India

FY2015 Ex-Post Evaluation of Japanese ODA Loan

"Bisalpur Jaipur Water Supply Project (Transfer System)"

External Evaluator: Akiko Ishii, Ernst & Young Sustainability Co., Ltd.

0. Summary

The objective of the project[1] was to provide a stable and safe drinking water supply in Jaipur city, which is the capital of Rajasthan state, located in the northwestern part of India, by constructing and renovating related water supply facilities, such as water purification, transfer system and distribution systems, based on surface water from the existing Bisalpur Dam, located 120km from Jaipur city. Thereby the project would contribute to improve public hygiene standards and mitigate deterioration of the groundwater level.

The project has been relevant to the country's development policy, which stipulated the importance of supplying safe drinking water and mitigating deterioration of groundwater levels due to excess extraction, the development needs, as well as Japan's ODA policy. Therefore its relevance is high.

Implementing the project allowed the amount of water supplied and population served to meet the targets. Furthermore, the groundwater in Jaipur city, which had a high nitrate concentration and caused health problems before the project implementation, but the water quality was improved to meet the drinking water quality standards by alternating the water source from groundwater to surface water and the dependency ratio of groundwater was also significantly reduced to exceed the target level. Accordingly, the effectiveness and impact of the project are high.

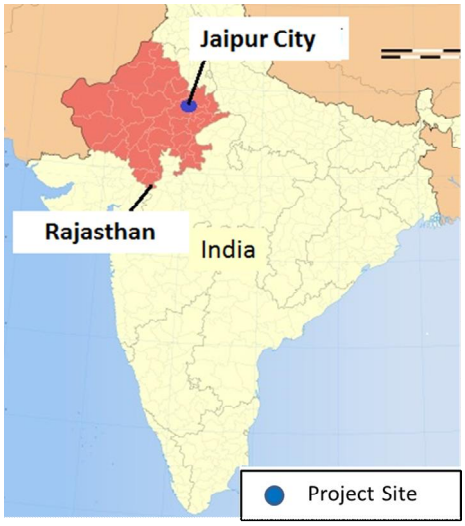
The project period was significantly longer than planned due to the delay in starting operations of consultants and longer time required to redesign the water pipe layout and pumping station caused by the relocation of pumping stations. The configuration change in the pumping stations and delays to the project caused increase in the construction cost and price escalation, thus the project cost also exceeded the planned cost. Therefore, efficiency of the project is low.

The operational and maintenance conditions of the project facilities, including the pumping stations and water pipes, were good, with no major problems observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

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

[1] The project was implemented with co-financing from JICA and ADB; with a primary transmission system by ADB and a secondary transfer system by JICA.

1. Project Description



Location of Project Site

Balawala pumping station

1.1 Background

The State of Rajasthan is located in one of the most arid regions of India. In addition, because most of the river basins in the state are concentrated in the southern and south-eastern part of the state, there is almost no water source in the west of the state, where Jaipur city is located. At the time of appraisal, 97% of the water supply in Jaipur city (345,000m^3/day) came from groundwater and the remainder from Ramgarh Lake, which is the sole source of surface water. Ramgarh Lake actually provided a supply of only 10,000～15,000m^3/day against the assumed supply capacity of 72,000m^3/day[2]. Under these circumstances, the water supply situation was serious because the amount of groundwater extracted exceeded the natural recharging volume[3] and depletion was reported in some areas. Furthermore, the high nitrate concentration of the groundwater due to intensive groundwater usage and undeveloped city sewage facilities caused health problems such as methemoglobinemia[4] and diarrhea. In response to soaring demand for treated water to cope with the population increase, to mitigate any decline in groundwater level and improve water quality, developing a new water source based on surface water and establishing a water supply system were urgent issues faced by the Government of Rajasthan.

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[2] Source: Documents provided by JICA

[3] The natural recharging means the process which groundwater is recharged naturally by the surface water (rainfall and river water) penetration. The natural recharging volume is estimated by subtracting the amount of evapotranspiration from the amount of surface water measured hourly.

[4] Methemoglobinemia is a blood disorder in which an abnormal amount of methemoglobin -- a form of hemoglobin -- is produced. Hemoglobin is the protein in red blood cells that carries and distributes oxygen to the body. With methemoglobinemia, although the hemoglobin can carry oxygen, it is unable to release it effectively to body tissues.

1.2 Project Outline

The objective of this project is to meet the increasing water demand of Jaipur city, reduce groundwater abstraction to a sustainable level and improve the public hygiene standard by constructing related water supply facilities, such as a transfer system, based on surface water from the existing Bisalpur Dam, located about 120km southwest of Jaipur city, thereby contributing to improving public hygiene standard and mitigating deterioration of groundwater level.

Loan Approved Amount/ Disbursed Amount	8,881 million yen /8,873 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	March, 2004 /March 2004	
Terms and Conditions	Interest Rate Repayment Period (Grace Period) Conditions for Procurement:	1.3% 30 year (10 year) General Untied
Borrower / Executing Agency(ies)	The President of India/Public Heath Engineering Department, State Government of Rajasthan (PHED)	
Final Disbursement Date	October, 2013	
Main Contractor (Over 1 billion yen)	Larsen & Toubro Ltd.(India), Kirloskar Brothers Ltd.(India), Subhash Projects and Marketing Limited (India)	
Main Consultant (Over 100 million yen)	TCE Consulting Engineers Limited (India)/Lahmeyer International (INDIA) Pvt. Ltd.(India)/Nippon Koei Co., Ltd. (Japan) /Nihon Suido Consultants Co., Ltd. (Japan)/KRI International Corporation (Japan)/Louis Berger Group, Inc.(United States of America)(JV)	
Feasibility Studies, etc.	"Jaipur Water Supply and Sanitation Project Feasibility Study" Public Heath Engineering Department, State Government of Rajasthan, October, 2000 "Special Assistance for Project Implementation (SAPI) for Bisalpur Jaipur Water Supply Project (Transfer System)", JICA, October 2004	
Related Projects	"Capacity Development Project for Non-Revenue Water (NRW) Reduction in Jaipur"(August,2013-January, 2017) "Rajasthan Urban Infrastructure Development Project (RUIDP) (December, 1999 – June, 2009)	

