

Upper Solo River Improvement Project

Report Date : October 2002

Field Survey : August 2001

1 . Project Profile and Japan's ODA Loan



Location Map of the Project



Shortcut on Solo River and Neighboring Farmers

1.1 Background

Solo (Surakarta) City is the center of politics, economy and culture in the eastern part of Central Java Province. Since the 15th century, growth in this city has extended from its central palace; it is the most crowded city in the Province (population of 480,000 at the time of project appraisal in 1985). The Solo River, *Bengawan Solo*, flows northward along the east side of the city to the Java Sea, and there have been efforts, such as construction of the Wonogiri dam, to prevent damage from frequent floods along the main and tributary streams.

The river is divided into two parts, those extending above and below its confluence with the Madiun River. The upper part (290 km) can be divided into three more sections --- 1) from the source to Wonogiri, 2) from Wonogiri to Solo City, and 3) from Solo City to Ngawi. This project improved a 15.3-km section of the river from Jurug to Temulu, which falls within the 54.5-km Wonogiri to Solo City section.

1.2 Objectives

To mitigate flood and inundation damage by means of improvement works on the Upper Solo River, based on a ten (10)-year return period flood control plan.

1.3 Project Scope

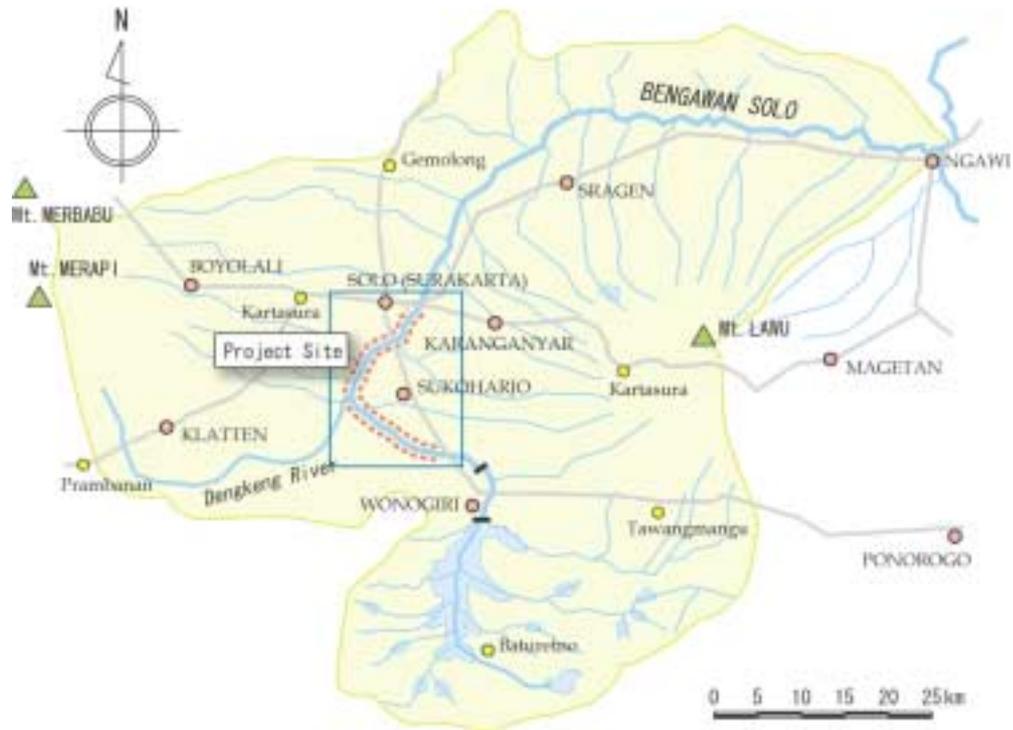
1) River Improvement

Excavation, Levee Embankment, Revetment and Shortcut between Jurug Bridge and Kembangan River (Temulu).

2) Consulting Services

- Assistance in tender evaluation and contract negotiation
- Detailed design of flood forecasting and warning system
- Construction supervision
- Technology transfer
- Reporting

Figure 1 : Project Map



Rectangular area is illustrated in more detail in Figure 2

1.4 Borrower / Executing Agency

The Government of the Republic of Indonesia / Directorate General of Water Resources (DGWR), Ministry of Settlements and Regional Infrastructure

Project Implementation Unit is PBS (Project Office of Bungawan Solo)

1.5 Outline of Loan Agreement

Loan Amount	4,746 million yen
Loan Disbursed Amount	4,611 million yen
Exchange of Notes	December, 1985
Loan Agreement	December, 1985
Terms and Conditions	
-Interest Rate	3.5 % p.a.
-Repayment Period (Grace Period)	30 years (10 years)
-Procurement	General Untying
Final Disbursement Date	June, 1994

