Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan Project

"Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project"

External Evaluator: Hirofumi Tsuruta, Octavia Japan Co., Ltd.

0. Summary

This project aimed to restore the function and to ensure the sustainability of the existing facilities as well as to improve and strengthen the operation and maintenance (hereinafter referred to as "O&M") system by assisting the capacity development of O&M agencies[1] through the rehabilitation of the past completed loan projects in the water resources sector such as the rehabilitation of the river facilities in upper Solo River basin, the countermeasures against sedimentation of the multipurpose dams and the rehabilitation of the river facilities in Brantas River basin, and the recovery of Ular River irrigation that were highly emergent and needed. Because the project is consistent with Indonesia's National Medium Term Development Plan to prioritize the development, management and infrastructure improvement of water resources, Indonesia's national needs and Japan's aid policy, the relevance of the project is high. On the other hand, although project costs were within budget, the project period was significantly longer than had been planned. Thus, the efficiency is fair. The effectiveness and impact are high, because alleviation of flood suffering in the upper Solo and Brantas River basins and increased rice production in the Ular River irrigation have been observed, as well as because living standards of neighboring residents have been enhanced. The sustainability of the project is fair as minor institutional, technical, and financial problems arose: although the facilities and equipment rehabilitated by the project had been for the most part properly operated and maintained, the demarcation of responsibilities among O&M agencies was somewhat unclear and O&M agencies had insufficient experience with preventive maintenance and would not have been able to conduct large-scale rehabilitation without external financial resources.

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

1. Project Description

Project Locations

Revetment and riverbed repaired by the project (O&M agencies and residents remarked, "river flow became smooth", etc.)

[1] They are Directorate General for Water Resources of Ministry of Public Works and Housing (hereinafter referred to as "Ministry of Public Works") and Solo River Basin Management Offices (hereinafter referred to as "RBO"), Brantas RBO and Sumatra II RBO under the direct control of Ministry of the Public Works.

1.1 Background

Indonesia is a tropical monsoon climate country and has an average annual rainfall of 1,500–4,000 mm. The rainy season (from November to March) accounts for about 80% of annual rainfall. During the rainy seasons floods and landslides that occur in various locations substantially damage the social economy of Indonesia. Furthermore, the absolute amount of water resources available has been insufficient with increasing the residential and manufacturing demand (for example, the water demand increased from 156.0 billion m^3 per year in 2003 to 356.5 billion m^3 per year in 2015[2]). Appropriate water resources management is thus increasingly important.

For such needs, from the time of appraisal to the current ex-post evaluation, the improvement of the basic infrastructures for water resources has been challenges. The Indonesian government has developed various regulations in regard to water resources control and preservation and promoted long-term comprehensive water resources management and development. In particular for the development of the major rivers like this project, the Indonesian government has promoted the infrastructure developments including construction of multipurpose dams, flood control measures and development of irrigation systems in river basins in cooperation with the Japanese government, the World Bank, and other entities since 1960s.

However, the development of infrastructures remains insufficient. Interviews with the Ministry of Public Works indicated that while Presidential Order No. 12 of 2012 (regarding decisions pertaining to river basins) specifies about 55% of the total domestic river shoreline of 19,710 km as the rivers that should be protected (including the ones that had already been protected), most rivers have been neither protected nor improved. As well, while it is estimated that about 7 million ha can be irrigated in Indonesia, one-quarter of this area has not been developed and is not functional at present.

In addition, as for existing facilities and equipment, the number of facilities and equipment with 30-year passed after the construction had increased since 1990s, and they have become increasingly decrepit and have deteriorated their function. Moreover, due to chronic financial shortages and the Asian Financial Crisis of the late 1990s, facilities and equipment have not been well maintained, accelerating the deterioration. As a result, the quality of the public services was reduced. To ameliorate this, restoring the functioning of these existing facilities and strengthening the capacity of relevant O&M agencies were urgently necessary.

1.2 Project Outline

This project aimed to restore the function and to ensure the sustainability of the existing facilities as well as to improve and strengthen the operation and maintenance (hereinafter referred to as “O&M”) system by assisting the capacity development of O&M agencies through the rehabilitation[3] of the past completed loan projects in the water resources sector such as the rehabilitation of the river facilities in upper Solo River basin, the countermeasures against sedimentation of the multipurpose dams and the

[2] WEPA: Water Environment Partnership in Asia, “State of Water Environmental Issues,” http://www.wepa-db.net/policies/state/indonesia/indonesia.htm (accessed March 2015).

[3] “Rehabilitation” includes not only physical repair of existing facilities and equipment, but also recovery and supplements of their function. Thus, the project included new construction needed for the recovery and supplements.

rehabilitation of the river facilities in Brantas River basin in Central and East Java Provinces, and the recovery of Ular River irrigation in North Sumatra Province that were highly emergent and needed, thereby contributing to stabilizing the life of residents and enhancing their living standards.

Loan Approved Amount/ Disbursed Amount	14,696 million yen/13,784 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	March 2002/October 2002	
Terms and Conditions	Interest Rate	1.8%
	Repayment Period	30 years (Grace Period: 10 years)
	Conditions for Procurement	General untied (Bilateral tied for consulting services)
Borrower/ Executing Agency (ies)	Government of Republic of Indonesia /Ministry of Public Works (The present Ministry of Public Works and Housing)	
Final Disbursement Date	August 2012	
Main Contractors (over 1 billion yen)	PT. Adhi Karya (Indonesia)/PT. Istaka Karya (Indonesia) (JV), PT. Brantas Aripraya (Indonesia)/PT. Hutama Karya (Indonesia) (JV), PT. Nindya Karya (Indonesia)/PT. Pembanunan Perumahan (Indonesia)/PT. Hutama Karya (Indonesia) (JV), PT. Waskita Karya (Indonesia)/PT. Wijaya Karya (Indonesia)/PT. Adhi Karya (Indonesia) (JV)	
Main Consultants (over 100 million yen)	Nippon Koei Co., Ltd. (Japan)/Yachiyo Engineering Co., Ltd. (Japan)/ Nikken Consultant Inc. (Japan)/PT. Tata Guna Patria (Indonesia)/PT. Tri Tunggal Konsultant (Indonesia) (JV)	
Feasibility Studies, etc.	"Assistance Effectiveness Promotion Study on Rehabilitation Projects of Karangkates Dam Construction Project and others" (2001)	
Related Projects	【Loans】(The years in which the relevant loan agreements were signed are given within parentheses. In certain cases, loan agreements were signed multiple times in a single year; for these cases, the number of times is given within brackets.) - Wonogiri Multipurpose Dam Project (1976, 1977 [twice]) - Madiun River Urgent Flood Control Project (1985) - Upper Solo River Improvement Project (1985) - Countermeasures against Sediment in the Wonogiri Multipurpose Dam Reservoir (I)(II) (2009, 2014) - Karangkates Multipurpose Dam Project (1968, 1969 [twice], 1970, 1971) - Karangkates Hydropower Station Project (I)(II) (1970 [twice], 1971, 1973) - Karangkates Second Stage Development Project (1974, 1975) - Wlingi Multipurpose Dam Project (I)–(III) (1975, 1976 [twice]) - Brantas Middle Reaches Improvement Project (I)(II) (1979, 1985) - Kali Porong River Improvement Project (1970, 1971, 1976) - Porong River Rehabilitation Project (1988) - Mt. Kelud Urgent Volcanic Disaster Mitigation Project (1991) - Ular River Improvement Project (1971) - Ular River Improvement and Irrigation Project (1981) 【Technical Cooperation】 - Project on Capacity Development for RBOs in Practical Water	

	Resources Management and Technology (2008-2011) - Policy Advisory for Integrated Water Resources Management (2008–2015) - Project for Assessing and Integrating the Impact of Climate Change into the Water Resources Management Plans for the Brantas and Musi River Basins (2013-2016) - Project on Capacity Development for River Basin Organizations in Integrated Water Resources Management (2014-2018) 【Grant Aid】 - Pumping Station Project for the Lower Reaches of the Bengawan Solo (1991–1992) - Countermeasures for Sedimentation in the Wonogiri Multipurpose Dam (2001–2003) 【Other Donors】 - World Bank, Java Irrigation Improvement and Water Management Project (1994–2002) - Government of the Netherlands and the World Bank, Water Resources and Irrigation Reform Implementation Project (2001–2005) - World Bank, Java Water Resources Strategic Study (2009–2011) - World Bank, Water Resources and Irrigation Management Program (2003–2010)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hirofumi Tsuruta, Octavia Japan Co., Ltd.

2.2 Duration of Evaluation Study

Duration of the Study : September 2014–July 2015

Duration of the Field Study: November 22, 2014–December 5, 2014

March 2, 2015–March 5, 2015

3. Results of the Evaluation (Overall Rating: B[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Relevance to the Development Plan of Indonesia

At the time of the appraisal, the Government of Indonesia prioritized maintenance of the functioning of the existing facilities by restoring and improving as one of crucial part of “the Program to Maintain Service Levels of Public Facilities and Infrastructures” in the “National Development Program 2000-2004” (hereinafter referred to as “Propenas”). In addition, the increase of food production and promotion of agricultural business through the expansion of water resources and streamlining of the management of irrigation system were also regarded as one of the goals in the

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

[5] ③: High, ②: Fair, ①: Low

“Program to Develop and Manage Water Resources” in Propenas.