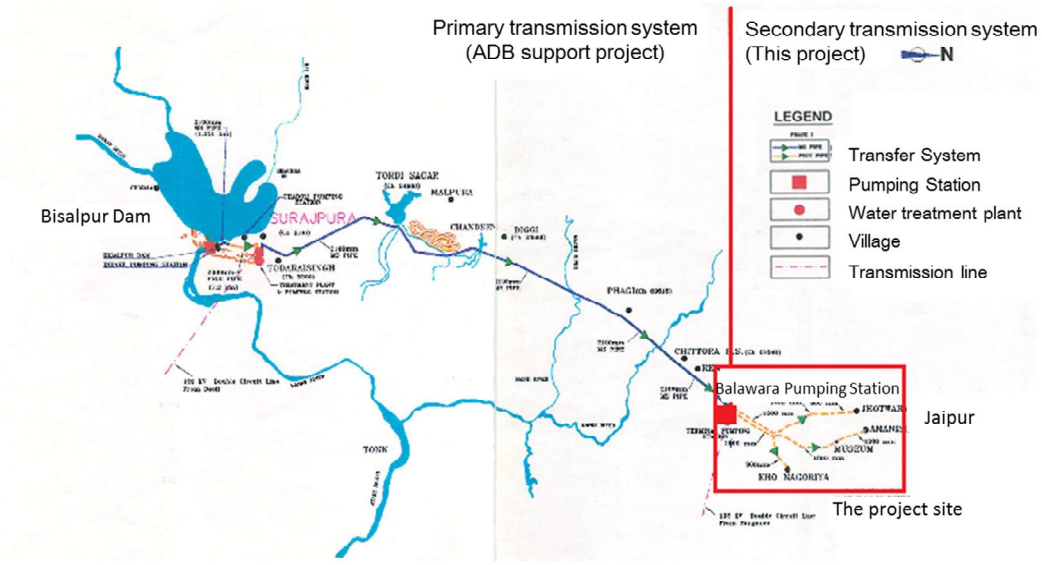

Figure 1. The Site of the Bisalpur Jaipur Water Supply Project

Source: Documents provided by PHED

2. Outline of the Evaluation Study

2.1 External Evaluator

Akiko Ishii, Ernst & Young Sustainability Co., Ltd.

2.2 Duration of Evaluation Study

The evaluation study was conducted as follows:

Duration of the Study: August, 2015 – September, 2016

Duration of the Field Study: November 18, 2015 – December 4, 2015, February 24, 2016– March 1, 2016

2.3 Constraints during the Evaluation Study

The project comprises eight packages of construction of transfer mains (packages 1 and 2), construction of pumping stations (packages 3 and 4), installation of Supervisory Control and Data Acquisition (SCADA) system (package 5), construction of electric supply facilities (package 6), upgrading existing distribution systems and construction of new distribution centers (package 7), and reducing Non-Revenue Water (NRW) measures (package 8). However, because the project cost exceeded the ceiling of the Japanese ODA Loan, packages 7 and 8 could not be covered by the Japanese ODA Loan and the decision was made to fund them from the Rajasthan state budget instead. Although the decision was made in the ex-post evaluation to include packages 7 and 8 as part of the project, the project efficiency was evaluated excluding packages 7 and 8 because the new distribution center planned under package 7 was still under construction at the time of ex-post

evaluation, and the level of completion of package 8 was unclear. Also, the information concerning the effectiveness of packages 7 and 8 was treated as a reference.

3. Results of the Evaluation (Overall Rating: B[5])

3.1 Relevance (Rating: ③[6])

3.1.1 Relevance to the Development Plan of India

Development Policy

At the time of appraisal, the development policy "Tenth Five Year Plan (2002-2007)" stipulated that every village should have access to drinking water within five years and a water supply for drinking purposes was considered the top priority over water supplied for irrigation and industry use. Furthermore, the "Master Development Plan-2011 Jaipur Region (1998)" prioritized a shift from groundwater to surface water and managing water resources effectively.

The country's development policy at the time of ex-post evaluation "Twelfth Five Year Plan (2012-2017)" stipulated that 60% of the country faced serious water quantity and quality issues and that urgent measures were required. In addition, the "Master Development Plan-2025 Jaipur Region (2011)" acknowledged the depletion of groundwater due to excess extraction and declining water quality as problems and stipulated the importance of taking measures against increasing water demand with the increasing population. The development policy estimated the water demand of the city in 2025 would be 1,170,000m^3 a day; 820,000m^3 of which would be supplied from Bisalpur Dam.

Sectoral Policy

The sectoral policy at the time of appraisal "National Water Policy 2002" prioritized supplying safe drinking water. At the time of ex-post evaluation, the revised version of the sectoral policy "National Water Policy 2012" stipulated that safe water for drinking and sanitation should be considered pre-emptive needs and stated that the domestic water supply should preferably be from surface water in conjunction with groundwater and rainwater.

Accordingly, the supply of safe drinking water and the shift in groundwater usage to surface water are emphasized in the national and city's development policy and the sectoral policy at the time of appraisal, as well as at the time of ex-post evaluation. Therefore, the project has been relevant to the development plan of India.

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

3.1.2 Relevance to the Development Needs of India

At the time of appraisal, the population ratio of Jaipur city served by water remained 68%, as opposed to 90% in all of India and 84% in the state of Rajasthan[7]. Moreover, the depletion of groundwater had been reported in part of the region, since 97% of the water supply in Jaipur city was dependent on groundwater and the amount of groundwater extracted exceeded the natural recharging volume. Furthermore, since the water in the city was sourced mainly from groundwater and had high nitrate concentration causing health problems such as methemoglobinemia, obtaining safe water sourced from surface water was an urgent issue for Jaipur city.

At the time of ex-post evaluation, the population ratio served with water had improved to 92% and the quality of water was also improved to meet the nitrate concentration standard, while dependency on groundwater was reduced to 19%. Conversely, with the population increase from 2.3 million in 2001 to 3.6 million in 2011, and 6.5 million expected in 2025[8], daily water demand is expected to increase to 1,170,000 m^3 by 2025, of which 820,000m^3 is expected to be supplied from Bisalpur Dam[9]. The estimated amount of water supplied from Bisalpur Dam in 2025 is 1.7 times the total volume at the time of ex-post evaluation. In response, establishing and expanding the water supply system became urgent issues.

Accordingly, from the time of appraisal to the time of ex-post evaluation, the development of water supply system has been consistently recognized as an important issue and high needs.

3.1.3 Relevance to Japan's ODA Policy

At the time of ex-post evaluation, the Japanese government stipulated priorities of "alleviating poverty by developing agriculture and rural areas" and "environmental conservation" for Japanese ODA loans towards India during the Policy Dialogue Mission on Economic Cooperation (March 2002). In addition, JICA's "Strategy for Overseas Economic Cooperation Operation (2002-2005)", also raised "rural development benefitting the poor" and "improving the environment and sanitary situation which have been severely deteriorated especially in urban areas" as important. Accordingly, the project targeting improved public sanitation and preserving the aquatic environment by developing the water supply system was consistent with Japan's ODA policy.

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7 Source: Documents provided by JICA

8 Source: Master Development Plan-2025 Jaipur Region (2011), Jaipur Development Authority https://www.jaipurjda.org/page.aspx?pid=201&mid=31

9 Source: Master Development Plan-2025 Jaipur Region (2011), Jaipur Development Authority https://www.jaipurjda.org/page.aspx?pid=201&mid=31

This project has been 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: ①)

3.2.1 Project Output

This project is comprised of eight packages. The original plan and actual output of the contents contained in each package are compared in Table 1, while the location of the transfer systems and pumping stations are shown in Figure 2.

