

ASIAN DEVELOPMENT BANK

RE:INO XXX

Reevaluation Study Series (Number 23)

REEVALUATION

OF THE

**LOWER CITANDUY IRRIGATION PROJECT
(Loan No. 479-INO)**

IN

INDONESIA

December 1996

I. HIGHLIGHTS

1. **Objectives and Scope.** The major objective of the Project was to improve income and employment opportunities in the Project area through increased food production on 24,200 hectares (ha) of irrigated land. The Project also aimed to improve the quality of rural living through the provision of rural water supply facilities and rural roads. The Project was expected to benefit about 52,800 families (300,000 people) and contribute substantially towards achieving the Third Five-Year Development Plan's (REPELITA III, 1979/80 - 1983/84) goal of food sufficiency. At full development, the Project was expected to bring about net increase of paddy production by 114,000 tons per annum and soybean production by about 6,700 tons per annum. The scope of the Project consisted of: (i) provision of irrigation, drainage, flood and tidal protection facilities for the development of 20,400 ha irrigated land in the Sidareja-Cihaur area; (ii) rehabilitation of small irrigation systems covering 3,800 ha in four schemes in Central Java; (iii) improvement of 239 kilometer (km) of rural road; (iv) construction of drinking water supply systems for 27 villages in the Sidareja-Cihaur area; (v) provision of a water management training program; and (vi) consulting services for Project implementation, environmental protection, and benefit monitoring and evaluation. Because of shortage of local counterpart funding, the Project was reformulated by reducing the scope of the irrigation system in Central Java by about 2,530 ha and limiting the implementation of on-farm development to construction of on-farm structures and part (10 m per ha) of the tertiary canals.

2. **Postevaluation Assessment.** At postevaluation in 1991, irrigation, drainage, flood and tidal protection facilities under the Project were successfully constructed for the development of about 20,400 ha of irrigated land. In Central Java, the small irrigation system covering about 1,270 ha of paddy land were rehabilitated. The Postevaluation Mission (PEM) estimated that 40 percent of Project output was incremental which was substantially below the reformulated appraisal target. The cropping intensity achieved was 175 percent which was also below the appraisal target of 225 percent. Based on the PEM's expectation that further production increases were moderate, the economic internal rate of return (EIRR) was estimated at about 4 percent. PEM's overall assessment indicated that the Project has had a major positive impact on local institutions and farmers involved in river basin development. It also highlighted that external factors such as rapid deterioration and erosion in the upstream watershed and the downstream siltation and sedimentation of Segara Anakan Lagoon were creating risks which could reduce the performance and sustainability of the Project. The Project Performance Audit Report (PPAR) rated the Project as partly successful.

3. **Reevaluated Project Performance.** The reevaluation confirmed many aspects of the general findings and assessments of the postevaluation. The Project has undergone further improvement since the time of the PEM. Tertiary canals were constructed to provide sufficient water to Project farms and both cropping intensity and yield have increased substantially. Most farmers are now achieving over 5 tons per ha using the high yielding variety and incremental paddy production exceeded the appraisal target. The irrigation, flood and tidal protection facilities are currently well maintained, contributing to sustained benefits. The bulk of operation and maintenance (O&M) is still being funded by the Government. The Reevaluation Mission (REM) highlighted the substantial benefits brought about by the road and water supply components. The

Project roads enabled the farmers to have easy access to markets, and this resulted in increased farmgate prices for produce and decreased prices for inputs. Delivery of Government services has significantly improved. Most farmers have potable water supply and the incidence of cholera has virtually disappeared. The Project has also brought about rapid socioeconomic development in the region. Farm incomes have increased and significant employment opportunities created.

4. **Institutional Impacts.** The functions and capability of both the central Government and provincial offices have been expanded and the Project provided a good opportunity for management and technical personnel to gain experience in river basin development. The organizational structure and management system have improved but staffing needs to be strengthened especially in the monitoring aspect. A substantial pool of knowledge on irrigation, and flood and tidal protection management had been built up by the Executing Agency. The Water Users Associations (WUA) were formed and farmers trained and gained experience in the administration and management of their own organization to ensure that the system provided by the Project is well maintained to sustain benefits.

5. **Environmental Impact.** The Project had converted a previously flood pruned and waterlogged area into irrigated paddy fields. The irrigation system and the system of dikes have kept most of the suspended clay in the river from depositing in the previously flood plains (now paddy fields) causing greater siltation in the downstream of the rivers. The river channelization by the levees had further accelerated the siltation which impedes the flow of river water to the sea. Urgent attention is needed to mitigate erosion and conserve the watershed areas.