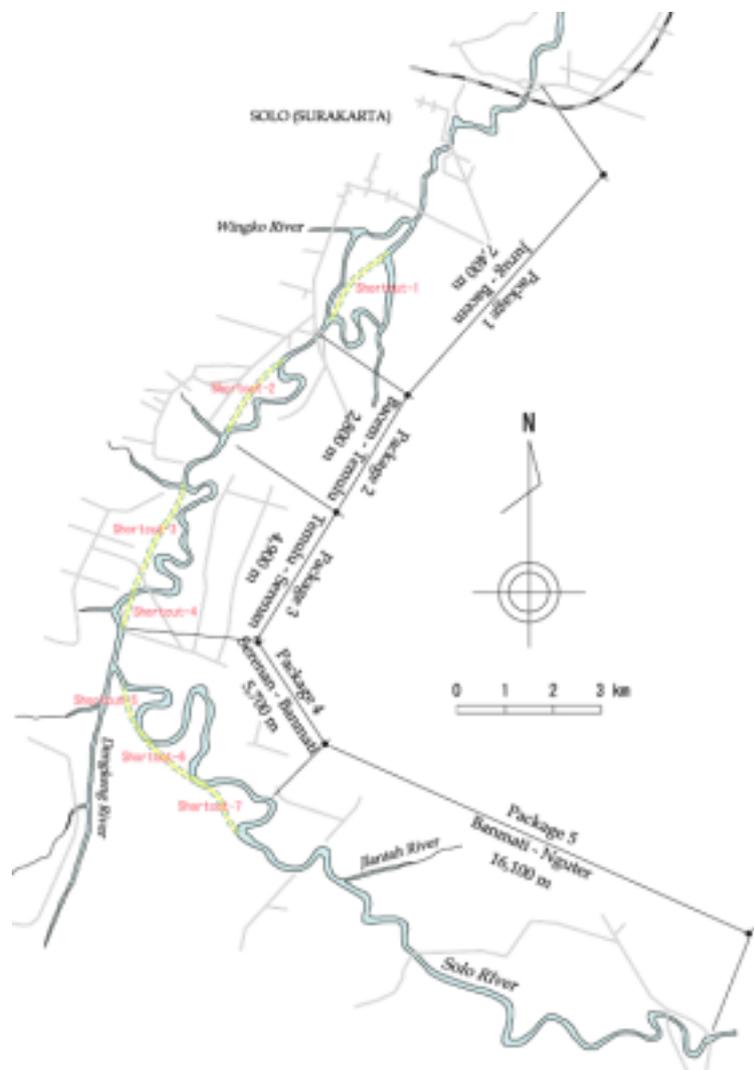
2 . Results and Evaluation

2.1 Relevance

Prior to the project, construction of the Wonogiri Dam had been completed (in 1981) in connection with a flood control plan for the overall Bengawan Solo river basin. The dam, which started service in 1981, is capable of controlling a 60-year flood with a discharge of 4,000 m³/sec to 400 m³/sec in Wonogiri. However flood inundation has still occurred, especially in the upper Bengawan Solo river area, because the existing capacity of the river channel from Nguter to Sragen (400 to 600 m³/sec) is smaller than potential flood discharges of 780 to 1,850 m³/sec (10-year flood) and 980 to 2,440 m³/sec (50-year flood). Given this situation, river rehabilitation and management works were still required to improve the river channel capacity. Improvements were urgently required at the time of appraisal, and are still relevant under current requirements for regional development¹⁾. In addition, Packages 3, 4 and 5 were incorporated during the implementation stage to maximize flood control in the subject area. This modification of the actual scope of works was in line with the project's original objective, and is assessed as relevant.

It is necessary to have a solid understanding of the technological background of the corresponding engineering field when evaluating the relevance of the completed project's design/technical applications. At the time of project appraisal, the short-cut method was considered the best way to mitigate flood damage, but in this evaluation survey, it was found that this method caused riverbed degradation and morphological changes. An environmentally friendly river improvement method would

Figure 2 : Detailed Project Map



¹⁾ There are six major requirements in the CDMP (Comprehensive Development Master Plan) for Bengawan Solo River Basin: 1) Water Resources Development for Equitable Regional Development, 2) Watershed Management, 3) Water Quality Management, 4) Water Allocation Management for Diversifying Water Demand, 5) Flood Control Management and 6) Inter-regional Coordination Management for Water Users and Allocation.

have been preferable. Today, a “Passive” approach to flood control has replaced the former “Active” approach. The thinking has changed from “Compulsory control with morphological change of river” toward “Minimal morphological change with utilizing original river course,” reflecting global concerns about natural environments, ecology, landscape and related issues. Under the circumstances, the focus of river improvement works has shifted from shortening the river course for the purpose of releasing flood water quickly, to conserving the original river course as much as possible in order to minimize impact on the surrounding natural environment. The latter approach has become mainstream and is now a mainstay in the river engineering field.

2.2 Efficiency

2.2.1 Project Scope

As stated above, three packages were incorporated into the scope of the project. All the packages, shown in Figure 2, were completed within the estimated project budget, as described below in 2.2.3.

2.2.2 Implementation Schedule

The project was implemented by Bengawan Solo River Basin Development Project (PBS), a regional office under the Directorate General of Water Resource Development (DGWRD), Ministry of Public Works, which is recently reestablished as Directorate General of Water Resources (DGWR), Ministry of Settlements and Regional Infrastructure. It was completed in 1994 with delays totaling four years, the result of the modification.

In addition, the original contractor for Package 1 left work uncompleted because of a managerial problem; the remaining work was completed under an additional package, 1A. This complication also delayed the project implementation schedule.

2.2.3 Project Cost

The substantial appreciation of the Japanese Yen between 1988 and 1990 (the original construction period) left the Project with a surplus in ODA loan funds after the necessary amounts for the two original packages were secured. Consequently, scope of works was modified.