Table 1. Comparison of original and actual scope

Package		Original (At the Appraisal)	Actual (At the Ex-post Evaluation)
1	Construction of transfer mains on central feeder (primary and secondary)	Total length: 95,597m	Total length: 75,114m
2	Construction of transfer mains on western and southern feeders (primary and secondary)	Total length: 77,843m	Total length: 69,507m
3	Construction of pumping stations at Balawala, Ramniwas Bagh and Amanishah	Three pumping stations at Balawala, Ramniwas Bagh and Amanishah	Mostly same as plan (Change in the specification of installed pump)
4	Construction of central, western and eastern booster pumping stations	Central/eastern: on-line booster pumping stations at Malviya Nagar and University Western: on-line booster pumping station	Central/eastern: Pumping station with storage reservoir at Jawahar Circle and on-line booster pumping station at Central Park Western: Pumping station with storage reservoir at Mansarovar
5	Installation of Supervisory Control and Data Acquisition （SCADA） system	11 units (Balawala main control center, intake pumping station, treatment plant, booster centers, distribution centers)	85 units (Balawala main control center 1, Sub monitoring centers 13, local control centers 71)
6	Construction of electric supply facilities	・ 132/33 kV station, two units ・ 132kVD/C distribution lines, two units	・ 132/33 kV station, one unit ・ 132kVD/C distribution line, one unit
7	Upgrading existing distribution systems and construction of new distribution centers	・ Three new distribution centers ・ Upgrading existing distribution systems: total length 70km	・ Three new distribution centers ・ Upgrading existing distribution systems: total length 70km
8	Implementation of reduction of Non-Revenue Water (NRW) measures	・ Installation of bulk meters at distribution centers ・ Installation of 100,000 consumer meters ・ Replacement of pipes with significant leakage problems	・ Implementation of pilot project of 24 hours' water supply and leakage test in the Mansarovar distribution zone (The installation of bulk meter is addressed in Table 2)

Source: Documents provided by JICA and PHED

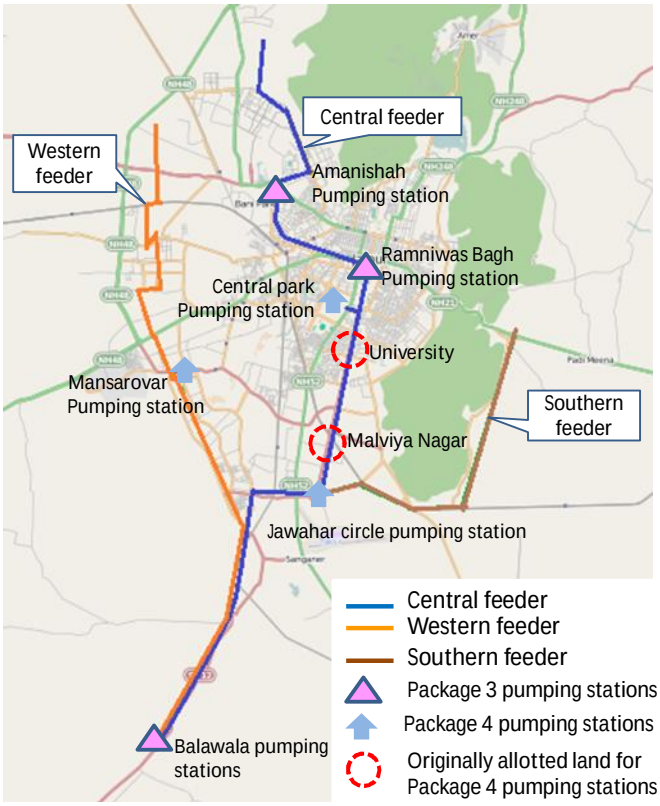

Figure 2. Overview of the Jaipur Water supply project site[10]
Source: Prepared by the evaluator based on documents provided by PHED

As shown in Table 1, the location of pumping stations was changed. In accordance with this change, the configuration of pumping stations and layout of water pipes were also changed. However, the water pipes distribute water to the zones as originally planned (details explained in Figure 2 and Table 2). Because the originally allocated land for pumping stations became unavailable, the change in the new location, configuration and specification of the facilities were made to supply water to the originally planned zones. These changes, which did not affect the function of the pumping stations and transfer mains, were thus justified as reasonable. The construction cost increased due to the changed configuration of the pumping stations and the price escalation caused by the project delay, which meant the project cost exceeded the ceiling of the Japanese ODA Loan. Exceeding the loan ceiling meant packages 7 and 8 could not be covered by the Japanese ODA Loan and the decision was made to fund them from the Rajasthan state budget instead. Under this situation, the decision to exclude those packages which would have minimal influence on the overall project effects from the scope of the Japanese ODA Loan and to implement them by the Rajasthan state budget was reasonable. The major reasons for the changes made for each package are listed in Table 2.

[10] The figure was prepared to show the relative position of transfer systems and pumping stations and does not show the exact location of these facilities.

Table 2. Major reasons for changes made to outputs

Packages 1 and 2: Changed layout of water pipe lines
Changes to the location and configuration of pumping stations as explained below caused changes to the layout of water pipes. Also, during detailed design, due to the lack of comprehensive information on terrain, hydrology, and underground buried objects used for the designing outline before starting the project, the design had to be revised to change the water pipe layout. According to PHED, although the total length of water pipe was shortened due to the above-mentioned revision and adjustment, the constructed water pipe lines supply water to the distribution zones as originally planned. Furthermore, the water pipe layout was changed even after the start of construction because of the structural change needed at two locations to traverse the river; and the change in route to avoid a major road, which had become unfeasible after the project delay to lay water pipes due to heavier traffic than at the time of appraisal.
Packages 3 and 4: Relocation and reconfiguration of pumping stations
a) Change in the location of pumping station The project took longer for the appointment of the consultant and detailed engineering and the construction start was delayed (Details described in "3.2.2.2 Project Period"). During the delay of the project, the land initially allotted for the pumping stations at Malviya Nagar and University was allotted for commercial purposes and became unavailable for this project. b) Change in the configuration of pumping station The pumping stations had to be reconfigured due to site restrictions at the new location, Jawahar circle and central park, to be constructed below ground level rather than above. c) Change in the configuration of on-line booster pumping facilities The relocation and reconfiguring of the pumping stations and water pipe lines meant the pressure condition changed and the on-line booster pumping facility originally planned became technically unfeasible. Accordingly, the water storage reservoir was constructed with the pumping stations.
Package 5: Increase in the number of installed SCADA systems
The installation of SCADA systems in each distribution center was not originally planned. However, to monitor the water distribution situation city-wide, including the distribution centers continuously from the main control center and control the distributed water at an appropriate pressure and volume, it was decided to install a SCADA system in each distribution center. Accordingly, the number of installed SCADA systems was increased.
Package 6: The number of substations and electricity transmission lines
The construction plan for electric supply facilities was changed in accordance with the change to the pumping station construction site. At the time of appraisal, the construction