6. **Economic Impacts.** The EIRR was calculated at 10.7 percent. This is lower than the EIRR calculated at appraisal (19.0 percent) but higher than the estimate made by PEM (4.0 percent) at postevaluation. The REM's higher EIRR relative to the PPAR estimation was due to higher forecasted prices for paddy and higher expected incremental paddy production. The REM's higher EIRR also reflected quantified benefits derived from the rural road component.

7. **Overall Performance and Sustainability.** The performance of the Project is considered successful, in view of the improved situation relating to crop yields and production and improved farm incomes since PEM. The Project provided an effective irrigation system, flood and tidal protection facilities; assisted in on-farm development leading to substantial rice production, improved living conditions of the beneficiaries, and rapid socioeconomic development of the area. Project benefits could be sustained if measures are taken to mitigate constraints resulting from siltation of rivers. Further development works are needed in the upstream watershed areas to mitigate and to prevent further watershed degradation and erosion.

8. **Lessons Learned.** The lessons learned brought out in the PPAR are confirmed by the reevaluation. In particular, the need for beneficiary involvement and developing their capabilities in O&M are essential for the success of irrigation projects. Another important lesson learned was that the development of irrigation, and flood and tidal protection system should adopt an integrated and coordinated approach involving upstream watershed management and conservation. It is important that resources and demands for water within the entire river basin and watershed are considered in a rational and coordinated manner to ensure that the water users are optimally and equitably served. Project facilities should not be turned over to local authorities unless they are technically and financially equipped to assume the role of managing the project. Finally, irrigation and rural development projects should give adequate attention to cross-cutting

issues as well as technical and human resource capabilities of the Executing Agency in implementing the project.

II. BACKGROUND

A. Irrigation Sector

9. Increased food production and rural poverty reduction were two major objectives of the REPELITA III of the Indonesian Government in the early 1980s. Food sufficiency, particularly rice, was an important strategy of REPELITA III. It was envisaged that food security can be improved through increasing rice production by rehabilitating existing and constructing new irrigation schemes.

10. Major investments were made in irrigation to meet food self-sufficiency. From 1968 to 1994, external assistance for irrigation investment amounted to \$6.6 billion of which the Bank contributed about 21 percent (loans and technical assistance). Rice self-sufficiency was reached in 1985, but in recent years, droughts and floods have made it necessary to import again. The Government intends to continue expansion of irrigation and intensification of rice cropping.

11. Current major issues that are central to the viability and sustainability of irrigation systems include: (i) need to carry out O&M, including responsibility and the adequacy of funding; (ii) flood reduction through major investments in embankments, river channeling to reduce aggradation, dredging and moving large amounts of silt deposited by rivers; and (iii) management of agricultural pests to reduce crop losses. Of these, the most crucial issue facing the irrigation sector is the adequacy and effectiveness of O&M in the existing irrigation schemes. To strengthen O&M and to shift the burden of O&M financing to beneficiaries and local governments, the Government adopted an irrigation O&M policy in 1987. This policy provided several sources of funding for the O&M of irrigation schemes including: (i) introduction of an irrigation service fee (ISF); (ii) local mobilization of additional levies by enforcing the collection of land and building tax; and (iii) increased central Government budget allocations for O&M as an interim measure, until the local ISF financing can become fully established. The new policy sought to strengthen WUAs by authorizing them to: (i) collect their own membership fee (distinct from ISF); (ii) take responsibility for O&M activities in parts of large irrigation schemes; and (iii) take over complete responsibility for all management and operations of small irrigation schemes (less than 500 ha). The policy has been carried out by local government at the provincial and district (*kabupaten*) levels, with guidance from the Directorate General of Water Resources and Development (DGWRD).

12. The extent of the accomplishments of the 1987 O&M policy is less clear. For instance, although rates of collection of ISF have been high in certain provinces, the overall revenue generated is still less than 20 percent of the level required to undertake O&M of irrigation. As a consequence, the dependence on central Government allocations for O&M as an "interim" measure has continued to increase rather than decline.

B. Lower Citanduy River Basin

13. The Citanduy river forms the border between West Java Province and Central Java Province. Its upstream watershed and the catchment areas of its tributaries cover an area of about 350,000 ha, making it one of the largest watersheds in Java. As early as 1969, it was recognized as a "critical watershed" because of high rates of erosion, sedimentation and downstream flooding. To address the flooding problem, a master plan for the development of the Citanduy river basin was prepared in 1975. The master plan contained a strategy for a two-pronged approach, viz.: (i) a comprehensive flood mitigation-irrigation-salinity control scheme for the lower Citanduy areas; and (ii) a watershed management scheme for the upper Citanduy areas with emphasis on erosion control and sediment reduction. Rehabilitation of existing small upstream irrigation schemes and development of new irrigation schemes in the lower Citanduy areas were part of the plan to achieve the overall flood control objective of the master plan.