As of the ex-post evaluation, the Government of Indonesia has included “improvement of infrastructure” as an approach to accelerate economic and social development in the ”National Medium Term Development Plan 2010–2014”. Moreover, the plan regards improving the management of water resources as a priority issue.

From the time of the appraisal to the ex-post evaluation, maintaining and rehabilitating existing infrastructure have been regarded as important. It thus is recognized that the project is consistent with national and sector plan.

3.1.2 Relevance to the Development Needs of Indonesia

As mentioned in “1.1 Background”, restoring functions of existing infrastructure and developing the capacity of O&M agencies in Indonesia are urgently necessary.

At the time of the appraisal in the Solo and Brantas River basins targeted by the project, the risks of flood damage in the future had increased among facilities and equipment that had been completed in various past loan projects: extreme riverbed scouring; bank erosion; and destabilized existing river protection, bridge foundations, and groundsills were observed, and rehabilitation was thus urgently necessary. Furthermore, even in Ular River irrigation, problems such as difficulties of water intake because of scouring had been occurred, and countermeasures to ensure a certain amount of water intake were essential. In the background of these challenges, the lack of adequate and appropriate maintenance was one of the causes. Thus, it is highly necessary to develop the capacity of the Solo RBO, Brantas RBO, and Sumatra II RBO.

As of the ex-post evaluation, the situation has been improved but continued efforts are still required. According to interviews with the Solo and Brantas RBOs, certain river and dam facilities and equipment that were not targeted by the project require rehabilitation. Even among the Ular River irrigation facilities, there are still spaces of the improvement of agricultural productivity through the rehabilitation of the second and third canals. Regarding O&M capacity, organizational structures has been improved and strengthened by the establishment of the O&M Directorate in the Directorate General of Water Resources of the Ministry of Public Works, however, as the Directorate of O&M has indicated, experience with preventive maintenance remains insufficient.

As the above indicates, at the time of the appraisal and this ex-post evaluation, the project has been consistent with Indonesia’s developmental needs because this project targeted rehabilitating existing facilities for rivers and irrigation and developing the capacity of O&M agencies.

3.1.3 Relevance to Japan’s ODA Policy

At the time of the appraisal, Japan’s “Strategy for Overseas Economic Cooperation Operation” (2002) indicated that in providing assistance to Indonesia, priority would have been placed on restoring the social and economic infrastructure necessary to redirect to sustainable growth. In addition, the “Country Assistance Program for Indonesia” (2001) indicated three areas of focus: ① ensuring

economic stability, ② providing assistance for reform, and ③ providing assistance to improve infrastructure to overcome economic bottlenecks, and prioritized the rehabilitation of existing facilities and assistance for O&M as important agendas.

Thus, because this project targeted the rehabilitation of existing facilities, it was consistent with Japan's ODA policy.

As the above indicates, this project is highly consistent with Indonesia's development plan and developmental needs as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

3.2.1.1 Civil Works and Equipment

In the course of conducting the detailed design study and during construction period, engineering changes were made, but not changes in regard to the scope of the project—"the civil works needed for recovery and maintenance of the function of targeted rivers and irrigation system" remained unchanged. Therefore, on the whole, the outputs of the project were as planned.

The first engineering change was made as the detailed design study was being conducted. This change was made because priorities had been revised in regard to the recover and maintenance of function of facilities and equipment servicing the targeted rivers and irrigation systems[6] as well as because of policy changes implemented by the Ministry of Public Works.[7] At this time, per a request from the Ministry of Public Works,[8] the packages of the civil works were rearranged and divided; the originally planned 7 packages at the appraisal were finally divided into 13 packages.

The second change was conducted after the detailed design study, because it became apparent that additional civil works were necessary to deal with the occurrence of hot sludge during river rehabilitation work in the Brantas River basin, and the planned procurement of dredging equipment capable of dredging to a depth of 30 m was cancelled.[9] As a result, in place of this planned

[6] This project aimed at the "civil works needed to recover and to maintain the function of river and irrigation system". Thus, several problems were clearly identified through careful investigation in the detailed design study (including river water leakage at the embankment of the Brantas River and change of a type of headworks at the Ular River irrigation), and new problems emerged during the implementation period (including the occurrence of hot sludge at the Brantas River Basin and aging of facilities of the Ular River irrigation as mentioned above). To deal with these problems, civil works were added each time on the basis of the needs.

[7] At first, a rubber weir was planned for the headworks of the Ular River irrigation facilities. However, as a result of technical discussion in regard to ease of operation and maintenance, etc., the decision was changed into installing a fixed weir. This change necessitated conducting detailed design studies twice.

[8] The civil works were reorganized and subdivided to improve efficiency (by making each package smaller and/or the civil works included in each package exhibited more of a unity, work efficiency can be improved, etc.). In separated procurement, besides such benefits, there was a risk that smaller packages could increase coordination costs among contractors. Thus, it is difficult to judge how many packages were of optimal size, and it cannot be said that there were problems with this reorganization and subdivision in the plan, even though issues were raised after the beginning of the project and during the project period as shown in Table 5. .

[9] As of the project, it was judged that there was less influence at least for a short-term period because the executing agency had the dredging system with dredging depth 10m. On the other hands, because the excusing agency had faced the challenges to manage urgently the hot sludge generated during the civil works of siphon at the Brantas River basin, it was necessary to secure the cost for it. If we focus on the "dredging", the cancellation might be a problematic in the mid- or long term. However, the decision of the cancellation was unavoidable for the project on the whole because emergency measures against the hot sludge were needed.

procurement, civil works to recover and maintain the targeted rivers and irrigation systems were entirely added.

The third change was conducted at the latter half of the construction period when it became obvious that additional rehabilitation work for the existing facilities[10] was necessary within the existing irrigation area (due to many years of waterlessness, facilities in the area had deteriorated, etc.) Thus, addition of civil works was undertaken.

As the above indicates, although the procurement of dredging equipment was cancelled, civil works were added with the surplus. In addition, these additional civil works remained in line with the project scope, which called for "civil works needed for restoring and maintaining rivers and irrigation system". Thus, the engineering changes of the civil works in the project were judged to be appropriate.

Table 1. Plan and Achievements in Regard to Project Outputs

Civil Works	Plan as of the Appraisal	Achievements
① Rehabilitation of the Solo River Basin		
Rehabilitation of the Solo and Madiun Rivers	- Repair of the revetment of the upper Solo River - Repair of the revetment of the Madiun River and of rubber gates	As planned Additions were made; among other things, bridges were replaced and pier foundations were rehabilitated.
② Rehabilitation of the Brantas River Basin		
Rehabilitation around the Karangkates Multipurpose Dam	- Construction of groundsills (5 locations) - Repair of the revetment of the spillway	As planned Additions were made; among other things, the number of groundsills was increased (6 locations), and consolidation dams (2 locations) and a settling pond (1 location) were constructed.
Rehabilitation around the Wlingi Multipurpose Dam and Mt. Kelud	- Construction of groundsills (7 locations) - Construction of a bypass channel	As planned Additions were made; among other things, the number of groundsills (8 locations) was increased.
Rehabilitation of the Brantas and Porong Rivers	- Repair of the revetment - Repair of groundsills - Repair of irrigation weirs	As planned Additions were made; among other things, siphons were constructed.
③ Rehabilitation of Ular Irrigation		
Rehabilitation of Ular River irrigation facilities	- Repair of headworks (1 location) - Construction and repair of link canals (1st channel)	As planned Additions were made; among other things, a target length of canals was expanded (approximately 4 km) and relevant facilities (culvert, siphon, etc.) were installed additionally.
④ Procurement of equipment		
Procurement of dredging equipment	- Procurement of two dredging systems	Changed Only one dredging system was procured.

(Sources) Plan: Documents provided by JICA
Achievements: Documents provided by JICA and interviews with stakeholders

[10] Farming areas, inlet channel, sough, culvert, siphon, turnouts, etc.

3.2.1.2 Consulting Services

Consulting services were provided as planned.

Although the input for consulting services was more than planned, it is judged that this change was appropriate in light of schedule changes to consider the progress of civil works. .The main reasons of the increase are that additional work was added to the project during the construction period,[11] that the timeline of activities was reviewed[12] and that the schedule was extended.