for on-line booster pumping station was planned at Malviya Nagar and therefore the construction of substation and transmission lines were also planned to supply electricity to the pumping station. However, the pumping station was relocated to Jawahar circle from Malviya Nagar due to the unavailability of land. At Jawahar circle, two substations had been newly constructed near Jawahar circle during the delay of the project, which eliminated the need to construct a new substation and transmission facilities from the substation to supply electricity to Jawahar circle.
Package 7: Variation in the number of distribution centers and implementation of the package by the state government fund
The increased construction cost due to the reconfigured pumping stations and price escalation by an annual average of 12-13% in material and labor costs resulted in project costs exceeding the ODA Loan ceiling amount. Accordingly, it was decided to execute package 7 using the state government budget. At the time of ex-post evaluation, the construction of two distribution centers at Swage Farm and Kho Nagorian had been completed. Regarding the Swage Farm distribution center, although the construction was originally planned at Devi Nagar, the site was relocated to Swage Farm due to the unavailability of land at Devi Nagar. At Kho Nagorian, the construction launch originally scheduled for 2012 was delayed one year due to the delay in obtaining approval for land utilization from the Jaipur Development Authority. Construction of the remaining distribution center at Dev Nagar had not commenced at the time of ex-post evaluation due to opposition from local residents.
Package 8: Implementation of a 24-hour water-supply pilot project and leakage test by the state government. The number of installed flow-meters and the completion level of Non-Revenue Water (NRW) measures were unclear.
For the same reason as package 7, the project cost exceeded the ceiling amount of ODA Loan and it was decided to execute package 8 using the state government budget. For the component of NRW measures were originally planned as a pilot project in four among a total of 72 distribution zones, identification of pilot areas, a 24-hour water-supply pilot project, and the leakage test in the Mansarovar distribution zone were implemented. However, the actual number of flow-meters installed was unclear although 100,000 flow-meters were originally planned to be installed. As of July 2012, consumer meters were installed in approximately 340,000 households, an increase of 76,000 compared to 2007, although 37% were out of order[11]. In 2011, PHED introduced a new quality standard for the tender of consumer meters to improve the failure rate, which includes seven years'

[11] Benchmarking of Urban Water Supply Schemes of Rajasthan Milestone # 4: Problem Analysis and Remedial Measures –Jaipur City, Public Health Engineering Department, Government of Rajasthan, October 2012

operation and maintenance service after installing meters. Due to this change, no vender had participated in the tender since 2011, and therefore the consumer meters were not installed as planned. In February 2016, the vendor was selected and the decision to install 12,000 consumer meters was approved.

Regarding the NRW measures, the "Capacity Development Project for Non-Revenue Water (NRW) reduction in Jaipur" (August 2013 – January 2017) has been implemented after this project. This capacity development project supports PHED to strengthen the institutional capacity of the NRW reduction, provide technical training to detect leakage in the pilot area and establish a plan to expand NRW reduction measures city-wide. The pilot project of NRW was implemented in a limited area with installation of 1,144 consumer meters[12] as of July 2015 by Indian side.

Jawahar circle pumping station

Mansarovar pumping station

Ramniwas Bagh pumping station

Balawala main control center and SCADA monitor

12 Minutes of Meeting on the Capacity Development Project for Non-Revenue Water Reduction in Jaipur between the Public Health Engineering Department, Government of Rajasthan and JICA, November 27, 2014

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 12,113 million yen (the ODA Loan portion was 8,873 million yen) against the plan of 11,983 million yen (the ODA Loan portion was 8,881 million yen); 101% of the planned cost (Table 3). Although the total project cost was mostly as planned, the project cost was deemed to have exceeded the plan, given that packages 7 and 8 ended up outside the scope of the ODA Loan and partially remain incomplete; 113% of the planned cost excluding packages 7 and 8 (10,748 million yen). The planned budget was exceeded due to the increased construction cost caused by the delay in starting the project, reconfigured pumping stations, the changed layout of the water pipes and the price escalation.

Table 3. Planned and Actual Project Cost

Project Cost	Plan (million yen)		Actual (million yen) Note1), Note2)	
	Total	JICA Portion	Total	JICA Portion
1. Transfer mains	3,097	3,097	5,354	5,329
2. Pumping Stations	1,513	1,513	2,462	1,732
3. Distribution System	516	516	0	0
4. Supervisory Control & Data Acquisition (SCADA)	182	182	416	234
5. Electric Supply	1,052	1,052	689	593
6. Reduction of NRW	719	719	0	0
7. Price Escalation	536	536	1,087	144
8. Physical Contingency	379	379	17	0
9. Consulting Services	491	491	438	438
10. Tax & Duties	2,181	0	945	0
11. Administration Cost	741	0	254	0
12. Land Acquisition	180	0	33	0
13. Interest during Construction	396	396	359	359
Total	11,983	8,881	12,055	8,830

Source: Documents provided by JICA and PHED

Note1): The actual cost is based on the document provided by PHED. Because the JICA portion was shown in yen using the same exchange rate used at the time of appraisal in the document from PHED, the amount in yen was returned to INR and re-calculated at the IMF rate. Therefore, the total amount differs from the actual project cost previously mentioned.

Note2): Exchange rate used: JPY1 = 0.39 INR (At the time of appraisal) JPY1 = 0.43 INR[13] (At the time of ex-post evaluation)

3.2.2.2 Project Period

Because part of packages 7 remain incomplete, and the completion of the project planned under this Project was unclear since part of the project component is duplicated with the Technical Cooperation Project related to ODA Loan started in August 2013 as mentioned above, this makes it impossible to evaluate the project period including these packages. Accordingly, the project period is evaluated excluding the period for packages 7 and 8 as below. The actual project period, excluding packages 7 and 8, was 87 months from March 2004 to May 2011 as opposed to 46 months from March 2004 to December 2007. This was significantly longer than planned, constituting 189% of the planned project period.

[13] Source: Average IMF exchange rate between 2005 and 2013

Table 4. Planned and Actual Project Period

Item	Plan	Actual	Comparison
Signing of Loan Agreement	March 2004	March 2004	-
Completion of detailed engineering	February 2005	October 2007	-
Consulting services	October 2004 - December 2007 (39 months)	April 2005 - November 2009 (56months)	144%
Total project period	March 2004 - December 2007 (46 months)	March 2004 - May 2013[Note 1)] (87 months)	189%
Construction period of each package[14]			
Package 1	January 2006 - December 2007 (24 months)	February 2007 - November 2010 (46 months)	191%
Package 2	January 2006 - December 2007 (24 months)	July 2007 - July 2010 (37 months)	154%
Package 3	January 2006 - December 2007 (24 months)	July 2007 - December 2010 (42 months)	175%
Package 4	February 2006 - December 2007 (23 months)	October 2007 - December 2010 (39 months)	170%
Package 5	February 2006 - December 2007 (23 months)	April 2008 - July 2010 (28 months)	122%
Package 6	February 2006 - December 2007 (23 months)	Unknown[Note2)] - May 2011	-
Package 7	January 2006 - December 2007 (24 months)	Partly incomplete	-
Package 8	February 2006 - December 2007 (23 months)	Completion is unclear	-

Source: Documents provided by JICA and PHED

Note 1) Because package 7 is partly incomplete and the completion level of package 8 is not clear, the project period for packages 1 to 6 was used to calculate the ratio compared to the planned project period

Note 2) The construction of electric supply facilities was awarded to state power companies in December 2006. The start date of construction is unknown due to the unavailability of documents.