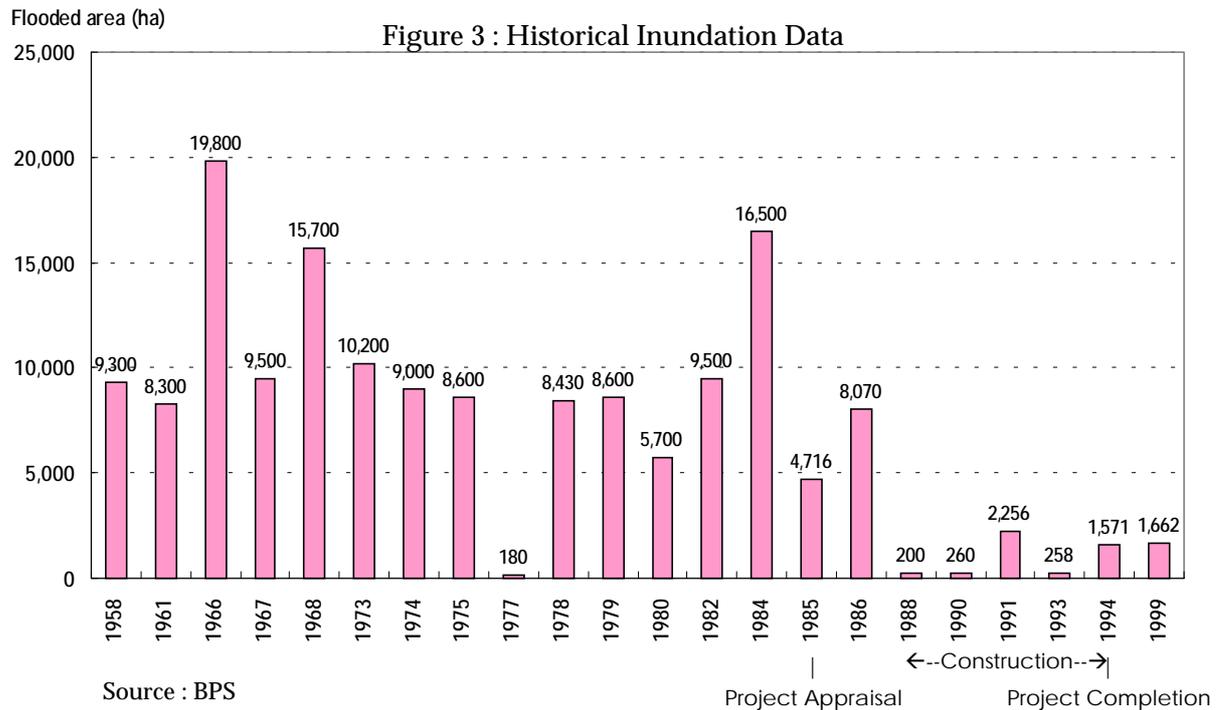
2.3 Effectiveness

2.3.1 Quantitative Effect ---Alleviation of Flood Damage---

Figure 3 illustrates the historical inundation data²⁾ in the project area (45,000 ha including

²⁾ Showing the major years.

the center of Solo City). As shown below, flood areas were not very big after the completion of the project. It can be concluded that the project contributes to flood damage alleviation to a large extent, though rainfall intensity data were not available at the time of evaluation.



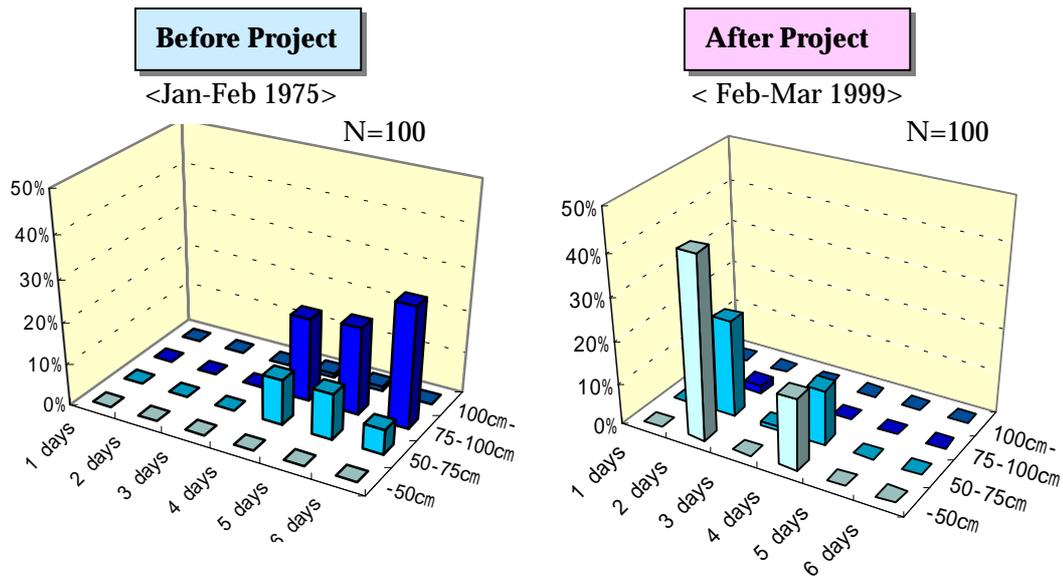
2.3.2 Assessment by beneficiaries---Results of Interview Survey³⁾---

To confirm the effect of the project from a different angle, an Interview Survey of beneficiaries was conducted. Figure 4 illustrates the beneficiaries' flood experience before and after the project, based on answers to the survey questions. The flood magnitude of 1975 was considered to be a 2- to 5-year flood (maximum flood discharge 1,000m³/sec), and the project office estimated that in 1999 the area was hit by a 10-year flood (maximum flood discharge > 1,500m³/sec).

In the 3-D graphs below, the two horizontal axes indicate the height of inundation (cm) and the length of inundation (days), and the vertical axis shows the percentage of effective responses.