Table 2. Plan and Achievements of Consulting Services Provided to the Project

	Plan as of the Appraisal	Achievement
Services	1) Overall project management 2) Holding meetings regarding monitoring 3) Tendering and monitoring civil works 4) Assistance in establishing the Solo River branch of the Perum Jasa Tirta 1 (hereinafter referred to as "PJT1"), the public company that manages the Brantas River 5) Development of a plan for basin-wide sediment management in the Solo and Brantas River basins 6) Monitoring and evaluation in regard to organizing and strengthening the water users' association of the Ular River irrigation 7) Consultation for environmental issues	As planned Regarding 6), activities and the schedule were amended in light of the reinforcement of the Water Resources Management Law 2004.
Amount of Input	Foreign experts: 432 person-months; local experts: 1,014 person-months (service period: January 2003 to December 2007)	Foreign experts: 679.2 person-months; local experts (1,656.6 person-months; service period: October 2003to June 2012)

(Source) Plan: Documents provided by JICA
Achievements: Documents provided by JICA and interviews with stakeholders

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned and actual project costs are shown in Table 3. While the planned total project cost was 17,408 million Japanese yen (with the loan accounting for 14,696 million Japanese yen), the actual cost of the loan portion, 13,879 million Japanese yen, was 94% of what had been planned at the time of appraisal,[13] and was within the plan.

As for the project outputs, although the cost of procuring equipment was less than planned, additional works were instead added to each civil works package; in addition, during the project period, one additional package was added[14]. Thus, in terms of the total amount of outputs, there was not a large difference from what had been planned.

[11] As mentioned in the footnote No.7, the detail design study was conducted twice in regard to Ular River irrigation system.
[12] The timeline for "monitoring and evaluating water user associations' activities in the targeted area in the Ular River irrigation" was postponed because additional time was necessary for the preparation of the implementation system of the Ministry of Public Works in accordance to the reinforcement of the Water Resources Management Law of 2004.
[13] As of the ex-post evaluation, reliable information was not collected regarding costs borne by the Government of Indonesia because of data from the governmental budget and the budget of the Ministry of Public Works had not been kept. Completion reports submitted by the consultant constituted the entirety of the records kept at the Ministry of Public Works; these records do not reveal anything about disbursement from the governmental side. Thus, the loan part was compared between planned and actual cost.
[14] Civil works in the Ular River irrigation were added.

Thus, it was adequate project cost.

Table 3. Planned and Actual Project Costs

(Unit: millions of Japanese yen)

Category	Foreign Currency				Local Currency				Total			
	Plan		Actual		Plan		Actual		Plan		Actual	
	Total	Loan	Total	Loan	Total	Loan	Total	Loan	Total	Loan	Total	Loan
Civil Works	4,949	4,949	0	0	4,210	4,210	10,403	10,403	9,159	9,159	10,403	10,403
Procurement of equipment	1,415	1,415	447	447	734	734	202	202	2,149	2,149	649	649
Consulting services	1,258	1,258	1,629	1,629	1,561	1,561	1,198	1,198	2,819	2,819	2,827	2,827
Contingency	321	321	Unknown	0	333	248	Unknown	0	654	569	Unknown	0
Land Acquisition	0	0	Unknown	0	1,021	0	Unknown	0	1,021	0	Unknown	0
Administration	0	0	Unknown	0	745	0	Unknown	0	745	0	Unknown	0
Tax	0	0	Unknown	0	861	0	Unknown	0	861	0	Unknown	0
Total	7,943	7,943	2,076	2,076	9,465	6,753	11,803	11,803	17,408	14,696	13,879	13,879

(Sources) Plan: Documents provided by JICA
Actual: Documents provided by JICA and interviews with O&M agencies
Note: Total actual project costs were not equal to the amount of loans disbursed (13,784 million yen). This gap emerged because reported numbers were drawn from actual disbursements until July 2012 and estimations for July and August 2012.

Moreover, the portion of actual project costs covered by the loan decreased; this was because of differences in the exchange rate between the time of the appraisal and during the project period. At the time of the appraisal, 1 rupiah was equal to 0.014 Japanese yen (as of October 2001), whereas during the project period, 1 rupiah was equal to 0.011 Japanese yen (on average from July 2004 to June 2012),

3.2.2.2 Project Period

The planned and actual project periods are shown in Table 4. The actual project period was significantly longer than what had been planned—by 190%. The main reasons for the delay in implementation of each package are shown in Table 5. Because the delay was not caused only by the increase in outputs, this implies that the project period was lengthened in light of the outputs.

Table 4. Planned and Actual Project Periods

	Planned Period as of the Appraisal	Actual Period
Overall	October 2002 (Signing on L/A)–September 2007 (Completion of all the civil works) (60 months)	October 2002 (Signing on L/A)–March 2012 (Completion of all the civil works) (114 months)
Selection of Consultants	October 2002–December 2002	May2003–December 2003
Consulting Services	January 2003–December 2007	December 2003–June 2012
Civil Works (Procurement and Construction)	December 2003–September 2007	May 2005–March 2012
Procurement of Equipment	January 2005–December 2005	November 2005–June 2007

(Sources) Plan: Documents provided by JICA
Achievements: Documents provided by JICA and interviews with stakeholders

Table 5. Causes of Project Delays

Causes	Detail
Delays due to the detailed design study	Two detailed design studies were conducted in regard to Ular River irrigation system due to changes in policy put forth by the Directorate General of Water Resources, Ministry of Public Works. As a result, the start of the project implementation was delayed for about one year.
Delays due to project implementation	【Delays related to procurement of contractors】 The prequalification of contractors for tendering was delayed. 【Delays related to decision-making processes within the Ministry of Public Works】 Regarding the start of the work on the bypass channel around the Wlingi Multipurpose Dam, time was necessary to obtain consensus within the Directorate General of Water Resource, Ministry of Public Works. 【Delays related to bad weather】 The project implementation period was postponed due to floods and a prolonged rainy season. 【Delays related to civil works added to the original plan】 Additional civil works were necessary to deal with hot sludge generated in the Brantas River basin during the project period; this caused delays. 【Delays related to the managerial structure and capacity of joint ventures of contractors】 Certain civil works packages for the Brantas River basin were contracted to joint ventures consisting of major companies and small companies; in these joint ventures, however, the former provided insufficient supervision and assistance to the latter, giving rise to technical[15] and financial problems and delays on the small companies' end. 【Delays related to contractors' internal management】 Civil works to rehabilitate Ular River irrigation facilities were contracted to a major company. However, the company repeatedly delayed payment to subcontractors. As a result, work stoppages were frequent. Furthermore, this company repeatedly changed subcontractors, consistently rewarding subcontracts to subcontractors of progressively worse technical capacity. This delayed implementation.

(Sources) Documents provided by JICA and interviews with O&M agencies

3.2.3 Results of Calculations of Internal Rates of Return (for Reference Only)

Economic internal rates of return (hereinafter referred to as "EIRR") for the project are shown in Table 6. EIRRs at the time of the ex-post evaluation were a little more than those planned at the time of the appraisal. This is because benefits were enlarged by, among other things, the escalation of the price of the rice (a 2.7-fold increase in comparison to the appraisal, according to the rice price in annual reports of each province).[16]

Financial internal rates of return (hereinafter referred to as "FIRR") were not calculated because the project didn't raise financial return. Even as of the appraisal, FIRRs were not estimated.

[15] Problems related to concrete placement, coffering, method of rehabilitation works, etc.

[16] Regarding the EIRR of the Ular River irrigation, it was a bit below the number at the time of the appraisal because the project cost increased (twice of the planned cost). In this connection, the project cost of the Solo River basin and the Brantas River basin were approximately 1.1 and 1.2-fold of the planned cost, respectively.

Table 6. EIRRs at the time of the Appraisal and as of the Ex-post Evaluation

Civil Works	Benefit	Appraisal	Ex-post Evaluation
Overall		20.3%	22.1%
Solo River	Alleviation of flood damage stemming from river rehabilitation	10.7%	16.4%
Brantas River	Increase of power generation stemming from recovery of the water capacity of the dam; alleviation of flood damage stemming from river rehabilitation	21.4%	23.6%
Ular River irrigation system	Increases in income stemming from increases in rice production made possible by irrigation rehabilitation	22.2%	21.0%

(Sources) Documents provided by JICA, statistics
Note: EIRRs as of the ex-post evaluation were estimated using the conditions and formulas mentioned in the appraisal documents, but with current exchange rates, commodity prices, rice prices, etc. In addition, in the estimation, the project life of each civil work was set at 50 years and the cost sets included both of the civil works cost and O&M cost.

As the above indicates, the project cost was within the plan and project period exceeded what were planned. Therefore, the efficiency of the project is fair.

3.3 Effectiveness[17] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

3.3.1.1 Rehabilitation at the Solo River Basin

① Operation indicators

As shown in Table 7, as of the ex-post evaluation, the destruction of the river revetment rehabilitated by the project has not been reported. Although a survey was not conducted and precise data are unavailable, interviews with the staff of the Solo RBO indicated that the river revetment has not since been damaged and no expansion of flood damage has been observed around the project sites. Thus, targets of the operation indicators were (substantially) achieved.