Major reasons for the delay were as follows:

1. The primary transmission system from the intake to the pumping station at the entrance point of Jaipur city, which was implemented with support from ADB loan,

[14] The actual completion dates indicated are those of the takeover certificate issued by the department to the respective contractors tasked with operation and maintenance, rather than the actual completion date of construction. (Source: Documents provided by PHED)

was necessary to implement this project, which meant approval of ADB loan for the primary transmission system was a prerequisite for the effectuation of JICA's loan agreement for this project. Due to the delay in ADB loan approval by six months compared to the original plan, the signing of the agreement with a consultant was also delayed by a similar period.

2. The lack of required information on terrain, hydrology and underground buried objects from the relevant organizations extended the time required to conduct detailed engineering, which caused seven months of delay.
3. During the above-mentioned project delay, the land initially allotted land for the pumping stations at Malviya Nagar and University was freed up for commercial purposes and no longer available for this project. Thus, the pumping stations had to be relocated and reconfigured and also led to site restrictions at Jawahar circle and central park, which means pumping stations had to be constructed below ground level for scenic reasons. More time was required to conduct detailed engineering for the pumping station and the layout of water pipes, which resulted in further delay over three months.
4. Considerable time was required when constructing water pipes along major roads and railway crossings to obtain permission from the authority agencies. In particular, the above-mentioned delay resulted in increased population and traffic volume during the delay, which forced a change of plan for water pipelines along major roads with heavy traffic and areas with a high population density. Consequently, obtaining construction permission from the authority agencies took a very long time.

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) was calculated as 8.3% and the Economic Internal Rate of Return (EIRR) was calculated as 16.5%. At the time of ex-post evaluation, FIRR was calculated at 5.0% and EIRR at 12.0% under the same condition used at the time of appraisal. Despite the estimation of a higher water tariff in the future when calculating the IRR at the time of ex-post evaluation, the actual NRW was higher than planned, which was set low based on the national target and used when calculating the IRR at the time of appraisal, whereupon water revenue was lower than planned. However, due to the high failure rate as explained later, the NRW is inaccurate. The condition used for the IRR calculation at the time of appraisal is shown in Table 5.

Table 5. Condition for calculation of FIRR and EIRR at the time of appraisal

	Condition for FIRR Calculation at the Time of Appraisal	Condition for EIRR Calculation at the Time of Appraisal
Cost	Initial investment, additional investment, operation and maintenance costs	Initial investment and operation and maintenance costs excluding tax and duties
Benefit	Revenue from incremental sold water valued at assumed tariff rates (based on the future water tariff)	Cost for PHED-connected households obtaining water from other sources and cost for Non-PHED connected households obtaining water from other sources
Project Life	30 years	30 years

Source: Documents provided by JICA

The project cost exceeded the plan and project period significantly exceeded the plan. Therefore, efficiency of the project is low.

3.3 Effectiveness[15] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

At the time of appraisal, operation and effect indicators were set as targets for four years after completion. At the time of ex-post evaluation (2015), four years had elapsed since the completion of pumping stations, water pipes and electric supply facilities in May 2011. Accordingly, the quantitative effects were evaluated based on indicators set at the time of appraisal.

(1) Operation Indicators

The baseline (2003), Target (four years after completion), actual data one year after completion (2012) and actual data at the time of ex-post evaluation (2015) for operation indicators were summarized in Table 6. The population served, amount of water supply, facility utilization rate and water intake from Bisalpur Dam achieved the targets. Because both population served and the amount of water supplied exceeded the target, it can be said that the water supply facility constructed by this project significantly contributed to a stable water supply by transmitting and transferring water from a new water source, namely Bisalpur Dam. Conversely, it can be said that the NRW rate, accounted for water rate, and leakage rate were inaccurate because the failed consumer meters have not been fully replaced. Therefore, the actual data of these indicators are considered reference information.

[15] Sub-rating for Effectiveness is to be put with consideration of impact.

Table 6. Baseline, Target and Actual of Operation Indicators

	Baseline	Target	Actual	Actual
	2003		2012	2015
	At the Time of Appraisal	4 Years after Completion	1 Years after Completion	At the time of Appraisal
Population served (persons)	1,801,514	2,766,646	2,970,000	3,000,000
Amount of water supply (m^3/day)	345,030	477,500	372,200	480,000
Facility utilization rate (%)	N.A.	95.13	83.33	100.00
NRW rate (%)	37.0	20.0	35.0 Note1	37.0 Note3
Accounted for water rate (%)	63.0	80.0	70.0 Note2	63.0 Note4
Leakage rate (%)	30.0	15.0	28.0	13.0 Note5
Water intake from Bisalpur Dam (m^3/day)	N.A.	342,500	300,000	396,000

Source: Documents provided by JICA and PHED

Note 1-2: The data is based on the Project Completion Report provided by PHED. The value is shown as a reference since it seems inaccurate because the total amount does not reach 100.

Note 3-5: The data is provided by the PHED. However, the study[16] conducted in the four distribution zones from May 2014 to July 2015 showed that 45-81% of the consumer meters were out of order. Therefore, there is a high possibility that these indicators were not measured accurately.

(2) Effect Indicators

As shown in Table 7, the percentage of population served exceeded the target by 10%, while the water supply per capita also exceeded the target by 15%. The dependency rate on groundwater was limited to 19% as opposed to 97% before the project implementation, and exceeded the target by 5%. Furthermore, the water quality was improved by alternating the groundwater with surface water and the nitrate content declined significantly to a level below 45mg/L which is the quality standard of drinking water set by the Bureau of Indian Standards.[17] Accordingly, it was confirmed that the water supply facility constructed by the project helps supply safe drinking water and reduce the groundwater dependency rate.

16 Based on the study result conducted in Mansarovar, Adarsh Nagar, Chitrakoot, Banipark by "Capacity Development Project for Non-Revenue Water (NRW) reduction in Jaipur", the failure rates for the consumer meters in each zone were 45.3, 80.3, 77.0 and 81.0%, respectively.