³⁾ A questionnaire-based Interview Survey of the beneficiaries was carried out in order to examine the project effect/impact derived after the project completion, during the field survey on this project. A hundred (100) interviewees were selected in the subject river basin (the population of Solo City is about 590,000 in 1998), basically by means of a random sampling method. The major interview items in the questionnaire are: 1) Suffering record and people's assessment in terms of security, sanitation and socio-economical benefit, 2) Impact/indirect effect of the project, 3) Further request.

Figure 4 : Beneficiaries' experience of flooding



Prior to the project, most respondents suffered inundation for a period of four to six days, at depths of more than 50 cm. After the project, however, the duration was reduced to less than four days, and the depth to less than 75 cm. The flood damage in 1999 was caused mainly by insufficient urban drainage system. From these responses, it is possible to say that flooding damage has been reduced in terms of the depth and duration of inundation, notwithstanding the fact that the flood magnitude in 1999 was larger than in 1975.

Figure 5 and Figure 6 show the answers to two questions in the Interview Survey, asking respondents to compare the extent of flood damage before and after the project and to evaluate to what extent the project improved regional safety/security. As Figure 5 shows, generally the degree of damage eased. Accordingly, most of the respondents can, at present, live without being seriously threatened by floods, whereas prior to project completion worries about potential flooding made many consider relocating. Even though this kind of comparison is based on the subjective impressions of respondents, it is helpful in understanding the project's effects. In this case, the respondents' answers indicate that the project contributed to improving living conditions in terms of safety and security.

Figure 5 : Comparison of the extent of flood damage before and after the project

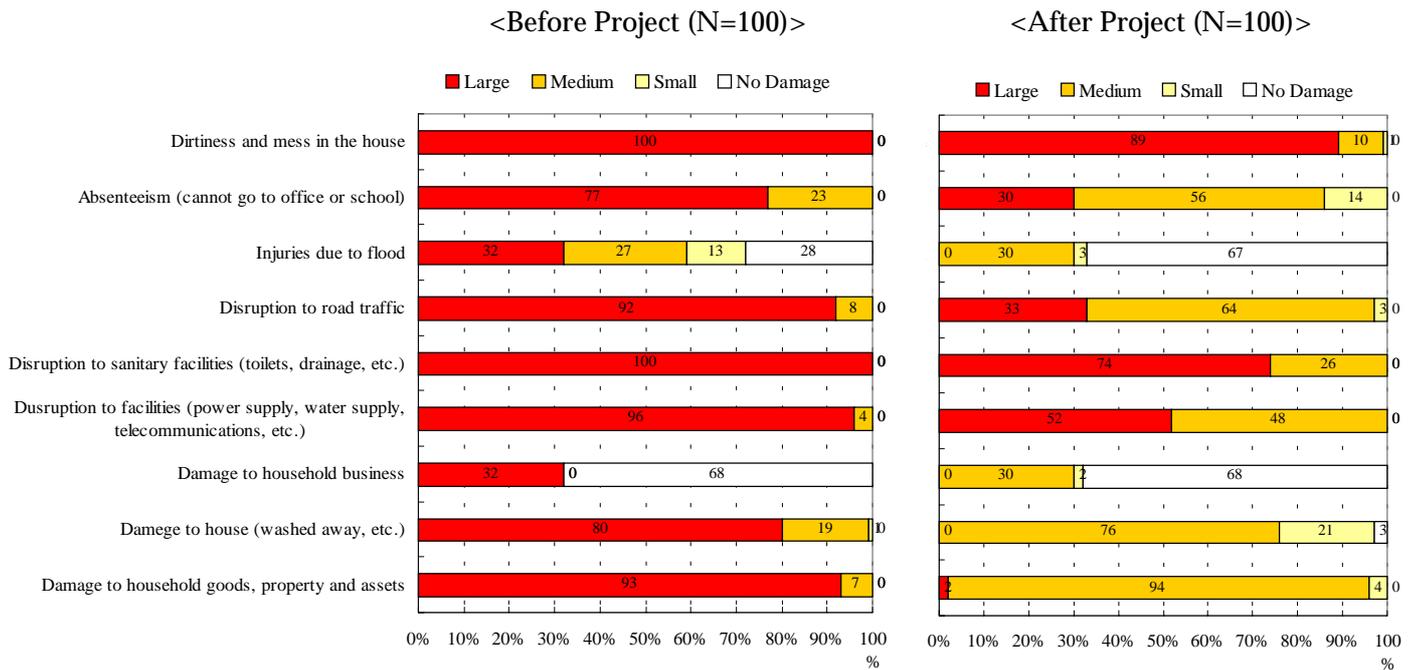
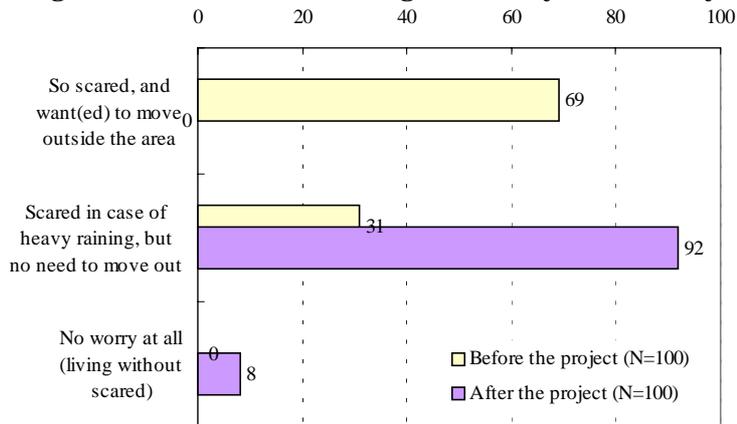


Figure 6 : An assessment of regional safety and security



2.3.3 Recalculation of EIRR (Economic Internal Rate of Return)

EIRR of the current project was re-calculated using the same assumptions for Packages I through V: annual cost data were applied on the actual disbursement basis, and the computation was adjusted using the economic cost conversion ratio. EIRR for 50 years' operation was re-evaluated at 13.9%; the projection at appraisal was 7.8%. The difference results mainly from the cost under-run – actual costs were about 70% of the original estimate -- in the implementation stage. Specifically, five Packages were completed within the budget originally estimated for two (Packages I and II) owing to the substantial appreciation of the Yen.