C. The Project

14. The major objective of the Project was to improve incomes and employment opportunities in the Project area through increased food production on 24,200 ha of irrigated land. The Project also aimed to improve the quality of rural living through the provision of rural water supply facilities and rural roads. The Project was expected to benefit about 52,800 rural families (300,000 people) and contribute substantially towards achieving the REPELITA III's goal of food sufficiency. At full development, the Project was expected to bring about net increase of paddy production by 114,000 tons per annum and soybean production by about 6,700 tons per annum.

15. The scope of the Project consisted of: (i) provision of irrigation, drainage, flood and tidal protection facilities for the development of 20,400 ha irrigated land in the Sidareja-Cihaur area; (ii) rehabilitation of small irrigation systems covering 3,800 ha in the four schemes in Central Java; (iii) improvement of 239 km of rural roads; (iv) construction of drinking water supply system for 27 villages within Sidareja-Cihaur area; (v) provision of water management training program; and (vi) consulting services to assist the Executing Agency in Project implementation and in conducting environmental and Project benefit monitoring and evaluation.

16. The Project was appraised from 22 July to 22 August 1980. A loan of \$55.2 million from the Bank's ordinary capital resources was approved by the Board on 13 November 1980 to finance the foreign exchange cost of \$45.7 million and \$9.5 million local cost equivalent. The Project was cofinanced by an EEC grant of \$4.9 million, targeted toward provision of improved drinking water supplies. The loan became effective on 10 August 1981.

17. During the course of its implementation, the Project was reformulated and reduced in scope to overcome the Government's problem of local counterpart funding constraints. The reformulated Project maintained the original objectives but the rehabilitation for four Central Java schemes was reduced to one covering an area of 1,370 ha. On-farm development was reduced to construction of part (10 m per ha) of the tertiary canals.

18. It was envisaged that the Project would be completed over a seven-year period, commencing February 1981 with loan closing in December 1987. The loan became effective on August 1981, and the Project was actually completed in September 1989, with a 24-month delay. The loan was closed on 31 December 1989, with one extension. The Executing Agency was the DGWRD. Project implementation was carried out by Citanduy Project Office in Banjar, West Java.

19. Total Project cost at appraisal was estimated at about \$107.6 million, consisting of \$48.4 million in foreign exchange, and \$59.2 million in local currency equivalent. The actual cost of the Project was \$90.7 million consisting of \$42.4 million foreign currency cost and \$48.3 million local currency cost equivalent. The actual total cost of the Project was 15.6 percent less than the appraisal estimate. The cost underrun was due primarily to devaluation of the rupiah and reduction in scope of the rehabilitated scheme as a result of shortfalls in Government funding. Disbursement under the Project came to \$54.8 million compared with the original loan amount of \$55.2 million.

20. The Project Completion Report (PCR) was prepared in May 1990. The PCR found that Project implementation was generally satisfactory, in spite of a delay in completion, and that the Project had helped improve farm incomes and enhanced the quality of life and local economic activities. There was no cost overrun and DGWRD had generally performed well; the quality of most completed facilities was satisfactory.

D. Postevaluation Findings

21. The PPAR was prepared in July 1991, 14 months after the PCR. PEM estimated that 40 percent of Project output was incremental which was below the Project appraisal target. Although the average crop yield reached the appraisal target of about 4 tons per ha, this was not significantly higher than the future "without" Project situation because water supply was not sufficient in parts of the Project area to enable the adoption of the high yielding variety. The cropping intensity achieved was 175 percent compared with the appraisal target of about 225 percent. At that time, part of the Project area still suffered from waterlogging and poor drainage because of inadequate maintenance of drainage facilities and increasing siltation from the river. The PPAR forecasted that prospects for further production increases were moderate because of the low level of O&M funding. The report highlighted that the relatively low increases in yield could be compensated by larger areas being cultivated, and production could stabilize and then progressively decline in future years.

22. The PPAR reported that the organizational structure, staffing pattern and management of the executing and implementing agencies were generally satisfactory. Management policies and systems were consistent with Project goals. The Project had a major impact on the central and provincial institutions involved in river basin and irrigation development. The Project had contributed to the development of skills, improved technical and infrastructural administration and gave an impetus to decentralization in decision making and administration.

23. The EIRR estimated by PEM for the Project as a whole was 4 percent compared with the appraisal estimate of about 19 percent. The major reasons for the low estimate were lower than expected agricultural outputs and adverse price movements. The poor drainage problems related to inadequate O&M led to lower incremental rice production. Over the Project period, the price of rice dropped significantly from an average of \$551 per ton to about \$265 per ton in 1990 constant prices. The PPAR raised concerns on the sustainability of the Project benefits. The major factors affecting Project benefits sustainability included (i) inadequate O&M funding; (ii) impact of siltation from the river affecting the drainage outlets; and (iii) further degradation in the upstream watershed areas making the Project areas susceptible to flooding, raising the risk that levees would be overtopped and destroyed.