17 Indian Standard Drinking Water Specification (Second Revision), Bureau of Indian Standards, May 2012 https://law.resource.org/pub/in/bis/S06/is.10500.2012.pdf

Table 7. Baseline, Target and Actual of Effect Indicators

	Baseline	Target	Actual	Actual
	2003		2012	2015
	At the time of Appraisal	4 Years after Completion	1 Years after Completion	At the time of Appraisal
Percentage of population served (%)	70.1	81.4	82.6	91.7
Water supply per capita to consumer (L/person/day)	121	138	125	160
Dependency rate of groundwater (%)	97.0	24.1	19.0	18.8
Water Quality (Nitrate content）（mg/L）	28-230	Below 45	Below 45	Below 45

Source: Documents provided by JICA and PHED

3.3.2 Qualitative Effects (Other Effect)

The effects in terms of (1) improved water quality, (2) improved water supply services (volume, service hours) raised as qualitative effects at the time of appraisal are described below:

(1) Improvement of water quality

Before the project implementation, the nitrate content in the supplied groundwater attributed to nitrate nitrogen in the soil was significantly high, which caused health problems in Jaipur city. After the project was implemented, water supply from the well was stopped at 80% of distribution centers and alternated by water from Bisalpur Dam. Following this change, the nitrate content in the water supplied was reduced to a level meeting the quality standard for drinking water. In addition, the quality of water supplied from all distribution centers was controlled to meet the drinking water standard by sampling and testing quality at the laboratory once a week.

(2) Improvement of water supply system (volume and time)

The per-capita volume of water supplied at the time of ex-post evaluation was increased by 32% compared to before the project implementation and exceeded the target by 15% as shown in Table 7. The result of a beneficiary survey[18] conducted at the

[18] To complement efforts to evaluate the quantitative effect and impact, a beneficiary survey was conducted among 100 neighbours at eight distribution zones (number of persons at each zone); Pratap Nagar (20), Vidhyadhar Nagar (17), Mansarovar (22), Jhotwara (15), Khatipura (4), Jawahar Nagar (15), Vaisali Nagar (4), Sahstri Nagar (3). Based on the discussion with PHED, eight distribution zones which were supplied water from this project were selected considering the geographic dispersion. Despite visiting households randomly in each distribution zone, judgement sampling was used considering the gender and age distribution among the respondents. The respondents included 45 males and 55 females, 18 of whom were aged below 30 years old, 17 between 31 and 40, 25 between 41-50, 20 between 51-60 and 20 respondents aged above 61.

time of ex-post evaluation among 100 beneficiaries at eight locations in Jaipur city showed that 38% of respondents were highly satisfied and 32% were satisfied with the volume of water supply (Table 8). Although the duration of water supply at the time of ex-post evaluation (1.5-2 hours) showed no significant difference from the duration at the time of appraisal (1.5 hours), 29% of respondents were highly satisfied and 36% were satisfied with the duration of water supply a day according to the result of the beneficiary survey (Table 8). Because residents in Jaipur city stored water for a day in a storage tank equipped to individual households, they tend to be satisfied with water supplied regularly on a daily basis, without any dissatisfaction over the duration of water supply.

Table 8. Satisfaction with the water supply volume and the daily duration of water supply

【Question】	Highly satisfied	Satisfied	Fair	Not satisfied	Not satisfied at all
How satisfied are you with the current volume of water supply?	38%	32%	14%	11%	5%
How satisfied are you with the current duration of water supply a day?	29%	36%	11%	22%	2%

Source: Results of the beneficiary survey

3.4 Impacts

3.4.1 Intended Impacts

(1) Improvement in living standards and public hygiene conditions

At the time of appraisal, improvement in living standards and public hygiene conditions among residents due to improvements in water quality were expected. Since residents of the project site had already been provided with water supply services via individual water pipe connections, even before project implementation, the type of water supply services remained unchanged before and after project implementation. Therefore, it cannot be said that the residents and beneficiaries of the project were fully aware of the relation between the project effect on improving living standards, the living environment and public hygiene conditions. However, 73% of the respondents stated that the living environment had improved (Table 9) and 76% stated that public conditions had improved (Table 9) following the implementation of the project according to the result of the beneficiary survey. With regard to living environment, “became convenient due to water supply at a regular time”, “sufficient water can be stored in the storage tank” were cited as examples of improvement. For public hygiene condition, “fewer incidents of sickness”, “cleaner laundry”, “less floating substances detected in the water” were raised as the reasons for improvement.

Table 9. Improvement in living standards (environment) and public hygiene conditions

【Question】	Significantly improved	Improved	Same	Worsened	Significantly worsened
Has the living standard (environment) improved?	10%	63%	17%	10%	0%
Has the public hygiene condition improved?	13%	63%	15%	9%	0%

Source: Result of the beneficiary survey

(2) Mitigation of the deterioration of groundwater level by reducing groundwater usage

Mitigating the deterioration of groundwater level by alternating groundwater usage with transferred water from Bisalpur Dam was expected as an impact of this project. As described in "3.3.1 Quantitative Effects (Operation and Effect Indicators)", the 97% dependency rate of groundwater before the project implementation was reduced to 19% afterward. The water supply sourced from groundwater was 334,679m^3 per day before project implementation but reduced to 90,240m^3 per day after, marking a reduction in groundwater usage of 244,439m^3 per day. Furthermore, it was expected that 465,600m^3 per day of groundwater would be required in 2015 if groundwater were supplied keeping pace with the same groundwater dependency, to cope with increasing demand for water in Jaipur city, and thus it can be said that 375,360m^3 per day of groundwater was saved by the project implementation. Accordingly, it can be said that the effect of the project on reducing deterioration in the groundwater level and conserving the groundwater is significantly high.

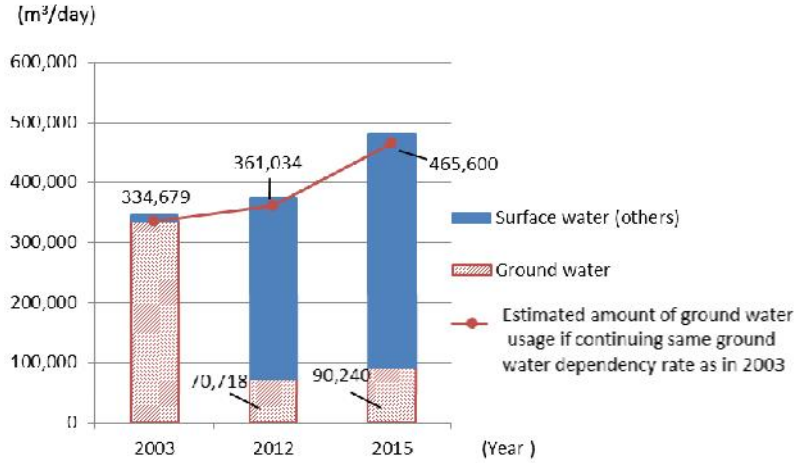

Figure 3. Change of amount of water supply and water source

Source: Prepared based on documents provided by PHED

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

This project was implemented to supply surface water from the existing Bisalpur Dam, which had been constructed to supply drinking water to Jaipur city before the

project implementation. Therefore, there was no negative impact on ecosystem expected by the project implementation. Also, the project was classified into Category B based on the "Environmental Guidelines for ODA Loans (1999)" （JICA）, reflecting the view that the project had no significant environmental impact. According to the Environmental Guidelines of the Government of India, an Environmental Impact Assessment (EIA) report and environmental clearance need not be prepared for this project, although PHED prepared an EIA report in 2000, in which environmental impact mitigation measures and a monitoring plan were established. Based on feedback following interviews among residents and a site visit, no negative environmental impacts have been observed during and after the project implementation.