2.4 Impact

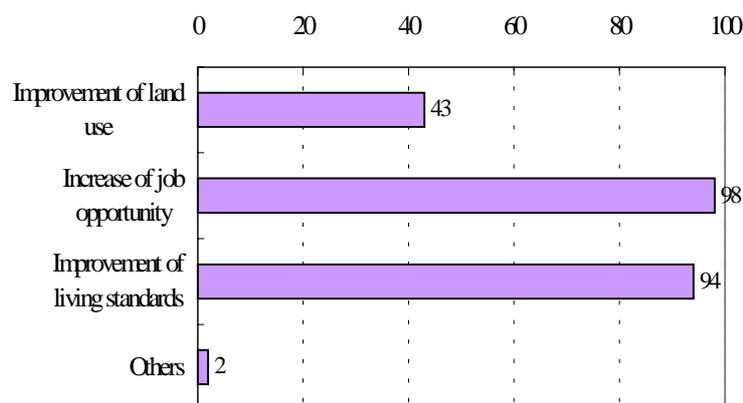
2.4.1 Impacts on Environment

According to the sample data set representing seasonal variation of BOD (Biological Oxygen Demand) and water flow in Solo River measured at Becam, a location between the sites of Package 1 and Package 2, water quality of the Solo River was assessed as being “fairly good or not bad” in terms of BOD level since the BOD was at most 10mg/liter all the year round which is less than 10mg/liter of a barometers of water quality. Although this project does not have a direct impact on water quality of the river, the beneficiaries’ assessment based on the interview survey shows that water quality has improved after the project, to a certain extent, while most of them still feel the quality is insufficient. Consequently, no negative impact has been recognized after the project implementation.

2.4.2 Impacts on Economy

To gain insight into the contributions made by this project, this section will refer to the results of the Interview Survey. Asked, “Do you think this project supports economic activity?”, 100% of those asked responded that the project had made a sufficient contribution. Beneficiaries were asked to respond to a multiple-choice question to specify the type of contribution, the results of which are shown in Figure 7. Ninety-eight of ninety-nine respondents indicated that the project had “increased job opportunities”, ninety-four said it had “improved living standards,” and forty-three said it had “improved land use”. These responses imply that the project has had certain, positive impacts on the regional economy.

Figure 7 : An assessment of regional safety and security (N=99, MA)

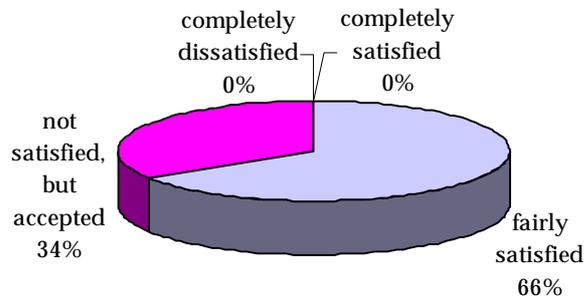


2.4.3 Social Impacts ---Land Acquisition---

There were some areas along the shortcuts that were subject to land acquisition in the project implementation stage. Most of those who had lived in the shortcut construction site resettled to the existing river basin area, after consulting with the land acquisition

committee under the local government⁴). According to the project official, these people were not fully satisfied with the official compensation rate (land price) offered by the government at the beginning, but they finally agreed. The land of 70% of the Interview Survey respondents had been subject to land acquisition, and all compromised on the compensation rate.

Figure 8 : Assessment of compensation (N=70)