[17] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 7. Achievement of Operation Indicators

	Baseline	Target	Actual		
	2001	2014[*1]	2012	2013	2014
	Baseline year	5 years after completion	3 years after completion	4 years after completion	5 years after completion
Indicator "Length of Damaged Revetments among Revetments Repaired by the Project" (Unit: m)					
Upper Solo River	960[*2]	0	-[*3]	-[*3]	-[*3]
Madiun River	760[*2]	0	-[*3]	-[*3]	-[*3]
O&M Cost (Unit: millions of rupiah)					
Upper Solo River	288[*4]	617[*4]	Unknown	Unknown	43,538[*5]
Madiun River	268[*4]	733[*4]			

(Sources) Documents provided by JICA, documents provided by O&M agencies

*1 The relevant civil works were completed in 2009; thus, five years after the completion of construction would be 2014.

*2 These numbers refer to the total length of the revetment targeted by the project. In the detail design study, these numbers were changed to 1,420 m for the upper Solo River and 594 m for the Madiun River.

*3 Because a survey was not conducted, precise measurements could not be grasped. However, according to interviews with O&M agencies, destruction of the revetments has not been reported since the end of the project.

*4 Targeted O&M costs were estimated only in regard to facilities and equipment rehabilitated in the project.

*5 This number was estimated based on the O&M budget for the Solo RBO (refer to 3.5.3 Financial Aspects of O&M). The Solo River basin is 16,100 km^2 in total; of this, upper Solo River basin and Madiun River basin are 6,072 km^2 and 3,755 km^2, respectively. Thus, the O&M cost for the upper Solo and Madiun Rivers is 43,538 million rupiah (or the total O&M budget allocated to the Solo RBO: 71,331 million rupiah multiplied by (6,072+3,755)/16,100).

In addition, the target O&M costs planned for the upper Solo and Madiun Rivers at the time of the appraisal was only about 3.1% of actual costs estimated as of the ex-post evaluation[18]. According to the staff of the Solo RBO, the O&M budget was allocated for daily O&M activities and no problems around the project sites have been reported. Therefore, the indicators can be judged to have been (substantially) achieved.

As the above indicates, facilities and equipment in the Solo River basin are operated appropriately; no problems with the river facilities rehabilitated by the project have occurred and allocations for O&M have been disbursed as of the ex-post evaluation.

② Effect Indicators

Table 8 illustrates the flooding of the upper Solo River (a part of Solo river basin in the Central Java Province). The baseline and target estimations were established based on probability in a 10-year period. Floods of the same scale occurred in December 2010 and May 2011. Floods that were relatively larger in scale occurred in January 2012 and January 2013. The number of suffered houses in these floods was compared with the target numbers; in all cases (including in the large flood that occurred in January 2013 of a scale that was estimated only to occur every 20 years), the number of actual flooded houses was much lower than estimated with the exception of the flood that occurred in January 2012 with 100-year probability. Thus, it is judged that the indicators were mostly achieved.

[18] O&M costs at the time of the appraisal were only those for the rivers and facilities targeted by the project. These numbers were obtained by multiplying the project cost with a certain rate. However, in the ex-post evaluation, the O&M budget of the entire Solo RBO was referred to because of the difficulty involved in calculating costs separately by rivers and/or facilities.

Table 8. Achievement of Effect Indicators [+1](Flooding in the upper Solo River)

	Year	Highest Water Level at Jurug (m)[*1]	Estimated Water Flow (m^3/s)[*2]	Estimated Probability of a Flood of Similar Scale[*3]	Number of Flooded Houses [*4]
Baseline	2001 (Year of appraisal)	-	-	10 year	2,500
Target	2013 (5 years after completion)	-	-	10 year	1,900
Actual	December 2010	8.52	1098	10 year	300
	May 2011	8.14	995	10 year	136
	December 2011	Unknown	Unknown	Unknown	102
	January 2012	10.24	1,624	100 year	4,072
	January 2013	9.06	1,252	20 year	77
	February 2013	7.38	806	2 year	1,462[*5]

(Sources)
*1 These numbers were drawn from newspaper reports. Jurug is a measuring point near Surakarta at the upper Solo River.
*2 Water flow were estimated using the formula $(4.116 \times \text{water level} - 2.362)^2$, which was cited from the documents provided the consultant.
*3 These numbers were estimated with a "table of water flow and occurrence probability" provided by the O&M agencies.
*4 These numbers were drawn from a document provided by the O&M agencies. It indicate the number of flooded houses around the Solo Rivers in Central Java Province,
*5 This flood occurred upstream from Jurug. Thus, the figures for estimated water level can be considered to have been estimated low. As results, estimated water flow and occurrence probability can also have been estimated low.
Notes:+1 No data were available for other indicators, such as areas inundated by flood, amount of damage, and number of people affected.
+2 Shaded cells indicates floods that had a probability of occurring every 10 years.

Moreover, these data shows that flood damage was alleviated. Table 9 shows that the flood prevention has been promoted through various efforts besides the project: strengthening the early warning system, enhancing flood management capacity with multipurpose dams and weirs, and improving land utilization.

Table 9. Efforts or Environmental Change Influencing the Alleviation of Flood Damages

Efforts and Change	Description
Changes in the weather and natural environment	① If the amount of rainfall is compared between the time of the appraisal and the time of the ex-post evaluation, it has increased (for example, the average rainfall over a period of five years in Surakarta located on the upper Solo River, was 2,022 in 2000, and increased to 2,484 mm in 2012). This indicates that climate change has increased the risk of floods. However, the flood occurrence has been decreased. Thus, efforts to alleviate flood damage (the following activities described in ③–⑥ or their synergy, in addition to this project) have been successful.
Development of infrastructure by other entities	② During the project period, no other infrastructure projects sought to conduct large-scale rehabilitation.
Efforts to alleviate flood damage besides this project	③ A technical cooperation project supplementary to this loan project sought to develop the capacity of the Solo RBO. ④ The Water Council of the Begawan Solo Basin was established in 2009. Since then, efforts to alleviate flood impacts and facilitate coordination among stakeholders have been undertaken. ⑤ The Asia Development Bank conducted a survey in regard to the alleviation of flood damage (Project number: TA-7547); the results were shared.

	⑥ The Integrated Flood Analysis System (system analyzing flood occurrence) for alleviating flood impact, was developed and disseminated by the Ministry of the Public Works.*1

*1 The system can provide comprehensive predictions from the amount of rainfall and the water flow of the river to flood areas.

3.3.1.2 Rehabilitation at the Brantas River Basin

① Operation indicators

Operation indicators are shown in Table 10.

The dams were judged to have been adequately operated and utilized on the whole with the exception of Sabo dams for which data were unavailable.

As for the Sengguruh and Karangkates Dams, maintenance dredging has been undertaken. That is, dredging has been conducted with a consideration of the labor costs and capacity of the relevant O&M agencies and the minimal amount of dredging necessary for ensuring functioning has been kept. Nevertheless, the capacity of the dams' effective total reservoir capacity[19] has been slightly increased in comparison to 2011. It indicates that dredging has dealt with little more than annual sedimentation.

In addition, according to interviews with PJT1 staff, floods resulted from effective reservoir capacity have not occurred in the past. This was also indicated by the situation that floods have not since occurred in the main stream despite a storm with a chance of occurring once every 100 years having occurred in January 2012 (Table 8) as well as that the PJT1 estimated that in a storm with a chance of occurring once every 50 years, the number of flooded areas has decreased (Table 12).

Thus, the dams may now be operated appropriately because maintenance dredging needed to their functioning has been undertaken.

Regarding the revetment, the destruction of the river revetment rehabilitated by the project had not been reported as of the ex-post evaluation. Although a survey was not conducted and precise data are unavailable, interviews with the staff of the Brantas RBO indicated that the revetment has not since been damaged and no expansion of flood damage has been observed around the project sites, even though there was a heavy rain with 100-year probability such as in January 2012 (Table 8). Thus, targets of the operation indicators were (substantially) achieved. In addition, as mentioned above, the PJT1 also estimated that flood damage had been reduced.

Table 10. Achievements of Operation Indicators

	Baseline	Target	Actual		
	2001	2014*1	2011	2013	2014
	Baseline year	5 years after completion	3 years after completion	4 years after completion	5 years after completion
Indicator "Effective total reservoir capacity" (Unit: million m^3)					
Sengguruh Dam	1.2	2.5	0.57	No data	0.64
Karangkates Dam	144.0	144.0	133.9	No data	134.2
Wlingi Dam	1.4	1.5	1.99	2.01	No data
Indicator "Total reservoir capacity" (unit: million m^3)*2					

[19] Effective total reservoir capacity is calculated by subtracting the volume of the sedimentation and dead water from the volume of the total reservoir capacity.

