Honduras, Nicaragua and the Dominican Republic as regional cooperation. The purpose of this project was consistent with the health policies and development needs of those countries as well as Japan's ODA policy, thus its relevance is high. In terms of the regional cooperation, while the standardization of nursing education and the establishment of training, and monitoring and evaluation system had been in progress, the sustainability of the training system had been observed half way and the achievement level of the project purpose by the indicator measurement could have not been confirmed. Therefore, the project had achieved its purpose at a moderate level at the time of the project completion. Subsequently, the project achievement level was found to be high at the time of ex-post evaluation with the progress of standardization of nursing education and establishment of fairly good self-sustainable training system in a few countries/local areas, and the positive impact on the improvement of the regional nursing network and nursing services was also observed. For the bilateral cooperation, the project largely achieved its purpose at the time of the project completion, and the positive impact on the strengthening of the continuous education training system in Santa Ana Department, the increase of institutional delivery and the improvement of nursing services in the western region including Sonsonate and Ahuachapan Departments was observed. Thus, the effectiveness and impact of the project are high. Although the project cost was within the planned, the project period was extended by one year. Therefore, the efficiency of the project is fair. In terms of the sustainability, while the situation varied among the countries, the models and manuals developed through the project were officially approved and the activities were

integrated into the national plans in some countries. Therefore, the sustainability of the project is high.

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

## **4.2 Recommendations**

### **4.2.1 Recommendations to the Implementing Agencies**

<Regional Cooperation>

#### Strengthening of collaboration between major stakeholders in nursing education

The Nursing Department/Ministry of Health, Nursing Association, and Nursing School are major actors and hold the key roles in the policy, institutional, and technical development for nursing education. The project employed an approach to bring these actors together into the project advisory committee. As a result, the standardization of the curriculum, strengthening of the training system, integration of training plans, and financial collaboration were enhanced. Therefore, this approach is regarded as one of the promoting factors. While this collaboration was observed in all the countries, the level varies from one country to another. It is expected that the Nursing Department/Ministry of Health plays a leading role and accelerate the collaboration by organizing regular joint meetings among the concerned officers, sharing of annual plans or joint planning, joint training and monitoring, and frequent discussions on the coordination of basic education and on-site training. This could lead to the effective and efficient expansion of the standard models and sustained monitoring and training.

#### Expansion of the cascade training system through committees

The cascade training system utilizing the central and regional committees was considered to be effective to nurture the regional human resources and to expand the training to wider areas with relatively low cost. However, it was found that the two-step cascade of the central and regional committees placed limitation on the geographical coverage. One of the approaches to extend the effects brought about by the project to wider areas is to involve regional health offices proactively. In the areas where there are active regional committees, namely health facilities or schools, the project coordinator could engage the regional health officer as a coordinator within the region and set up a sub-national committee with a pool of active and skilled regional committee members/facilitators. This approach is expected to diffuse the training activities to organizations other than the existing regional committees.

### Utilization of the existing regional mechanisms

It is expected that, in order to enhance the regional cooperation, further utilization of the existing regional mechanisms such as COMISCA and GPECC should be pursued through active participation in the regular meetings/conferences, presentations on the research findings, and information sharing/exchange among the members. The new COMISCA health policy aimed to assist the effective and efficient policy realization of the member countries through strengthening of regional cooperation. According to the Director of the COMISCA Secretariat, while the project effects were valued, it was recommended to construct a more institutionalized relationship with the nursing network rather than the ad-hoc joint activities. This could increase the opportunity for resource mobilization by COMISCA. Therefore, it is expected that the Nursing Department of El Salvador will accelerate the discussion with COMISCA to integrate the nursing section into COMISCA's technical commissions in order to contribute to the overall human resource development for health in the region. It is also recommended to each country to proactively participate in nursing or health conferences in the neighboring countries – e.g. the nursing education congress in Nicaragua planned in 2015.

#### <Bilateral Cooperation>

It is recommended that the Nursing Department and the health office in the western region develop a best practice booklet with innovative tools and successful stories based on the experiences in the western region. It should be shared with other regional health offices together with their training materials and manuals in order to expand the activities.

#### **4.2.2 Recommendations to JICA**

None

#### **4.3 Lessons Learned**

##### Effectiveness and challenges of regional and triangular cooperation

The project adopted the regional cooperation and utilized the resources nurtured by the previous JICA cooperation, including the third country experts from El Salvador and Paraguay. The latter is called triangular cooperation. It was concluded that the project was a successful case to realize the benefits by synergetic effect of the two approaches. It was confirmed that the counterpart countries could obtain concrete advice and solutions through tackling the common challenges and objectives among countries with a common language, culture and environment and sharing their experiences and progress among each other. They could also raise motivation through peer competition. Strictly speaking,

the clinical policy and nursing education system should be developed under each country's system and law, and regional integration is not always possible. However, the project witnessed that several issues in each country have been addressed by the joint learning on nursing education and services. Therefore, the regional cooperation approach worked in this case.

El Salvador showed the strong leadership as project headquarters and the El Salvadorian experts continued to provide proactive technical support to the neighboring countries even after the project completion. They also provided opportunities for face-to-face interaction such as video and regional conferences. This triangular approach is key to maintain or accelerate the activities in each country after the project completion.

El Salvador's strong leadership and commitment<sup>35</sup> have been presumably consolidated by JICA's extended and sequential cooperation, consisting of two technical cooperation projects, third country training, and the follow up scheme for more than 15 years. This could also tighten the relationship of the participating countries. Continuous cooperation is regarded to be useful to enhance the triangular approach.