24. The PPAR's overall assessment indicated that the Project had a major positive impact on local institutions and farmers involved in river basin and irrigation development. Factors related to the design and external effects could reduce the performance and sustainability of the Project. Due to overpopulation and poor farming practices, environmental conditions in the upper watershed deteriorated rapidly, increasing risks for the Project. The PPAR rated the Project as partly successful. To achieve and sustain production targets, the PPAR recommended that (i) additional investments are needed for drainage, flood control and lagoon improvement; (ii) watershed problems related to erosion in the upstreams need to be resolved; (iii) funding for O&M needs to be increased; and (iv) collection of ISF should be enforced.

E. Rationale and Objectives of Reevaluation

25. The Bank's reviews and assessments of the Project at completion and at postevaluation were made when the Project was still in a relatively early stage of operation. The PCR and PPAR's judgments about long-term benefits and sustainability could only be considered indicative or preliminary. In addition, the PPAR raised a number of issues (see para. 24) upon which the sustainability of the Project benefits depended. The resolution of these issues by the Government subsequently was crucial to attaining the expected outcome of the Project.

26. Reevaluation of the Project enables the Bank to take a second look at the Project's agricultural performance in terms of cropping patterns, yields, and cropping intensities. In particular, the impacts of siltation and flood damage reduction on agricultural production could be assessed. In addition, the reevaluation enables the Bank to quantify benefits from investments in rural roads, which were brought about at a later stage after the preparation of PPAR. Thus, the reevaluation would be able to arrive at firmer conclusions on the long-term performance and sustainability of the Project. Reevaluation also enables the Bank to critically examine the Government's resolution of various issues raised during PEM. Since PEM, the Government has provided further inputs to improve Project performance and it is timely to examine any new constraining factor(s) which may have emerged. Another objective is to examine and identify issues of relevance for future sustainability of Project benefits.

27. The reevaluation study is based on the findings of the REM that visited the Project area from 17 July to 2 August 1996 and on a review of the Bank's previous postevaluation findings, PCR, Project material in the Bank's files, and discussions with officials of the Bank, the DGWRD and other agencies concerned of the Borrower, and with relevant research institutions and private

contractors involved in implementation. The draft report was circulated to departments concerned in the Bank, and to the Government and DGWRD for their review and comment. Comments received were taken into consideration in finalizing the Report.

III. REEVALUATION FINDINGS

A. Assessment of Project Design and Implementation

28. The REM concurs with the PPAR that the Project design suffered from (i) a lack of provisions for detailed actions on monitoring flood control and siltation aspects; (ii) lack of siltation mitigation activities in the river downstream where Segara Anakan Lagoon is located; and (iii) weak institutional analysis in terms of Project management and human resources as well as Government funding capacity. The Project was prepared and implemented on the assumptions that erosion from watershed and upland marginal farmers would be reduced significantly under a USAID-funded conservation project and that levees would effectively mitigate floods and reduce both siltation and floods in the Lower Citanduy plain. A coordinated and integrated approach to mitigate watershed erosion and to control downstream floods was vital to the success of the master development plan. The success of the development of the Lower Citanduy areas depended on the effective actions to prevent soil erosion implemented in the watershed and upland marginal farmers' areas. Although an integrated approach was adopted in conserving the upstream watershed areas by a separate project, the Project was implemented independently without giving concerns to the situations in the watershed areas. Unfortunately, when the upstream conservation project was improperly carried out, the upland areas continued to suffer from significant erosion, aggravating the siltation problem. This resulted in higher O&M costs for the Project.

29. Upon Project completion in 1989, post-Project activities continued to be conducted by the Project offices in Banjar and Cilacap. At the time of REM, these offices continued to run smoothly. Skilled staff have been retained to continue daily work on irrigation system improvements and repairs. Improvements have been made in some areas by raising the height of dikes, ferrocement tertiaries have been installed in low-lying areas where hand made tertiaries do not have enough fall for water to reach the lower fields. Project implementation activities were supposed to be transferred to the local authorities upon Project completion. However, Project activities were turned over to local authorities in 1994 but technical supervision has continued to be provided by the Project offices. It appears that the current arrangements work smoothly in continuing and sustaining Project activities.