Mt. Kelud	37.8	38.8	No data	No data	No data
Dredging volume (Unit: m^3/year)					
Sengguruh Dam	200,000	500,000	240,782	283,544	248,199
Wlingi Dam	200,000	500,000	235,456	250,835	286,060
Indicator “Length of damaged revetments among functional revetments” (Unit: m)					
Brantas Middle Reach	1,550*3	0	-*4	-*4	-*4
Porong River	2,200*3	0	-*4	-*4	-*4
Indicator “O&M cost” (Unit: millions of rupiah/year)					
Sengguruh Dam	2,600	6,500			
Wlingi Dam	1,100	4,700			
Brantas Middle Reach	403	1,450	220,662*5	312,825*5	157,093*5
Porong River	250	890			
Sabo dam	135	308			

(Source) Documents provided by JICA, documents provided by O&M agency
*1 The relevant civil works were completed in 2009; thus, five years from the completion of construction would be 2014.
*2 Because no survey was conducted, no data were available. The 2014 eruption of Mt. Kelud exerted an influence.
*3 These numbers refer to the length of revetments targeted by the project. In the detailed design study, these numbers were changed to total 2,102 m for the Brantas and Porong Rivers.
*4 Because no survey was conducted, precise measurements could not be obtained. However, according to interviews with the O&M agency, no destruction of revetments has been reported.
*5 This number refers to the total O&M budget for the Brantas RBO.

For the O&M cost, calculating O&M separately by river and by facilities was difficult; thus, the O&M budget for the Brantas RBO was referred to. The O&M budget of the Brantas RBO represents the O&M cost for the entire Brantas River basin, including all of its branches, such as Porong River. The total O&M cost estimated at the time of the appraisal was about 4.4–8.9% of the O&M budget for the Brantas RBO as of the ex-post evaluation[20]. According to the staff of the Brantas RBO, the O&M budget was allocated for daily O&M activities and no problems with the O&M had been reported. Therefore, the indicators were judged to have been (substantially) achieved.

As the above indicates, facilities and equipment in the Brantas River basin are operated appropriately; no problems with dams and or the river facilities have occurred and allocations for O&M have been disbursed.

② Effect Indicators

Effect indicators are shown in Table 11. Floods have not occurred in the main stream of the Brantas River targeted by the project, although the baseline and target were established based on storms with a 50-year possibility of occurrence. It includes those storms in 2007 with a 50-year and in 2012 with 100-year possibility of occurrence. According to the interview to the staff of the Brantas RBO, in the future event of rainfall with a 50-year possibility of occurrence or more, floods would be unlikely to occur and, in the event of flooding, the mainstream of the Brantas River basin was functioned for the alleviation of flood damage. Thus, it was determined that indicators such as reductions in disaster areas caused by overflow, damaged houses, damage costs, and number of people

[20] O&M costs at the time of the appraisal were only those for the rivers and facilities targeted by the project. The numbers were obtained by multiplying the project cost with a certain rate. However, in the ex-post evaluation, the O&M budget of the entire Brantas RBO was referred to because of the difficulty involved in calculating costs separately by rivers and/or facilities..

affected by each flood were (substantially) achieved.

Table 11. Achievements of Effect Indicators

	Baseline	Target	Actual		
	2001	2014*1	2012	2013	2014
	Baseline year	5 years after completion	3 years after completion	4 years after completion	5 years after completion
Indicator “Disaster Areas Caused by Overflow” (Unit: km^3)					
Brantas River Middle Reach	198	0	0	0	0
Porong River	437	0	0	0	0
Mt. Kelud Sabo Dam	27	0	0	0	0
Indicator “Damaged Houses” (Unit: houses)					
Brantas River Middle Reach	12,040	0	0	0	0
Porong River	136,458	0	0	0	0
Mt. Kelud Sabo Dam	2,425	0	0	0	0
Indicator “Damage Costs” (unit: millions of rupiah)					
Brantas River Middle Reach	46,375	0	0	0	0
Porong River	102,335	0	0	0	0
Mt. Kelud Sabo Dam	3,370	0	0	0	0
Indicator “Number of People Affected” (unit: people)					
Brantas River Middle Reach	48,000	0	0	0	0
Porong River	604,000	0	0	0	0
Mt. Kelud Sabo Dam	3,908	0	0	0	0

(Sources) Documents provided by JICA documents provided by O&M agencies
*1 The relevant civil works were completed in 2009 thus, five years after the completion of construction would be 2014.
Note: All actual numbers are “0” as no floods with a 50-year possibility of occurrence have occurred between the completion and the ex-post evaluation.

In addition, the flooded area estimated by PJT1 is shown in Table 12. The table indicates that the project reduced estimated flood damage in the event of a storm with a 50-year possibility.

Table 12. Flood Damage Estimated by PJT1

(Unit: ha)

	Before 1990	1990 to 2000	2010 to the present
Brantas River Basin (Unit: km^3)	500	50	<50

(Sources) Centre for River Basin Organizations and Management (2014), Experiences of the Jasa Tirta I Public Corporation in Indonesia as a Corporate Type of River Basin Organization

As in the Solo River basin, the reduction of the risk of flood damage has been results of various efforts undertaken in the Brantas River basin. Furthermore, the project’s substantial size has ensured that its effects have not been small.

3.3.1.3 Rehabilitation at the Ular River Irrigation system

① Operation Indicators

Operation indicators are shown in Table 13. The indicators were largely achieved.

Table 13. Achievement of Operation Indicators

	Baseline	Target	Actual		
	2001	2017[*1]	2012	2013	2014
	Baseline year	5 years after completion	Year of completion	1 year after completion	2 years after completion
Irrigation area (ha)	18,500	18,500	18,500[*5]		
Irrigated paddy fields (rainy season) (ha)	14,500	18,500	Unknown[*6]		
Irrigated paddy fields (dry season) (ha)	9,520	18,500	Unknown[*6]		
Average water intake	18.0	24.5	28.1[*7]		
Number of water user associations	4	10[*4]	63[*8]		
Percentage of farmers who have joined water user associations (%)[*2]	90	100	100[*9]		
Collection ratio of water charges[*3]	22	100	Unknown[*10]		
Water fees (rupiah/ha/year)	55,000	145,400	600,000[*11]		
Irrigation Service Fees and Membership earned (millions of rupiah/year)	227	2,690	Unknown[*10]		

(Sources) Documents provided by JICA, documents provided by O&M agencies
*1 The relevant civil works were completed in 2012; thus, five years after the completion of construction would be 2017.
*2 The percentage of farmers who have joined water associations was calculated by dividing the number of farmers who were members of water user associations by the total number of farmers, then multiplying the result by 100.
*3 The percentage of water fees collected from farmers was calculated by dividing the actual total water fees collected by the expected total water fees, then multiplying the result by 100.
*4 Because the irrigation area is divided into 10 divisions by 10 turnouts, the target number was set, as at least one association was needed for one division. Significant increase in the actual numbers was likely because the association has been subdivided into smaller because their independency has been reinforced in the transformation of the irrigation management.
*5 This figure was provided by the Sumatra II RBO and was the target area of the water supply.
*6 According to the interview with the staff of the Sumatra II RBO, planting has been in all the irrigation area. In this case, the irrigated paddy fields can be 18,500 ha. However, because survey has not been conducted to measure the area precisely, “unknown” was put in this report.
*7 This number refers to the average water intake at the headworks.
*8 This figure was provided by the Sumatra II RBO.
*9 This figure was obtained from interviews with the staff of the Sumatra II RBO.
*10 Water fees are collected by water user associations. However, the Sumatra II RBO did not have total aggregated data.
*11 This figure was obtained in interviews with the staff of the Sumatra II RBO. This figure changes annually because it is determined by the price of the rice.

According to the interview with the staff of the Sumatra II RBO, the project contributed to the expansion of paddy fields into all the irrigation area by ensuring the provision of water to the entirety of the irrigation area. Since the completion of the project, neither the Ministry of Public Works nor other donors had undertaken efforts to expand or repair the irrigation areas. Thus, any expansion of irrigated paddy fields can be ascribed mainly to this project.

In addition, the number of water user associations increased, exceeding the target. Regarding this increase, the World Bank’s Water Resources and Irrigation Management Program (Phase 1: 2003–2010, Phase 2: 2012–2017) had also been implemented in the Ular River irrigation to strengthen water user associations. Because the project was focused on infrastructure improvement, the input was limited for the strengthening of the water user associations. Thus, this increase in the number of water user associations may mainly be ascribed to the influence of the World Bank’s program, and the project can be considered to have had an indirect contribution to the program.

②Effect Indicators

Effect indicators are shown in Table 14.[21] It is evaluated that the indicators were mostly achieved.

Table 14. Achievements of Effect Indicators

	Baseline	Target	Actual[*3]		
	2001	2017[*1]	2012	2013	2014
	Baseline	5 years after completion	Year of completion	1 year after completion	2 years after completion
Volume of rice produced (ton/year) (rainy season)	75,400	96,200	109,000[*4] (129,430–147,290)[*5]		
Volume of crops produced (ton/year) (rainy season)	50,456	98,050	109,000[*4] (129,430–147,290)[*5]		
Rice productivity (ton/ ha) (rainy season)	5.2	5.2[*2]	5.9[*6] (7–8[*7])		
Rice productivity (ton/ ha) (dry season)	5.3	5.2[*2]	5.9[*6] (7–8[*7])		
Annual net income of farmers from farming (thousand rupiah/year)	6,066	9,166	No data		

(Sources) Documents provided by JICA, documents provided by O&M agencies

*1 The relevant civil works were completed in 2012 thus, five years after the completion of construction would be 2017.