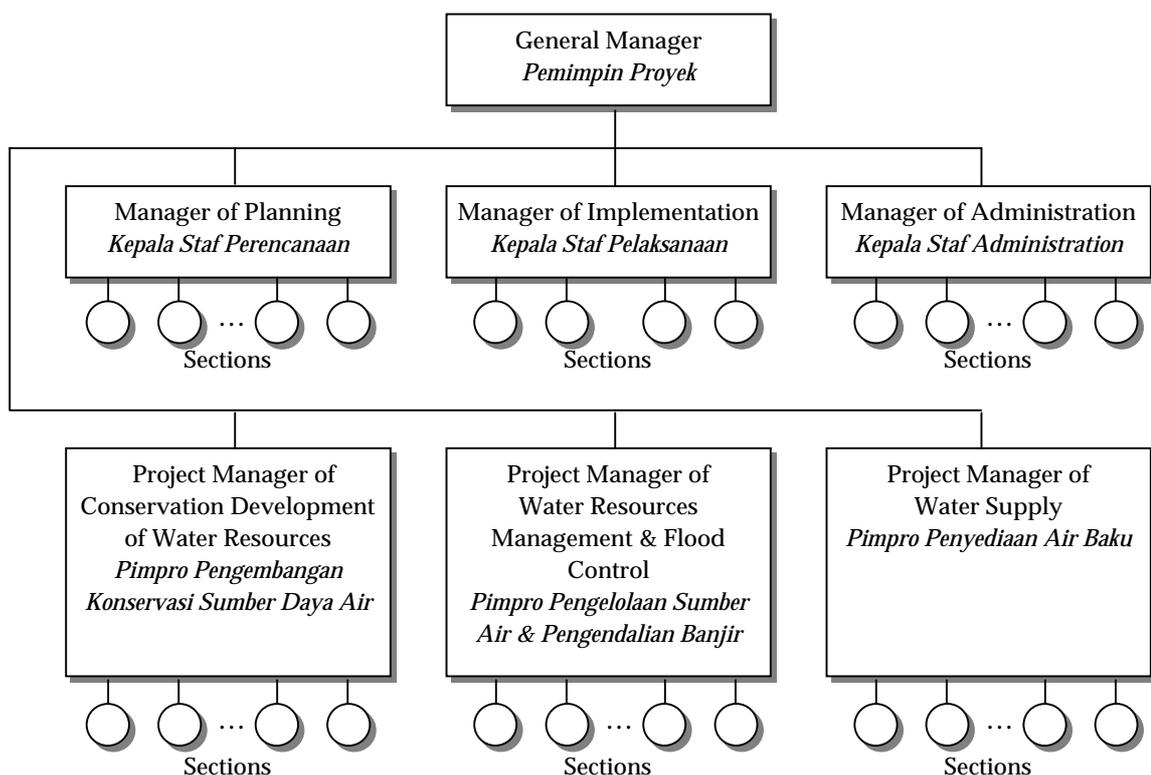
2.5 Sustainability

2.5.1 Operation and Maintenance

1) O&M Organization

The PBS (Project Office of Bengawan Solo) was established in 1969 as an executing agency with the task of maximizing utilization of water resources in the river basin for the benefit of the people and for the prosperity of the country. It has been responsible, until now, for the operation and maintenance of the completed facilities.

Figure 9 : Organization Chart of PBS



⁴) According to the PBS, roughly 4,800 households were resettled by the land acquisition.

The current organization chart, as of February 2001, is shown in Figure 9. There are 3 Senior Managers -- for Planning, Implementation and Administration -- and 3 Project Managers: one for Conservation Development of Water Resources (PKSA), located in Solo City; one for Water Resources Management & Flood Control (PSAPB), in Madiun City; and one for Water Supply (PAB), under the General Manager. PSAPB is the body that is actually responsible for the O&M of the project facilities.

The establishment of a new institution for Bengawan Solo O&M works was proposed; Currently, it is formed under the Branch Office of PJT-I⁵⁾. It will assume care-taking responsibilities for up to 25 rivers -- including the Bengawan Solo main stream -- during the first phase of inauguration and expand its role to include 37 rivers in the second phase.

2) Current Status of Project Facilities

The Project Evaluation Mission visited the site in July 2001 to inspect the current status of the completed project facilities.

The characteristics of the Solo River are likely to be altered as a result of morphological changes and the effects of completed flood control facilities. The most notable change in the upper Solo and Dengkeng rivers so far has been riverbed lowering/degradation, which has caused various problems, including bank erosion, and made existing revetments, bridge foundations and ground sills unstable. The degradation might be caused by a combination of the following factors:

- The river channel slope was increased by the construction of a short-cut channel between the bridge connecting Surakarta and Banmati. Short-cut channels generally increase riverbed scouring at their upstream reaches.
- Sediment supply from the Dengkeng River to the Solo River decreased owing to decreased volcanic activity of Mt. Merapi and to the installation of the Sabo dam. In addition, sand mining activities along the Dengkeng River decreased sediment supply from the Dengkeng River to the Solo River.
- The Wonogiri Multipurpose Dam, constructed in 1980, trapped sediment from the upper stream.

⁵⁾ PJT-I (Perum Jasa Tirta I), a public corporation for water service, was established in 1990 for O&M agency in the Brantas River basin, and is still a state owned corporation (BUMN).

Supplementary Information on “Dengkeng River”

Serious scouring/erosion was observed in the upper reaches of the Dengkeng River . According to the Project Official, this situation developed after the commencement of the project, and has been growing gradually more serious. People living in the surrounding area worry that continuous scouring/erosion will reach their land/property over the dyke and inspection road (the left of the picture) if no appropriate countermeasures are implemented. Currently, they are demanding that the Project Office, through the local government of Sukoharjo District, treat/solve the problem, but no proper action has been taken so far , owing to the lack of available governmental funds.

Current status of a problem river segment

...River flowing from left to right. Paddy area spreading behind the inspection road (on the left)...



2.5.2 Technical Capacity

PBS had a total of 739 employees at the time of the CDMP (Comprehensive Development Master Plan) study in June 2000, 30 of which were in charge of operation and maintenance for the project. O&M staff conduct maintenance activities every three months as follows:

- Patrol and inspection of the river courses and the river structures, and reporting of the results.
- Maintenance of equipment.
- Maintenance of river channels, which comprises maintenance of existing river channels and newly constructed shortcut channels, and removal of obstacles in river channels.
- Maintenance of river structures such as levees, parapet walls, revetments, ground

sills, groins, sluiceways, canal and roads.

The technical capacity of the staff has been sustained and improved through on-the-job training, an element of actual project implementation, and technology transfer from the consultants, according to the General Manager of the PBS. However, there seem to be general and structural problems in the PBS that are gradually, but steadily, affecting the capability of the office. The most obvious trend is the aging workforce. According to CDMP's Study: "36% of the total PBS workforce is between 41-45 years of age, and 38% between 46-50 years. In less than 5 years, 17% of the PBS staff will be eligible for retirement. This situation makes for low staff mobility, flexibility, and, therefore, more difficult human resources management."