B. Operational Performance

1. Project Management

30. A branch-office in Cilacap undertakes daily activities at the Project sites. This office is headed by a senior officer, who is supported by technical staff performing different aspects of O&M activities. In the middle of the Project area, there are three sub-branch offices (*Ranting*) which maintain primary and secondary canals and assist WUAs with the design, location and layout of tertiaries. The sub-branch offices are responsible for maintaining and clearing of drainage canals. Recently, they have also been responsible for supervising additional investments in (i) lining the East (Cihaur) primary canal, (ii) raising flood dike levels, and (iii) installing ferro-cement tertiaries in selected farmers fields.

31. The current Government policy on tertiary construction stated that the Government will provide on-farm and part (10 m per ha) of the tertiary canals while the construction of the rest of tertiary canals and drains was to be undertaken by farmers with technical assistance from Project management. The responsibility for building and installing most of the tertiary canals rests solely with the farmers. In practice, this did not materialize in some places in the Project areas because a substantial portion of the Project area is very flat and irrigation water cannot reach the far end of the command area using in-ground tertiary canals. In some areas, farmers were not able to fund the construction of the elevated tertiaries. The Project has had to provide funds from elsewhere¹ to construct and install elevated ferro-cement tertiaries in low-lying flat areas where there is insufficient fall in farmer-constructed tertiaries or field-to-field water flow.

32. The Sidareja-Cihaur new irrigation sites are under the supervision of Cilacap office which is under the administration of Central Java Province. The rehabilitation site at Cijalu is under the supervision of the Banjar office. Project management staff in these two offices worked with different local authorities. There is thus no common authority for supervision for all the areas irrigated under the Project. Such a decentralization of Project management has proved to be an effective management strategy because each office deals effectively with its local authorities. Nevertheless, the Project's management office, which is located at Banjar, undertakes the overall supervision of Project activities.

2. Project Facilities

33. Project facilities provided are summarized in Appendix 1. Most of the Project facilities appear to be in good and satisfactory condition. They include Project offices and buildings in Cilacap and sub-branch offices in Sidareja and Kawunganten, which were adequately maintained with electricity, communications, office facilities and equipment as well as staff recreation and social facilities. A random inspection of primary and secondary canals throughout the Project areas indicated that they appeared to be in good working order, with no visible cracks or

¹ Funding for the construction of ferro-cement tertiary canals was provided mainly from another Bank-assisted Project, Loan No. 1017-INO *Integrated Irrigation Sector* for \$170 million, approved on 17 April 1990.

breaks. However, some secondary canals need weeding and removal of debris during the dry season.

3. Cropping Intensity and Agricultural Production

34. The Project has proven to be effective at raising paddy production. At the time of appraisal, the multiple cropping intensity index was estimated at about 155 percent per year (including rice and non-rice crops). During the six year post-Project period 1990-1996, the main Project Sidareja-Cihaur site attained a cropping intensity of 195 percent per year (see Appendix 2, Tables 1 and 2). The Project irrigation facilities had enabled double cropping of rice, turned the rice deficit Project area into a surplus area, and promoted the growth of a cash economy with rapid market expansion of many goods and services.

35. At full development, the Project was expected to produce an annual incremental production of about 114,000 tons of paddy. Of this, 94,500 tons would come from Sidareja-Cihaur new irrigated area and about 19,500 tons from the Central Java rehabilitated schemes. At the time of REM, average annual incremental paddy production from the main Project area of Sidareja-Cihaur reached about 150,000 tons, which exceeded the appraisal target by nearly 60 percent. In spite of reduction in the rehabilitated Central Java scheme from 3,800 ha to 1,370 ha, average annual increment paddy production recorded during the 1993-1995 period was about 15,000 tons. Total paddy production from the main Project area of Sidareja-Cihaur site peaked at about 250,000 tons in 1992 but was not sustained and declined to about 210,000 tons in recent years mainly because of pest attacks (brown hopper, golden snails and rats) and frequent floods in some lower areas.

36. Soybean production in the Project area during the dry season did not achieve the appraisal target of about 6,700 tons. Most farmers in the Project areas enjoyed two cropping seasons for paddy and have abandoned soybean or other foodcrop production. Because of rapid economic development in the Project area, significant off-season employment opportunities have been created and most farmers prefer to do off-season non-farm work to earn additional cash income rather than undertaking a third season of soybean production.

37. Average yields for paddy in the Project area are much higher than expected at appraisal. The 1994 to 1995 paddy crops within the Project areas showed an average yield of 6.6 tons of dry threshed paddy per ha during the main rainy season, and 5.1 tons of dry threshed paddy in the second season. In 1980, at the time the Project was appraised, paddy yields were in the range of 1.7-2.1 tons per ha in the wet season and 1.2-1.7 tons per ha in the dry season.