*2 These figures were obtained from the Deli Serdan District at the time of appraisal. However, as of the ex-post evaluation, it couldn't be confirmed whether theses figures show only the data of the Ular River irrigation or the data all over the District.

*3 These figures were the volumes and rice productivity (the areas of registered paddy field multiplied by the unit productivity) estimated by the external evaluator, on the basis of the data provided by the O&M agencies. Thus, the number remained the same between the rainy and dry seasons.

*4 These figures were estimated by multiplying the irrigation area by rice productivity (5.9 ton/ha); rice productivity data were provided by the Deli Serdang District. Half of the irrigation area lies in the Deli Serdang District.

*5 These figures were estimated by multiplying the irrigation area by rice productivity, on the basis of the data of productivity obtained in interviews with the staff of the Sumatra II RBO(7–8 ton/ha).

*6 These figures were obtained from the Deli Serdang District. Differences between the rainy season and dry season could not be confirmed.

*7 These figures were obtained in interviews with the staff of the Sumatra II RBO. Differences between the rainy season and dry season could not be confirmed.

As for the production volumes and productivity, they increased subsequent to the project. The interview with the staff of the Sumatra II RBO and farmers indicated that the main reasons for this increase were as follows:

① The provision of a stable water supply increased the areas of paddy fields and the feasible cropping period, increasing the average amount of rice produced per irrigated field. (Effect of this project)

② Technological innovations and strengthening managerial capacity in the irrigation areas increased the amount of rice produced per irrigated field. (Effect of other efforts besides the project).

Regarding the famers' income per capita, although data could not be obtained, the farmers interviewed reported that their incomes had significantly increased subsequent to the project.

[21] At the time of the mid-term review, it was recommended that the target number be revised upward on the basis of situational changes. However, in the ex-post evaluation, it was not confirmed from documents that the target number was amended. Furthermore, the notion that the target number had been amended could not be confirmed in interviews with the O&M organizations and a project consultant.

3.3.2 Qualitative Effects

3.3.2.1 Rehabilitation at the Solo River Basin (Alleviation of Flood Damage)

According to interviews with the staff of the Solo RBO, there have been fewer floods in the mainstream; most floods have occurred in small branches and the lower reaches. Thus, the focuses of flood control efforts have also shifted to the lower branches.

In the hearing to residents conducted around the project sites (in focus group discussions that included a total of 23 people living at different three points), there were positive answers indicating "it has become more difficult for floods to occur" and that "flood damage has been lightened." It was reported that the flow of the river became smooth and that improvements to the revetments had made it more difficult for land erosion to occur.

3.3.2.2 Rehabilitation at the Brantas River Basin (Alleviation of Flood Damage)

According to interviews with the staff of the Brantas RBO, fewer floods have occurred in the Brantas River basin since the appraisal.[22] Documents of O&M agencies indicated that infrastructure for water resources had been developed between the 1960s and 80s; thus, floods with a 50-year probability of occurring have been controllable since the 1990s. However, until 2000, when the PJT1 became responsible for the management of the Brantas River basin, no O&M agency had worked continuously; thus, adequate O&M activities had not been conducted. Therefore, the project was implemented. All residents included in focus group discussions around the project sites[23] indicated that "flood damage has been lightened", while they reported that no catastrophic floods had occurred in the last 10 years.

Thus, although it was not very clear whether alleviation of the risk of flood damage had been undertaken, as flood damage had not worsened compared with when the appraisal was conducted, it was determined that facilities' functioning (revetment, agricultural weir, sabo dam, etc.) had been maintained.

3.3.2.3 Rehabilitation at the Ular River Irrigation (Change of the Water Supply and Agricultural Productivity)

Tables 15 and 16 show the results of the beneficiary survey targeting the members of water user associations who are farmers.[24] As for the satisfaction on the water supply, about 80% of respondents answered that the water supply in the dry season was "insufficient" at the time of the appraisal, but the same percentage of respondents indicated that the water supply was "adequate" as of the ex-post

[22] The project aimed to maintain the functioning of existing facilities. Thus, even though floods had not occurred, it was judged that the project was necessary as future flood risks were obvious due to problems with existing facilities and equipment.

[23] Focus group discussions were conducted with residents of three areas and at village offices near one Sabo dam construction site; a total of 26 residents were involved.

[24] Sampling targeted the members of water user associations for farmers as they were expected to be knowledgeable regarding the condition of Ular River irrigation facilities. Furthermore, water user associations could be regarded as a sampling cluster. Nine water user associations were selected randomly from a total of 63 water user associations serviced by Ular River irrigation facilities. A self-administrative questionnaire was distributed to 104 members from the sampled association who were available on the day of the survey. Then, the completed questionnaires were collected.

evaluation. In addition, as for the perception on agricultural productivity, about 60–70% of the respondents answered that productivity had increased across seasons. Interviews with water user association members indicated that the project facilitated the stable provision of water to farming areas where water had been insufficient or irregular prior to the implementation of the project. The project made it possible to double-crop rice and to plant two crops a year; the project also made it possible for farmers to cultivate more varied products.

However, regarding satisfaction with the water supply in the rainy season, about 90% answered that the supply was "excessive."[25] In addition, in the group discussions with about 35 farmers conducted in addition to the questionnaire survey, three participants indicated that "paddy fields are sometimes flooded during the rainy season.". Moreover, although no participants reported that productivity was significantly impacted, they indicated that "it is necessary to dig up sedimentation from the third channel to prevent flooding, but this is burdensome," and "additional work is necessary to restore paddy fields after flooding; workloads have increased.".

For such situation, interviews with the Sumatra II RBO indicated that agricultural productivity has not been damaged. However, they indicated that ① because the second channel's weir was stolen, the water supply to the third channel has not always been effectively controlled and ② because of the sedimentation of the third channel, there have been times in which water has not drained smoothly and accumulated easily. Appropriate O&M of the second and third channels needs to be undertaken by O&M agencies and water user associations

Table 15. Satisfaction with the Water Supply

(Unit: %, n=104)

Answers		Excess	Adequate	Insufficient
At the time of the appraisal	Dry season	0.9	12.5	86.6
	Rainy season	49.5	47.6	2.9
At the time of the ex-post evaluation	Dry season	8.7	79.8	11.5
	Rainy season	89.4	10.6	0

(Sources) Answers to the questionnaire survey

Table 16. Perceptions Regarding the Increase or Decrease of Overall Agricultural Productivity in Comparison with 10 Years Ago

(Unit: %, n=104)

Answers		Increased	No change	Decreased
At the time of the ex-post evaluation	Dry season	69.2	17.3	13.5
	Rainy season	58.6	15.4	25.6

(Sources) Answers to the questionnaire survey

3.4 Impacts

3.4.1 Intended Impacts

Regarding the impact; improvement of living standards and expansion of enablement of daily activities, residents of the Solo River basin indicated that "it became possible to plant banana trees and

[25] This indicator is just satisfaction, and then it cannot describe the actual situation of the irrigation area concretely and accurately. Thus, the achievement is judged not only by the indicator but also by the result of the interviews to the Sumatra II RBO.

other crops" and that "it became safe to engage in daily and leisure activities such as fishing" due to the decrease in the frequency of flooding. In addition, most residents near the rivers were wage laborers; the decrease in the frequency of flooding enabled them to work longer hours. As a result, they were able to broaden their sources of income, stabilizing their earnings and making daily life more affordable. Residents near the Brantas River basin indicated that their "incomes had been increased because it became possible to plant crops near the rivers and roads which had been improved" because the flood occurrence has been decreased. Farmers in the Ular River Irrigation indicated, "it became possible to construct new houses or repair them and to buy agricultural equipment such as tractor"

Although no background quantitative data for their responses were available, interviews with residents indicated that the project contributed to the improvement of the living standards and the expansion of enablement of daily activities.

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

As of the ex-post evaluation, no negative impacts on the environment had been reported. Because the project focused on the rehabilitation of the existing facilities and equipment, no new large-size civil works for facilities or equipment were undertaken in the project. At the time of the appraisal, it was confirmed that the environmental approvals were not necessary in accordance with the Indonesian laws[26]. In addition, at the time of the detailed design study, foreign and local experts on the environment were involved, and a comprehensive mid- /long-term basin-wide sediment management plan was developed with surveys in order to take environmental consideration thoroughly. Accordingly, the civil works for the repairs of the river and irrigation facilities and equipment were undertaken. During the project period, the consultant provided the practical assistance for environmental consideration, continuously monitoring the impact after the engineering changes.[27]

As the above indicates, the impacts on the natural environment were appropriately taken into consideration.

3.4.2.2 Land Acquisition and Resettlement

The project required the resettlement of four households and the acquisition of about 150 ha of land. According to interviews with O&M agencies, no significant problems, such as protests against relocation, arose, although negotiating the price of the land required time. However, as same as the impacts on the natural environment, the project had little adverse effect, as large land acquisitions were not necessary because the project focused on the rehabilitation of existing facilities and equipment.