On the other hand, it can be assumed as discussed earlier that the regional cooperation requires a longer time compared with the bilateral cooperation. It is necessary to carefully decide the project period and the number and positions of experts when planning regional cooperation.

#### Effectiveness and challenges of the cascade training system through committees

The cascade training system through committees is effective to expand training with relatively low cost. At the same time, the two step cascade system tends to result in limited geographical coverage. The considerations for the planning of similar projects should include the geographical scope, human and financial resources of the central and regional offices, expansion process, and ultimate activity or behavior change to happen.

- Geographical scope: When the national cascade system in the country or the capacity of the regional office is relatively high, it is possible to adopt the three-step cascade with the involvement of sub-national level for wider or nationwide coverage. If it is not possible, it is necessary to limit the geographical area and set a clear goal at the onset of the project.
- Expansion process: As a necessary step before expansion, it is important to establish an appropriate and workable system and develop human resources in

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<sup>35</sup> The project technical manager in El Salvador during the project period was retired but worked for the project voluntarily. Deputy nursing director mentioned that all the officers working in nursing have conviction and full commitment to implement necessary activities to provide the best possible care to the people no matter what resources available.



selected areas. Particularly, in case of regional cooperation where the activities are most likely implemented simultaneously in more than one country, the basic contents can be commonly introduced, but the details should be customized based on each country's or region's context. Thus, it is important to first establish the functional model in the selected areas.

- **Monitoring of training:** The implementation of training should not be the goal itself but it is important to set a clear approach that can bring about the effects or behavior changes aimed by the training, through developing monitoring standards and tools. In this regard, this project strengthened the implementation of monitoring and evaluation and follow up of the training. While the monitoring from the central committees to the regional committees was limited due to the financial constraints, some of the regional committees, such as hospitals or schools, understood its importance and could realize the intended effects of the training by utilizing monitoring tools. .
- **Cooperation between basic education and continuous education:** In principle, basic education at school (pre-service) and continuous education for nurses (in-service) should be linked each other for improvement of nursing services. The project provided training to nurses as clinical instructors in order to improve the learning environment for the students. This training resulted in the improvement of nursing care as continuous training for the nurses in service. Therefore, it is considered to be effective and efficient to address both pre-service and in-service education together for the development of nursing human resources. In this regard, promotion of the collaboration between the Ministry of Health, Nursing Association and Nursing School would be a useful approach.

#### Importance of setting appropriate indicators

The two indicators set for the project purpose of the regional cooperation component were not measured by the time of the project completion. The project aimed to ultimately benefit the nursing students through the development of training programs, capacity development of facilitators, training of nursing teachers and clinical instructors, and improvement of education programs. However, this requires a certain time. It was observed that the benefit of the project had not reached to the level of students by the time of the project completion, and this seemed to be the major reason why the indicators were not measured. Considering that the project covered five countries with the regional cooperation approach, the targets set for the expected outputs seemed to be a little too high. It is crucial to set appropriate indicators and targets based on the planned inputs and

to measure the progress toward the end of the project. The possible indicators include the evaluation of the training course and facilitators by the nursing teachers and clinical instructors and/or their understanding level of its contents, the percentage of facilities/schools introducing the standards/manuals developed under the project outputs, and the establishment of the model on the training management cycle from the planning to monitoring and evaluation among the Ministry of Health, central and regional committee and nursing teachers and clinical instructors on site. It is useful to include these indicators which can monitor the progress toward achieving the goal.

Annex: Achievement of Outputs and Project Purpose

**【Regional Cooperation】**

	<b>Project completion</b>	<b>Ex-post evaluation</b>
Output 1	Largely achieved (development of training programs/materials and implementation of the training)	Achieved (continuous implementation of training based on the developed programs/materials )
Output 2	Not achieved (incompletion of the standardized curriculum development)	Achieved (completion and adoption of the standardized curriculum)
Output 3	Partially achieved on indicator 1 (partial approval of the model on basic education/on-site training cooperation)	Achieved (implementation of the model on basic education/on-site training cooperation in all countries)
Output 4	Partially achieved on indicator 2 (the committees initiated, but the monitoring was partial)	Achieved (continuous activities of each committee including monitoring in all countries)
Project Purpose	Quantitative (indicator): not achieved (no data) Qualitative: partially achieved The establishment of the cascade training system, standardization of curricula, development of the model were in progress but not complete. Also the benefit to the nursing teachers and clinical instructors and students was limited.	Quantitative (indicator): largely achieved Qualitative: achieved Through development of standardized curriculum, development of standards or manuals, continuous activities of central and regional committees, and university networking, the benefit has reached to the students through the teachers/instructors in the selected major facilities/regions.

**【Bilateral Cooperation】**

	<b>Project completion</b>	<b>Ex-post evaluation</b>
Output 1	Achieved (development of midwifery training programs/ materials, implementation of training)	Achieved (continuous implementation of training based on the developed programs/ materials)
Output 2	Achieved (development and implementation of the monitoring and evaluation standard)	Achieved (continuous implementation of monitoring and evaluation based on the standard)
Output 3	Achieved (implementation of training and monitoring under the western region health office)	Achieved (continuous implementation of training and monitoring by committees under the western region health office)
Output 4	Partially achieved on indicator 1 (a manual for continuous education committee not developed)	Achieved (training implemented by facilitators in all departments of the western region and continuous education covered by the existing committees)
Project Purpose	Largely achieved (high rate for training facilitators, training programs and monitoring standard approved)	Achieved (high rate for nursing care by pregnant women, continuous implementation of the training programs and monitoring standard)