To cope with this situation, it is necessary for the PBS to make efforts to employ younger workers to rejuvenate the organization, improving capability and recapturing its vibrancy.

2.5.3 Financial Status

Table 1 shows actual annual O&M expenses for the last five years, from 1996 to 2000. Expenses increased nominally, reflecting both the effects of the Economic Crisis in 1997/1998 and the bad condition of the river structures. According to the General Manager, exceptional expenses exceeded the allocated national budget.

Table 1 : Actual O&M Expense (for all PBS)

Year	1996	1997	1998	1999	2000
Actual O&M Expense (10 ³ Rp/yr.)	65,124	116,430	362,684	389,513	998,166

source : PBS

The PBS is planning to implement a water tariff for major users of the river water, such as PLN (State-owned Power Company), PDAM (Public Company for Regional Water Supply), after establishment of the new O&M agency under PJT-I, in order to earn enough revenue to cover annual expenses.

2.5.4 Toward Sustainability

Though the flood control function of the existing structures can be considered effective, rehabilitation works on the damaged structures are urgently required in order to protect related structures (i.e. revetments, bridges, roads, etc.) and the surrounding environment from further possible deterioration. Furthermore, construction of several drop structures and ground sills for stabilizing the river channel is necessary.

In the 2000 study (Special Assistance for Project Sustainability), JBIC identified the following places/structures as locations that urgently need rehabilitation works. Riverbed degradation, decreases in sediment supply and sand mining have been

observed at all of the sites.

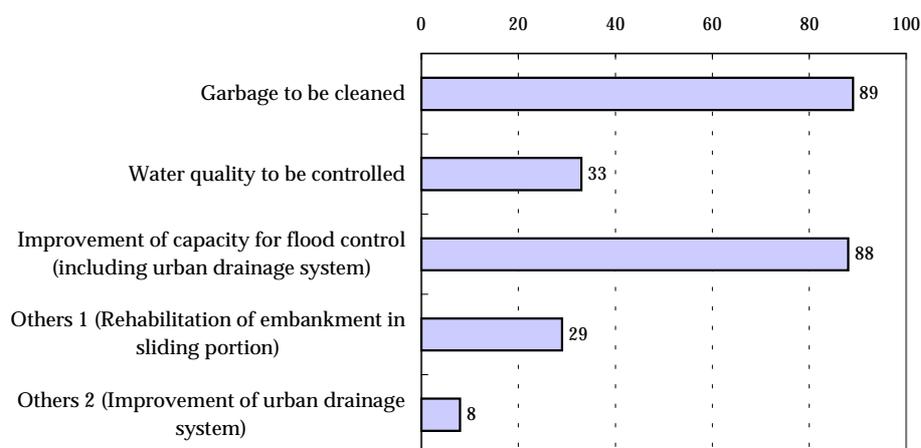
Table 2 : List of Sites on the Upper Solo River Needing Rehabilitation

River	Structure	Necessary rehabilitation works
Solo mainstream (near Lawu village)	Ground sill	Construction of additional ground sills, drop structures and revetments
Wingko river	Sluiceway WKA-1	Repair of revetment and outlet
Jlntah river	River stretches	Construction of additional ground sills & drop structures
Dengkeng river	Jarum bridge River Strechses	Repair of revetment Repair and construction of revetment, construction of additional ground sills & drop structures, repair of bridge foundation protections

source : Rehabilitation SAPS Study

At the same time, beneficiaries have indicated the need for further improvements, as seen in the results of the Interview Survey. Figure 10 shows that “Removal of garbage (98%)” and “Improvement of flood control capacity (97%)” are major concerns among the beneficiaries.

Figure 10 : Further requirements (N=91, MA)



To cope with the current condition, the rehabilitation works listed above and of O&M improvements will be implemented under Japan’s ODA loan, named “Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project”⁶⁾. Rehabilitation is necessary; however, it alone will not make the project sustainable. In addition, the project must secure the financial capability to implement appropriate maintenance activities. The proposed O&M agency under PJT-I is expected to run the project in a stable financial condition.

⁶⁾ Loan Agreement (L/A) for Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project was concluded on October 10, 2002.