[26] The impacts on environment were checked with the environmental checklist by the executing agencies.

[27] For example, in order to response against the hot sludge mentioned above, a temporal cofferdam was constructed to prevent environmental pollution. Eventually the rehabilitation work was stopped at the hot sludge area.

3.4.2.3 Unintended Positive/Negative Impact

As positive impacts, interviews with residents indicated that the scenery around the project sites was improved and areas around the project sites were made available for leisure activities such as fishing and picnicking due to improvements in safety, as a result of the civil works.

However, regarding negative impacts, according to the interview with the residents near the project sites, there was an increase of dissatisfaction with unfairness among residents[28]. Because, although the productivity of the farms around the project sites was increased as a result of the alleviation of the risk of flood damage, only landowners directly benefited from the project and those who did not own land did not sufficient benefit.

Furthermore, because of the negative impacts of the accumulation of water in the Ular River irrigation in the rainy season, residents reported that their costs and workloads for repairing the paddy fields had increased after the accumulation of the water.

These negative impacts were not taken into consideration in the evaluation judgment as they were not considered to significantly relate to flood damage and agricultural productivity, which were indicated in the specification of the operation and effect indicators.

As the above indicates, this project has largely achieved its objectives. Therefore, the project's effectiveness and impact are high.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of O&M

As of the ex-post evaluation, the Directorate of O&M, which was newly established in the Directorate General of the Ministry of Public Works in 2012, supervises O&M for river and irrigation infrastructure. Before 2012 and during the project period, the Directorate of Irrigation and Directorate of Rivers and Coasts were tasked with O&M in addition to planning and managing the project. Once the tasks became independent, the Directorate for O&M needed after the project was separated from the Directorate for planning and management of the project, and the responsibilities for O&M became clearer.

O&M work on river and irrigation sites was conducted by the agencies shown in Table 17 on the basis of the Water Resources Management Law of 2004 and the Irrigation Management Regulation of 2006. In addition, it was decided that these agencies exchanged Memorandums of Understanding with relevant provincial offices and engaged in cooperation when necessary.

[28] There was exchange of opinions between village administration including the chief of village and residents.

Table 17. O&M Agencies in the Project Areas

Areas		O&M Agencies
Solo River basin		Solo RBO, PJT1[*1]
Brantas River basin		Brantas RBO, PJT1[*1]
Ular River Irrigation Facilities	First Channel	Sumatra II RBO
	Second Channel	Sumatra II RBO and/or North Sumatra Province[*2]
	Third Channel	Water User Associations

(Sources) Documents provided by O&M agencies

*1 RBOs are responsible mainly for O&M for facilities and equipment for public services, whereas PJT1 is responsible for O&M for the facilities and equipment for commercial services.

*2 The Sumatra II RBO and the North Sumatra Provincial Office gave different answers in regard to which agency was responsible for the second channel.

However, in the ex-post evaluation when we asked certain O&M agencies and provincial offices which agencies were responsible for each facility and equipment, they sometimes gave different answers. This implied the situation that coordination and cooperation between RBOs and provincial offices did not remained smooth enough. In addition, many staff indicated in interviews that communication between RBOs, which are supervised by the central Ministry of Public Works, and provincial offices, is not always good. It could be essential to promote coordination among agencies to facilitate more effective and efficient operation of facilities and equipment.

As the above indicates, appropriate institutional structures to conduct O&M of facilities and equipment rehabilitated by the project have been established. However, the relevant agencies have minor operational problems.

3.5.2 Technical Aspects of O&M

According to the interviews with the staff of O&M agencies, no problems in regard to techniques for corrective rehabilitation have been observed. In addition, during the project period, the capacity of O&M agencies was developed through “the Project on Capacity Development for RBOs in Practical Water Resources Management and Technology” of JICA, a supplemental technical cooperation project to this loan project, undertaken from 2008 to 2011. As of the ex-post evaluation, each O&M agency has regularly conducted training sessions lasting from a half of day to several days that addressed topics from maintenance techniques for facilities to organizational management including human resources and financial management.

It was also indicated in the mid-term review that “the central and regional governments take responsibility for O&M of river protection facilities, but there are few engineers with sufficient skills and commitment because of budgetary constraints on work.” However, there is mechanism to gather skillful engineer because O&M activities have been partially contracted to PJT1, a public company, in which O&M performance directly influences the revenue; in other words, financial incentives for the O&M activities have been developed. .

However, according to the Directorate General of Water Resources, Ministry of Public Works, techniques and skills for preventive O&M are still underdeveloped. In particular, the Directorate of O&M pointed out that, although the capacity of RBOs as O&M agencies of the project has been strengthened, preventive techniques and skills tend to be underestimated and the O&M agencies still

do not have sufficient experience.

In sum, although O&M techniques for facilities and equipment completed by the project have been strengthened, minor problems remain because of insufficient experience with preventive maintenance.

3.5.3 Financial Aspects of O&M

Interviews with O&M agencies indicated that budgets for daily preventive O&M activities and minor corrective activities have been secured. Because O&M agencies fall under the direct supervision of the Ministry of Public Works except PJT1, O&M budgets are allocated from the budget of the Directorate General of Water Resources of the Ministry of Public Works. This overall budget of the Directorate General of Water Resources of the Ministry of Public Works has been increased (Table 18) and the budget for O&M is expected to be increased in the future because of the establishment of the Directorate of O&M.

In regard to actual conditions, increases and decreases in the budget of the Ministry of Public Works are influenced by the direction of the President. The overall budget of the Ministry of Public Works in 2014 was decreased sharply because it was based on the policy of the outgoing President Yudhoyono. However, the Ministry's budget was subsequently increased by the current President Joko, who was inaugurated in October 2014, for the proactive development of infrastructure. If organizational structures and institutional systems continue to be strengthened: O&M policy that is currently being drafted will become presidential orders, the O&M budget will be increased further.

Table 18. Budget of the Ministry of Public Works

Year	2010	2011	2012	2013	2014	2015
Directorate General of Water Resources of the Ministry of Public Works (Unit: trillions of rupiah)						
Overall Budget	8.92	13.02	19.08	23.18	21.12	30.02
O&M	Unknown	Unknown	Unknown	1.21	2.13	Unknown
Solo RBO (Unit: millions of rupiah)						
Overall Budget	678,166	1,247,414	1,516,984	1,140,272	949,940	Unknown
O&M	Unknown	Unknown	Unknown	Unknown	254,560	Unknown
Brantas RBO (Unit: millions of rupiah)						
Overall Budget	Unknown	Unknown	564,311	1,141,960	707,025	Unknown
O&M	Unknown	Unknown	220,662	314,825	157,093	Unknown
Sumatra II RBO (Unit: millions of rupiah)						
Overall Budget	99,380	134,569	133,300	117,455	89,685	Unknown
O&M	9,167	7,614	7,220	6,784	13,913	Unknown

(Sources) Answers to the questionnaires to O&M agencies

In addition, as for PJT1, to which O&M for facilities and equipment in the Solo and Brantas Rivers has been partially contracted, independent accounting has been used and the budget for basic O&M activities has been secured. Moreover, PJT1 is a well-run business; consequently, it is expanding in size—for example, it has newly expanded to servicing North Sumatra Province. Thus, PJT1's budget has tended to be increased (Table 19) and there have been no financial constrains on daily O&M activities.

Table 19 Budget of PJT1

(Unit: millions of rupiah)

Year	2010	2011	2012	2013	2014
Overall Budget	163,830	169,980	193,760	217,760	253,430
O&M	127,090	136,900	145,960	160,900	186,670

(Sources) Answers to the questionnaires to O&M agencies

However, it was reported that neither the Ministry of Public Works nor PJT1 have the revenue or financial resources to conduct large-scale infrastructure rehabilitation. Thus, when large-scale infrastructure rehabilitation is necessary, they have no choice but to obtain external funds from, among other entities, international donors. Furthermore, even spare parts for facilities and equipment cannot be purchased promptly once stock bought during the project period runs out. It is necessary to incorporate the procurement of such parts into planned budgets.

As the above indicates, daily O&M activities are not affected by financial problems and further improvements in financial situation are expected in the future. However, the lack of financial resources for large-scale infrastructure repair is a concern. Thus, it is judged that there is a minor challenge.

3.5.4 Current Status of O&M

3.5.4.1 Facilities of the Solo River Basin

According to the interviews with the staff of the Solo RBO and PJT1, facilities and equipment rehabilitated by the project have been operated well. As an O&M activity of the Solo RBO, the RBO investigates the problems along the river basin through a survey at the Solo River basin, based on the O&M plan once per a year. If the problem is found, the response is included in the action plan of the next fiscal year and practiced.

3.5.4.2 Facilities of Brantas River Basin

According to the interviews to the staff of the Brantas RBO the facilities and equipment rehabilitated by the project have been properly operated. O&M activities are conducted based on an annual action plan. In addition, branch offices with staff to manage facilities have been established, such as at Mt. Kelud and Semeru Sabo office and outreach is conducted around the river basin once a year.