4. Farm Incomes

38. Data collected by REM and information derived from rapid rural appraisal of four randomly selected villages (about 30 farmers in each village), showed that the Project farmers' income had increased considerably. For a typical one-hectare farm, the increase in income is estimated at about \$780 per annum. This increase had brought about significant changes in living standards of the farmers as evidenced by the ownership of motorcycles, radios, television, trucks

and even a few satellite dishes.

5. Rural Roads Improvement

39. The inadequate access-to-market rural roads was one of the major constraints on agricultural development in the Project area. Pre-Project roads were in very poor condition and, in most cases, were not for use by motor vehicles. The major Project town in Sidareja could be reached only in the dry season and farmers in the irrigated areas were without village roads. Paddy production had to be carried by labor to the nearest road. This resulted in high costs of transportation and low farmgate prices. The Project provided funding for the rehabilitation and construction of 42 km class A district roads, 138 km class B subdistrict roads and 121 km class C village roads. Using vehicle count data in the Project area² and information on savings in vehicle operating costs (see Appendix 3, Tables 14 and 15), the economic benefits (from savings in vehicle operating costs) derived from the road component was quantified at about \$1.6 million per annum. The roads provided by the Project brought about significant benefits to both the Project and non-Project farmers. The farmers can now have easy access to markets throughout the year and farmgate prices had improved substantially because of lower transport costs by trucks and other vehicles. The farmers' assets in terms of land value along both sides of the roads had increased substantially. The easy access for traders to the Project areas has increased Project's surpluses to outside markets, contributing to rapid economic development in the Project areas in recent years.

C. Institutional Impact

40. Under the Project, the technical capabilities of the DGWRD and provincial technical staff have been strengthened. The Project has contributed to the development of skills, improved technical and infrastructural administration, and better river basin management capability. This was one of the early irrigation Projects funded by the Bank in the Central Java region and the experience gained from this Project had benefited subsequent Bank's projects in Java and other islands. The Bank assisted two additional irrigation projects in adjacent areas and a new project to develop Segara Anakan Lagoon is under consideration. DGWRD is now able to undertake project planning, appraisal and implementation in a more effective manner. There are also indications of significant improvements in O&M as evidenced by the overall good conditions of the irrigation facilities provided by the Project. Project management has been responsive to field conditions and lessons learned from initial works were incorporated in subsequent implementation activities. Thus, the Project has had a major impact on the institutions concerned, at both the central and provincial levels, in river basin and irrigation development.

41. WUAs have been formed throughout the Project areas. The administration and management of the WUAs are satisfactory. The WUAs' leaders are elected by voice vote in the villages, and they serve with the consensus of the members. In addition to the top three leaders of each WUA, leading members known as *Pengurus* (village heads) are also elected to represent water users. The WUAs collect their operational funds through contributions in-kind from members. The WUAs have in some cases been able to construct tertiaries using self-help hand labor. In other

² Data obtained from provincial Public Works Road Service Department (Bina Marga Propinsi) in the Project areas.

cases, where the terrain is very flat or where distant fields are slightly elevated and irrigation water can not reach, the WUAs have been less successful at mobilizing members to install tertiary canals because of high construction costs that are beyond the financial capacities of farmers.

D. Socioeconomic Impact

42. The Project has had a positive and significant impact on the socioeconomic conditions of both the Project beneficiaries and other residents living in the areas. It has contributed to economic development of a previously flood-prone area with an uncertain agricultural production and poor living conditions. The Project has converted a rice deficit area into a surplus one, stimulated the development of towns and villages with improved housing, schools, health clinics and retail shops. A most significant development is the rising number of vehicles passing through the area facilitating market access of agricultural produce and inputs. The rice surplus position resulted in substantial increase in incomes and has enabled all Project beneficiaries to send their children to school.

43. Major changes have taken place in farm-level technology. At the time the Project began in 1980, most land preparation was done by human labor, being cheaper than animal draft or tractor power. As a result of increased incomes, almost all farms now undertake land preparation with power-tiller tractors, often on a custom-hire basis. This has reduced the requirement of labor in rice production. The extra labor saved is utilized in off-farm employment (such as making bricks from river mud) to earn additional cash incomes.

44. Rehabilitation and construction of rural roads in the Project area were undertaken to facilitate and improve farmers' market access and movement of agriculture inputs into the Project area by contractors and traders. The improvement and provision of rural roads have contributed substantial benefits to residents living in the Project areas in terms of higher farm gate prices and market orientation. A large volume of traffic into and out of the Project area has now been generated, much of which has brought about significant socioeconomic value to the residents living in the Project area (see Appendix 3, Tables 14 and 15 for average daily and yearly use of Project roads). REM estimated that the annual economic benefits from upgrading 42 km of Class A Project road is about \$679,000 worth of decreased vehicle operating cost per year. Similarly, the economic benefits of upgrading the 138 km of Class B sub-district roads is about \$1 million per year. The upgrading of village roads has produced additional, as yet unquantifiable benefits. Project villagers interviewed by REM stated that road rehabilitation under the Project was of major importance to the advancement of the region because it has facilitated greater access to markets and delivery of Government services.