Comparison of Original and Actual Scope

Item	Plan	Actual
(1) Project Scope		
1) Location	Solo River, in and around Surakarta City, Central Java Province	Solo River from Surakarta City extended to Sukoharjo, Klaten and Wonogiri Regency
2) River improvement		
a. Stretch to be improved	15.3 km river stretch between Jurug and Temulu <ul style="list-style-type: none"> • Jurug – Bacem : 11.1 km ...improved to 7.4 km • Bacem – Temulu : 4.2 km ...improved to 2.8 km 	55 km river stretch between Jurug and Nguter <ul style="list-style-type: none"> • Jurug – Bacem : 11.1 km ...as planned • Bacem – Nguter : 43.9 km ...improved to 29.5 km
b. Improvement method	Excavation, Levee embankment and short cut	Excavation, Levee embankment, Short cut, Dredging and Bridging
c. Designed flood discharge	-Jurug : 1,550 m ³ /sec -Wingko : 1,550 m ³ /sec -Samin : 1,450 m ³ /sec -Kembangan : 1,400 m ³ /sec	-Jurug : -as planned- -Wingko : -ditto- -Samin : -ditto- -Kembangan : 1,400 m ³ /sec -Brambang : 1,330 m ³ /sec -Pusur : 1,240 m ³ /sec -Dengkeng : 840 m ³ /sec -Jlantan : 780 m ³ /sec -Walikan : 400 m ³ /sec -Wonogiri Dam : 400 m ³ /sec
d. Designed riverbed gradient	1/1,807	-as planned-
e. Designed high water level	-Jurug Bridge : 86.33 m -Mojo Bridge : 87.34 m -Becam Bridge : 89.08 m	-ditto- -ditto- -ditto-
f. Main work volume		
- Excavation	1,765,000 m ³ (Pack.1+Pack.2)	2,698,630 m ³ (Pack.1+Pack.2) 5,588,883 m ³ (Pack.3+4+5) Shortcut length : 13km
- Levee Embankment	845,000 m ³ (Pack.1+Pack.2)	1,200,161 m ³ (Pack.1+Pack.2) 1,506,713 m ³ (Pack.3+4+5) 36km
- Revetment	47,800 m ² (Pack.1+Pack.2)	3,530 m ² (Pack.1+Pack.2) 34,735 m ³ (Pack.3+4+5) 9km
- Pile dyke Groin	67 nos	28 nos
- Sluice way	14 nos	43 nos
3) Consulting Service		
a. Terms of Reference (TOR)	-Assistance of tender evaluation and contract negotiation -Detailed design of flood forecasting and warning system	-as planned-

<p>b. Report</p> <p>c. Required Man-Month</p> <p>- Construction Supervision</p>	<p>-Construction supervision -Technology transfer -Reporting</p> <p>-Detailed design of flood forecasting and warning system</p> <ul style="list-style-type: none"> • Monthly progress report • Interim report • Design report <p>-Construction supervision</p> <ul style="list-style-type: none"> • Monthly progress report • Annual report • Technical guide notes • Completion report and drawing • Operation and Maintenance manual <p>Foreign : 180.5 M/M local : 126 M/M Total : 306.5 M/M</p> <p>Foreign : 127,5 M/M local : 108 M/M Total : 235.5 M/M</p>	<p>-as planned-</p> <p>Foreign : 327 M/M local : 496 M/M Total : 823 M/M</p> <p>Foreign : 232 M/M local : 464 M/M Total : 696 M/M</p>
<p>(2) Implementation Schedule</p> <p>1) Loan Agreement Signing</p> <p>2) Selection of Consultant</p> <p>3) Consulting Services</p> <p>4) Procurement of Contractors</p> <p>5) Civil Works</p> <p>(Completion)</p>	<p>Dec. 1985</p> <p>Nov. 1985 – Nov. 1986</p> <p>Nov. 1986 – Jul. 1990</p> <p>Package 1: Nov.1986 – Nov. 1987</p> <p>Package 2: Nov.1986 – Nov. 1987</p> <p>Package 1: Nov.1987 – Jul. 1990</p> <p>Package 2: Nov.1987 – Jul. 1990</p> <p>Jul. 1990</p>	<p>Dec. 1985</p> <p>Nov. 1985 –1986</p> <p>Nov. 1985 –1995</p> <p>Package I: Jul. 1987 – Mar. 1988</p> <p>Package II: Jul. 1987 – Mar. 1988</p> <p>Package III: Oct. 1989 – Sep. 1990</p> <p>Package IV: Oct. 1989 – Sep. 1990</p> <p>Package V: Oct. 1989 – Sep. 1990</p> <p>Package IA: Apr. 1991 – Oct. 1991</p> <p>Package I: Mar. 1988 – Mar. 1991</p> <p>Package II: Apr. 1988 – Jun. 1991</p> <p>Package III: Oct. 1990 – Sep. 1993</p> <p>Package IV: Oct. 1990 – Sep. 1993</p> <p>Package V: Oct. 1990 – Jun. 1994</p> <p>Package IA: Oct. 1990 – Jun. 1994</p> <p>Jun. 1994</p>

(3) Project Cost		
Foreign currency	3,533 million yen	3,403 million yen
Local currency	4,838 million yen (20,855 million Rp)	2,636 million yen (33,267 million Rp)
Total	8,371 million yen	6,039 million yen
ODA loan portion	4,746 million yen	4,611 million yen
Exchange Rate	1,071 Rp. = 248 yen (April, 1985)	

Independent Evaluator's Opinion on Upper Solo River Improvement Project

Professor of Economics and Accountancy, Gadjah Mada University
Revrisond Baswir

The project is a very good example of an urban biased and a loan driven development policy of the past. Originally, as stated in the report, the scope of project consists only Package 1 and 2. However, due to the appreciation of Yen, the availability of fund extends the scope of project into Package 3, 4, and 5. Considering that the modification in project scope was simply based on the availability of fund, send a clear message that basically there is no guarantee what so ever that the objective of the project is match with the priority needs of the target group.

Reducing rural and urban economic disparity is an important element of Indonesia's middle and long-term development plans. The project, specially its extensions, worked contradictorily with the middle and long term goals of Indonesia development policy. As stated in the report, in addition to improve living condition in term of security and safety, the project primarily provides job opportunity and improve living standard within the most crowded city in Central Java.

The project basically failed in considering its environmental impact. Even though the report stated that an environmentally friendly river improvement method is preferable these days as a new approach in the river improvement, the failure of the project in considering its environmental impact should be put into a serious attention. There is a possibility that the failure has also significant impact on the cost of the project.

Special attention needs to be put on the sustainability of the project. As a part of a loan driven development policy of the past, the project has failed in considering its impact on Indonesian overall debt burden, and eventually on the availability of fund in operating and maintaining the project.