According to interviews with the staff of the Brantas RBO, because some facilities around Mt. Kelud suffered from its volcanic eruption in 2014, large-scale rehabilitation will be necessary in the future.[29]

3.5.4.3 Ular River Irrigation Facilities

According to the interviews with the Sumatra II RBO, facilities and equipment in the first channel

[29] Regarding the facilities rehabilitated by the project, the needs of rehabilitation were not reported although the bypass channel was influenced by sedimentation.

rehabilitated by the project have been properly operated. Staff members are stationed at the first channel's main water intake weir. Among them, about six staff members are assigned to managing the first channel overall. They conduct not only corrective activities but also periodic maintenance as part of O&M activities.

It may be concluded that facilities and equipment servicing the Solo River basin, the Brantas River basin, and Ular River irrigation have been properly operated.

As the above indicates, some minor problems have been observed in terms of institutional aspects, technical aspects, and financial aspects. Therefore, the sustainability of the project is fair.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project aimed to restore the function and to ensure the sustainability of the existing facilities as well as to improve and strengthen O&M system by assisting the capacity development of O&M agencies through the rehabilitation of the past completed loan projects in the water resources sector such as the rehabilitation of the river facilities in upper Solo River basin, the countermeasures against sedimentation of the multipurpose dams and the rehabilitation of the river facilities in Brantas River basin, and the recovery of Ular River irrigation that were highly emergent and needed. Because the project is consistent with Indonesia's National Medium Term Development Plan to prioritize the development, management and infrastructure improvement of water resources, Indonesia's national needs and Japan's aid policy, the relevance of the project is high. On the other hand, although project costs were within budget, the project period was significantly longer than had been planned. Thus, the efficiency is fair. The effectiveness and impact are high, because alleviation of flood suffering in the upper Solo and Brantas River basins and increased rice production in the Ular River irrigation have been observed, as well as because living standards of neighboring residents have been enhanced. The sustainability of the project is fair as minor institutional, technical, and financial problems arose: although the facilities and equipment rehabilitated by the project had been for the most part properly operated and maintained, the demarcation of responsibilities among O&M agencies was somewhat unclear and O&M agencies had insufficient experience with preventive maintenance and would not have been able to conduct large-scale rehabilitation without external financial resources.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

4.2.1.1 Coordinating the Responsibilities of RBOs and Provincial Offices

It is desirable for the Directorate of Rivers and Coasts, Directorate of Irrigation, and Directorate of O&M in the Ministry of Public Works to examine the demarcation of responsibilities for O&M and coordination between the RBOs under their supervision and provincial offices by June 2016, when

discussions are to start regarding the supplementary budget for the next fiscal year. If necessary, it is better for the Directorates to agree to Memorandum of Understandings with provincial governments to clarify the demarcation of responsibilities and ensure coordination. In addition, it is desirable for the Directorates to monitor the actions of the O&M agencies for the coordination. In the ex-post evaluation, it was observed that coordination was not always achieved between RBOs under the supervision of the Ministry of Public Works and provincial offices. Promoting coordination could make O&M activities more efficient and effective.

4.2.1.2 Examination of the Condition of Facilities and Equipment After the Eruption of Mt. Kelud and Responses

It is desirable for the Directorate of Rivers and Coasts and the Directorate of O&M to investigate how facilities and equipment have been negatively affected by the eruption of Mt. Kelud by June 2016, when discussions are to start regarding the supplementary budget for the next fiscal year. Based on the results of investigation, a rehabilitation plan should be developed and actions should be specified in the draft action and budgeting plan for fiscal year 2017, if necessary. It is possible that there are facilities and equipment needed further rehabilitation to recover their functioning, because of the damage sustained around the project areas.

4.2.1.3 Investigation of the Accumulation of Water in Ular River Irrigation Facilities and Responses

It is desirable for the Directorate of Irrigation and the Sumatra II RBO to investigate the accumulation of water in Ular River irrigation and to analyze courses of action if there is problem by June 2016, when discussions are to start regarding the supplementary budget for the next fiscal year. If necessary, responses should be developed and included in the activity and budgeting plan for fiscal year 2017. While the water has been supplied to the entirety of the irrigation area as a result of the project, the beneficiary survey indicated that an increased number of farmers believed that the water supply had become excessive (accumulation of water).

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

4.3.1 Clarification of Managerial and Supervisory Responsibilities among Contractors of Joint Ventures

Some packages of civil works in the Brantas River basin were commissioned to joint ventures consisting of large companies and small- and medium-size companies. However, in certain cases, the large companies in these joint ventures provided insufficient support to the smaller companies, which encountered difficulties, delaying progress. During prequalification, tendering, or contracting, the executing agency should have requested the large companies, the main contractor, to clarify managerial and supervisory responsibilities in a document. In addition, during the implementation of

the civil works, the executing agency should have supervised the main contractor's management of joint ventures to the member companies.

4.3.2 Establishing Operation and Effect Indicators Based on Clear Definitions and Available Information and Data

It is desirable for JICA to reach a consensus with executing agencies regarding the selection of indicators, carefully considering the capacity of such agencies for the data measurement, collection, and aggregation, as well as the feasibility of evaluation, when operation and effect indicators are established at the time of the appraisal. For example, details pertaining to indicators should be defined clearly (particularly, confirmation and agreement should be reached in regard to data collection areas and the scope of the data). Furthermore, the practice of river surveys, types of periodically collected data, data aggregation situation and operation of information management systems should be taken into account. In this project, many indicators were established at the time of the appraisal, but data and evidence could not be collected sufficiently including at the time of the mid-term review.

Comparison of the Original and Actual Scope of the Project

Items	Civil Works	Plan as of the Appraisal	Achievements
①Outputs	① Rehabilitation of the Solo River Basin		
	Rehabilitation of the Solo and Madiun Rivers	- Repair of the revetment of the upper Solo River - Repair of the revetment of the Madiun River and of rubber gates	As planned Additions were made; among other things, bridges were replaced and pier foundations were rehabilitated.
	② Rehabilitation of the Brantas River Basin		
	Rehabilitation around the Karangkates Multipurpose Dam	- Construction of groundsills (5 locations) - Repair of the revetment of the spillway	As planned Additions were made; among other things, the number of groundsills was increased (6 locations), and consolidation dams (2 locations) and a settling pond (1 location) were constructed.
	Rehabilitation around the Wlingi Multipurpose Dam and Mt. Kelud	- Construction of groundsills (7 locations) - Construction of a bypass channel	As planned Additions were made; among other things, the number of groundsills (8 locations) was increased.
	Rehabilitation of the Brantas and Porong Rivers	- Repair of the revetment - Repair of groundsills - Repair of irrigation weirs	As planned Additions were made; among other things, siphons were constructed.
	③ Rehabilitation of Ular Irrigation		
	Rehabilitation of Ular River irrigation facilities	- Repair of headworks (1 location) - Construction and repair of link canals (1st channel)	As planned Additions were made; among other things, a target length of canals was expanded (approximately 4 km) and relevant facilities (culvert, siphon, etc.) were installed additionally.
	④ Procurement of equipment		
	Procurement of dredging equipment	- Procurement of two dredging systems	Changed Only one dredging system was procured.
② Project Period		October 2002 (Signing on L/A)–September 2007 (Completion of all the civil works) (60 months)	October 2002 (Signing on L/A)–March 2012 (Completion of all the civil works) (114 months)
③ Project Cost Foreign Currency Local Currency Total Loan part Ex-change rate		7,943 million Japanese yen 9,465 million Japanese yen 17,408 million Japanese yen 14,696 million Japanese yen 1 US dollar = 121.67 Japanese yen 1 rupiah = 0.014 Japanese yen (as of October 2001)	2,076 million Japanese yen 11,803 million Japanese yen 13,879 million Japanese yen 13,879 million Japanese yen 1 rupiah = 0.011 Japanese yen (Average from July 2004 to June 2012)

Evaluation Department, Japan International Cooperation Agency (JICA)

Opinion of JICA Evaluation Department on Ex-post Evaluation of "Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project"

[Evidence of Quantitative Effects regarding Rehabilitation at the Ular River Irrigation System] (Related Section: 3.3.1.3 ② Effect Indicators)

In the Ex-Post Evaluation Report, the rice productivity was estimated by multiplying the irrigable area by the rice productivity per unit area (calculated on the basis of the productivity data provided by the District) and the target was judged to have been achieved. On the other hand, with these estimates being used in the absence of objective monitoring data on the actual irrigated paddy fields, there do not appear to be sufficient grounds to judge the target to have been achieved simply based on the results of an interview with the executing agency in which it was stated that "irrigation water reaches all the irrigable area, so this area has been fully planted." In addition, considering the fact that not a few respondents of the beneficiary survey commented that there would be an excessive water supply during the rainy season, there is a possibility that the rice productivity per unit area might differ from what was originally envisaged.