45. Malnutrition has largely disappeared from the Project area. At appraisal, about 70 percent of the population suffered from mild malnutrition, and 20 percent suffered from severe malnutrition. Since 1994, records from health office statistics showed no cases of malnutrition in the Project villages.

46. Improved water supply has eliminated cholera in the Project area. Village health service records showed that no cases of cholera have been reported during the last three years. While cholera cases were reported at appraisal, no statistics were available; there is, therefore, no

baseline information with which to compare the current absence of cholera. However, meetings with villagers indicated that cholera had been frequent in the 1980s. This significant beneficial effect is attributed mainly to the potable water component of the Project.

47. The availability of jobs and higher income levels in the Project areas have completely stopped transmigrants to outer islands in the last three years. Villagers interviewed did not reveal any applications for transmigration in 1996, nor did the village statistics show any out-transmigration. On the contrary, there were many cases of young families that had migrated from nearby provinces to the Project area because of better employment opportunities and higher economic activities.

E. Impact on Women

48. Women have traditionally been serving as unpaid family labor, responsible for the transplanting of rice seedlings, field maintenance, and harvesting. In recent years, many women in the Project areas have organized themselves into contracting labor-groups for transplanting (*Borongan*). Farmers with larger farms could now hire women labor-groups to undertake rice seedlings transplanting on a contractual basis. Such labor earn a daily wage of about Rp8,000, which is about 2-3 times the daily unskilled wage rate in Indonesia. Many enterprising women are also involved in off-season brick production and other cottage industries instead of planting third season foodcrop (*palawija*) during the dry season. The Project has provided opportunities to many women to develop their own entrepreneurship.

F. Environmental Impact

49. The Project converted the once flood prone area into an extensive rice production area. Flood embankments and levees were built to prevent flooding during the rainy season. The construction of embankments and levees as well as the irrigation system had changed the water balance and dynamics in the Project area, affecting the ecological balance and capture fisheries in the river downstream and the Segara Anakan Lagoon. The flood embankment and levees have accelerated the siltation at river bed and the lagoon.

50. At the time of appraisal, the entire catchment area was estimated to yield about 715,000 cubic meters (m^3) of sediment, of which the major portion (550,000 m^3) was deposited into the Segara Anakan Lagoon, and about 165,000 m^3 would be deposited either in the streams or would enter the irrigation system for deposition on rice fields. The most recent estimates made by the Project office in Banjar suggest that currently about 5.8 million m^3 of sediment enters the rivers in the Project areas, of which about 1 million m^3 settles in the system, about six times worse than at the appraisal stage. The siltation and sedimentation problem has been aggravated and become a major environmental constraint in conserving the ecosystem of the lagoon.

51. The irrigation system and the system of dikes along major rivers in the Project areas have kept most of the suspended sediment from entering agricultural areas. Much of this clay (and some sand) have been deposited in river beds causing aggradation (raising of river beds). This, in turn, has resulted in the need to build higher dikes in certain areas, which continue

to aggravate the problem of aggradation of river beds. The finer suspensions are eventually deposited in the lagoon resulting in the formation of mud flaps and loss of lagoon area at an alarming rate. DGWRD indicated that the surface of the lagoon had shrunk by at least 30 percent in the last ten years. The Bank is currently processing a Segara Anakan Conservation and Development Project to help ease the siltation problem at the lagoon by constructing a channel to divert the downstream Citanduy river to the sea, bypassing the lagoon. This would help to reduce the silting process at the Lower Citanduy region, thereby reducing O&M costs.

G. Economic Impact

52. The EIRR of the Project was reevaluated at 10.7 percent (see Appendix 3, Table 16). This is significantly lower than the appraisal estimate of 19 percent but higher than the PPAR estimate of about 4 percent. REM's estimate is quite close to the estimate made at PCR, which was 12.6 percent. Compared with PPAR estimate, a higher EIRR was derived mainly because of higher cropping intensity and yields obtained by farmers. In addition, the farmgate prices obtained by farmers are also higher than those estimated by the PPAR. Another factor which the PPAR did not consider is the quantifiable benefits derived from roads provided by the Project. In view of abundant water flows in the major rivers in Lower Citanduy and the absence of competition for the use of water, no opportunity cost of water is included in the economic analysis. As discussed in para. 49, siltation continues to be a major constraint in the river system and higher O&M costs would be needed in the future to maintain and improve the flood protection facilities (levees and embankments) in the Project areas. A real increase of 5 percent in O&M costs have been used in the EIRR analysis. A sensitivity analysis was conducted to take into account the possibility of floodings, pest attacks which affect the yield of paddy, market price fluctuations, and higher O&M costs to maintain the flood protection facilities and canals (annual real increase of 10 and 20 percent). In most cases, the EIRRs are above 10 percent (see Appendix 3 for EIRR reevaluation and sensitivity analysis).