In terms of the positive impact on the natural environment, the project contributed to mitigate depletion in the groundwater level by significantly reducing the amount of groundwater usage as described in "3.4.1 Intended Impacts".

3.4.2.2 Land Acquisition and Resettlement

Because the land acquired for this project implementation was originally owned by the state government, no procedures under the Land Acquisition Act were required, nor any resettlement as a result of this project.

As described above, targets were achieved for major effect indicators of this project, including the percentage of population served with water in Jaipur city, water supply per capita, dependency rate of groundwater, and water quality. In terms of the improvement of living standards and public hygiene conditions, these were recognized by the residents as constituting positive impacts, although the direct relation between these indicators and the project remained unclear. Furthermore, the positive impact of mitigating the depletion of groundwater level by reducing the amount of groundwater pumped was observed.

This project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

PHED is responsible for developing, operating and maintaining of water supply facilities and collecting water bills in Rajasthan. At the time of ex-post evaluation, of a total 38,004 PHED employees, the number of engineers and technical staff were 3,275 and 28,531, respectively. The coordination team is also organized by area under chief

engineer. PHED Jaipur, the state agency of Jaipur, is divided into four departments, Circle North, Project Circle, City Circle South and District. All departments except District are responsible for the distribution of water throughout the Jaipur city and for the operation and maintenance (O&M) of facilities, including water pipes, pumping stations, SCADA and water distribution centers, all which were built under this project. At the time of ex-post evaluation, 1,919 PHED Jaipur employees were working for the O&M of project-related facilities. In addition, for the first few years, PHED outsources those O&M to the contractors who were engaged in constructing the facilities, in accordance with the laws and regulations of Rajasthan related to public services and staff appointments[19]. In fact, PHED had a two-year contract of the O&M with the contractors who engaged in the construction and selected a contractor by bidding afterwards. At the time of ex-post evaluation, November 2015, PHED made a bid for the O&M for the next five years. As a result, the current contractor has been selected again and continued its O&M. At the time of post-evaluation, the structure of O&M was well organized and adequate human resources had been secured. Therefore, no concerns were raised.

3.5.2 Technical Aspects of Operation and Maintenance

PHED is an organization overseeing the O&M of water supply facilities in Rajasthan and more than 80% of its employees are engineers or technical staff. PHED regularly sends its employees to take technical training at the Engineer's Staff Training Institute of the state training facility, which provides technical training related to water supply and sewerage, including computer skills and O&M.

The O&M of the project facilities have been outsourced to the contractor, who is selected under bid evaluation criteria requiring adequate technical skills and past performance. The O&M of the project facilities were conducted appropriately following the manual and no technical issues were observed at the time of ex-post evaluation.

3.5.3 Financial Aspects of Operation and Maintenance

The O&M budget of the project facilities is shown in Table 10. Water supply service of Rajasthan state is not financially independent but positioned as a public service, and the necessary O&M budget is allocated every year from the state budget. No issues arose during the procurement of spare parts. It was recognized that the O&M budget for the project facilities was appropriately ensured and there were no concerns regarding the same.

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[19] Rajasthan (Regulation of Appointments to Public services and Rationalization of Staff) Act.1999 http://finance.rajasthan.gov.in/aspxfiles/docs/rules/rapsar/rapsaract.pdf

Table 10. Annual O&M budget for the project facilities (Unit: 1,000INR)

	2012-2013	2013-2014	2014-2015	2015-2016
Annual O&M budget	287,544	411,206	384,309	289,975

Source: Documents provided by PHED
Note: Fiscal year is from April to March. For 2015, the data is up to end of October.

The financial status of PHED for the most recent three years is shown in Table 11. Because sales of water, have been far below direct expenses, including O&M costs, PHED has remained in persistent deficit and has declared a net loss. The water supply service of Rajasthan state is not financially independent but positioned as a public service, and its operation depends on the central government budget. One reason for this deficit is the fact that the water tariff for Rajasthan state has not been increased since 1998 and remains extremely low by Indian standards. However, water tariff of the state was revised in October 2015 after 17 years and raised by half in all sectors, including domestic, non-domestic and industry. In addition, it was announced that the water tariff would continue to increase by 10% annually for five years until the next review[20]. According to the PHED, it was planned to reduce the gap between expense and income gradually by increasing the tariff by 10% annually, considering annual inflation of around 8%. Although the water supply service is not expected to be financially independent, revising the water tariff can be considered a positive step toward improving the financial status.

Table 11. Financial status of PHED in past three years [Note]

(Unit: Million INR)

	2012-2013	2013-2014	2014-2015
Income			
Sales of water including meter rent	2,062	2,137	2,239
Miscellaneous Receipts	199	173	189
Total Income	2,261	2,309	2,428
Expenditure			
Direct Expense	9,136	10,306	10,416
Indirect Expense	3,203	3,544	3,795
Total Expenditure	12,339	13,850	14,211
Net profit and loss	-10,077	-11,541	-11,783

Source: Documents provided by PHED
Note: The year is based on PHED's fiscal year from April to March

3.5.4 Current Status of Operation and Maintenance

[20] Public Health Engineering Department Notification, Jaipur November 5, 2015, No. F/FA&CAO/RWSSMB/Mission/2014-2015

In general, the project facilities have been utilized and maintained without problems. During the site survey, it was confirmed that pump and SCADA systems at all pumping stations and distribution centers were operated proficiently and the condition of transferring and distributing water in particular was constantly controlled by utilizing a SCADA system. The O&M contractor also monitored and recorded the operating condition of the transfer mains daily as well as recording the pumps and SCADA data on an hourly basis. The specification, storage method and inventory number for spare parts of facilities were decided by PHED. The O&M contractor procured spare parts as necessary following the procedure provided by PHED and maintained equipment without problem. In addition, monitoring and O&M records of the project facilities were submitted to PHED in the form of a monthly report. The manual related to O&M of facilities was proficiently managed and there was no problem observed in O&M.

In light of the above, no major problems were observed in the O&M system for PHED or the contractor. PHED has provided opportunities to employees to take a series of technical training and selected a contractor based on the past performance record for O&M services of water supply facility. Manuals were also prepared and utilized proficiently, which meant no major problems emerged in O&M, from a technical perspective. In terms of the financial aspects, the necessary budget for O&M of the project facilities and equipment was allocated from the state budget of Rajasthan and no concerns were observed. To improve the financial status, there are plans to raise the water tariff.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project[21] was to provide a stable and safe drinking water supply in Jaipur city, which is the capital of Rajasthan state, located in the northwestern part of India, by constructing and renovating related water supply facilities, such as water purification, transfer system and distribution systems, based on surface water from the existing Bisalpur Dam, located 120km from Jaipur city. Thereby the project would contribute to improve public hygiene standards and mitigate deterioration of the

[21] The project was implemented with co-financing from JICA and ADB; with a primary transmission system by ADB and a secondary transfer system by JICA.

groundwater level.

The project has been relevant to the country's development policy, which stipulated the importance of supplying safe drinking water and mitigating deterioration of groundwater levels due to excess extraction, the development needs, as well as Japan's ODA policy. Therefore its relevance is high.

Implementing the project allowed the amount of water supplied and population served to meet the targets. Furthermore, the groundwater in Jaipur city, which had a high nitrate concentration and caused health problems before the project implementation, but the water quality was improved to meet the drinking water quality standards by alternating the water source from groundwater to surface water and the dependency ratio of groundwater was also significantly reduced to exceed the target level. Accordingly, the effectiveness and impact of the project are high.

The project period was significantly longer than planned due to the delay in starting operations of consultants and longer time required to redesign the water pipe layout and pumping station caused by the relocation of pumping stations. The configuration change in the pumping stations and delays to the project caused increase in the construction cost and price escalation, thus the project cost also exceeded the planned cost. Therefore, efficiency of the project is low.

The operational and maintenance conditions of the project facilities, including the pumping stations and water pipes, were good, with no major problems observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

・The effect on improving the water supply service, including the amount of water supply and water quality, was recognized by transferring surface water from Bisalpur Dam. Conversely, the ratio of Non-Revenue Water (NRW) remains high. To use water transferred by the project effectively and increase revenue from the water tariff to improve the financial status, PHED is expected to take measures to reduce NRW, including installing a flow meter and changing water pipes which leak continuously. In terms of NRW reduction, Technical Cooperation Project related to ODA Loan, which aims to expand NRW city-wide, is under implementation as mentioned above. It is expected that the Rajasthan state government will implement the NRW measures and disseminate them throughout the city based on the project expansion plan which is currently under preparation by that project.

・The revision of the water tariff by PHED in November 2015, ever since 1998, is recognized as a positive point to be evaluated. In addition, it was also announced that the water tariff would keep rising by 10% every year from 2016 until the next review planned after five years. Although the water supply service of Rajasthan state is not financially independent, PHED is expected to revise water tariff as planned to ensure the sustainability of the project.

4.2.2 Recommendations to JICA

As mentioned above, the measures to reduce NRW is crucial to use surface water transferred and distributed by the project from Bisalpur Dam effectively and also to assure project sustainability. It is also considered very important to implement the technical assistance project of JICA "Capacity Development Project for NRW reduction in Jaipur" which is under implementation during the ex-post evaluation and strengthen the technical and institutional capacity of PHED to implement NRW reduction through the project to maintain project sustainability.

4.3 Lessons Learned

Operation and Maintenance by the contractor engaged in construction

In the project, O&M of the project facilities were outsourced to contractors, who then engaged in construction for the first two years after completing construction as a defect liability period. By a contractor with the necessary expertise and technical capacity to handle the facilities and equipment, the project facilities were operated and maintained well. The technical know-how, manual, records, reporting systems and procedures regarding O&M established over two years were continuously used to set the bidding conditions for selecting contractors and O&M system afterwards, and were thus considered effective for other projects to ensure sustainability.

Information sharing of the project plan with concerned entities

The project period was significantly longer than planned at 189%. One of the major reasons is because land initially allotted to construct pumping stations was used for another purpose and became unavailable for the project. The other reasons were the increased length of time to obtain permission to construct water pipes along major roads and railway crossings from authority agencies. In addition, construction of a distribution center under package 7, which was under implementation using the PHED budget at the time of ex-post evaluation, was delayed due to the delay in obtaining permission for land use. Considering that all permissions causing delay were for state-owned land, it was expected that the delay would have been mitigated to a certain extent if information

sharing and coordination among the entities concerned had been established well before starting the project. When implementing a similar project, it is desirable that the executing agency would put its utmost attention to share information and coordinate with concerned entities, such as the Jaipur Development Authority.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1.Project Outputs Package: Item		
1 Construction of transfer mains on central feeder (primary and secondary)	Total length: 95,597m	Total length: 75,114m
2 Construction of transfer mains on western and southern feeder (primary and secondary)	Total length: 77,843m	Total length: 69,507m
3 Construction of pumping stations at Balawala, Ramniwas Bagh and Amanishah	3 pumping stations at Balawala, Ramniwas Bagh and Amanishah	Mostly same as plan
4 Construction of central, western and eastern booster pumping stations	Central/eastern: on-line booster pumping stations at Malviya Nagar and University Western: on-line booster pumping station	Central/eastern: Pumping station with storage reservoir at Jawahar Circle and on-line booster pumping station at Central Park Western: Pumping station with storage reservoir at Mansarovar
5 Installation of Supervisory Control and Data Acquisition （SCADA） system	11units (Balawala main control center, intake pumping station, treatment plant, booster centers, distribution centers)	85 units (Balawala main control center 1, Sub monitoring centers 13, local control centers 71)
6 Construction of electric supply facilities	・132/33 kV station, 2 units ・132kVD/C distribution lines, 2 units	・132/33 kV station, 1unit ・132kVD/C distribution line, 1 unit
7 Upgrading existing distribution systems and construction of new distribution centers	・3 new distribution centers ・ Upgrading existing distribution systems: total length 70km	・2new distribution centers ・ Upgrading existing distribution systems: total length 70km
8 Implementation of reduction of NRW measures	・ Installation of bulk meters at distribution centers ・ Installation of 100,000 consumer meters ・Restoration of pipes which have high leakage problems	・Implementation of pilot project of 24 hours water supply and leakage test in the Mansarovar distribution zone (The installation of bulk meter is addressed in Table 2)
Consulting Services	1) Project Management 2) Design and Supervision 3) PR	1) Project Management 2) Design and Supervision 3) PR (Contract was terminated during the project period by finishing M/M, which was used mostly for redesigning.)
2.Project Period	March 2004 – December 2007 (46 months)	March 2004 – May 2011 (87 months)
3.Project Cost Amount Paid in Foreign Currency Amount Paid in Local currency Total Japanese ODA Loan Portion Exchange Rate	 4,229 million yen 7,754 million yen (3,024 million INR) 11,983 million yen 8.881 million yen 0.39 INR = 1 yen (As of August 2003)	 541 million yen[22] 11,514million yen (4,950 million INR) 12,113 million yen 8,873 million yen 0.43 = 1 yen (Average between January 2005 and December 2013)

[22] The actual cost is based on a document provided by PHED. Because the JICA portion was shown in yen using the same exchange rate used at the time of appraisal in the document from PHED, the amount in yen were returned to INR and re-calculated using the IMF rate, hence the total amount differs from the actual project cost previously mentioned.