H. Project Sustainability

53. The Project has resulted in the construction of an irrigation and flood control system for 20,040 ha of new irrigated rice fields and the rehabilitation of 1,370 ha of existing small irrigation schemes. The irrigation system enabled double cropping of rice began to be realized from mid-1980s. The expansion and sustainability of irrigation benefits, together with those from flood control facilities would depend on continued investment from DGWRD to raise the levels of embankments and levees, repair flood damage, and increase funding for O&M of the irrigation system. The cost of operating the Project and maintaining its facilities could increase in the future if the siltation and sedimentation problem is not alleviated. Although the Project has sustained its benefits to date, there are concerns that degradation of upstream watershed areas would further accelerate siltation in the river basin areas resulting in the clogging of drainage outlets, raising the risks that bunds would be overtopped causing substantial flood damage. Siltation and sedimentation at the river and lagoon would gradually block the flow of the rivers in the Project area thus aggravating the risk of floods in the wet season. To sustain long-term Project benefits, there is, therefore, a need for significant Government financing in O&M, for remedial measures at the upstream watershed areas, and dredging of river beds and lagoons to reduce the problem of siltation in the entire river basin

area. The proposed Segara Anakan Conservation and Development Project would help to alleviate the siltation problem and contribute towards the sustainability of the Project.

IV. KEY ISSUES

A. Coordination on Integrated Watershed Management and Reduction of Erosion and Siltation

54. The original Project design did not address the issue of controlling erosion and sedimentation at the upper catchment areas. Instead, the conservation and erosion control component in the upstream watershed was independently implemented under a different Project funded by USAID. There was ineffective coordination between the Project implementation agency and the Forestry Department as well as the Agriculture Department regarding the activities of forestry agencies and upland marginal farmers whose activities caused serious erosion. There is a need to improve the relationship and coordination of various implementing agencies concerned for an integrated approach to watershed management. Relying upon complementary programs funded by other sources, and implemented by other agencies completely out of the control of the Project, has proven to be an inadequate strategy. As discussed in paras. 49 to 51, the siltation problem is worsening at the lower river basin and at the lagoon. There is an urgent need for a coordinated approach to reduce erosion and siltation and its negative impact on the entire river basin. The upper watershed and river basin development requires integrated planning and management. Obviously, the previous Citanduy River Basin Master Plan is not adequate to cope with the erosion and siltation problems. The Government needs to reformulate an effective watershed and river basin master plan and establish effective institutional coordination, management and environmental control mechanism to alleviate the erosion and siltation problems.

B. Operation and Maintenance Funding

55. To date, O&M of the primary and secondary canals is still funded by the Project office, using funds from DGWRD. The farmers pay WUA membership fees in kind consisting of 105 kg of paddy per ha per annum. The WUA fees cover the administration costs and the construction of tertiary canals and their maintenance. The Government is providing funds for the O&M of primary and secondary canals. ISF is envisaged to be collected from the farmers but it only began in 1994 in parts of the Project area. Although current O&M appears adequate, except for the need for additional funding to clean and weed small portion of the primary and secondary canals, Government funding to maintain the irrigation system cannot be relied upon indefinitely. The Government should introduce adequate ISF throughout the Project area and the fee collected should be sufficient for maintaining Project facilities in satisfactory conditions. The Project farmers should also be organized into self-help (*gotong-royong*) groups to assist with labor inputs in the cleaning and weeding of primary and secondary canals during the dry season.

C. Agricultural Pest Management

56. A major rice pest, the golden snail, appears to be causing serious damage to the newly planted paddy fields. It was unfortunately introduced into Indonesia during the 1980s by the Ministry of Agriculture as an alternative food source. This food source was disliked by local residents. The golden snail is known variously as *keong mas* or *ciput murbai* in Indonesia. The snail damages young rice plants, often causing the need for re-planting two or three times, increasing production costs. Control measures using integrated pest management techniques are being developed in Indonesia, but extension agents in the Project area are not trained in this aspect to advise farmers. Another pest problem is the increasing incidence of rat damage to maturing rice crops. As with the case of the golden snail, the existing agricultural extension services are unable to provide guidance to farmers to solve this problem which could be potentially serious in reducing rice production and increasing the cost of production.

V. CONCLUSIONS

A. Overall Assessment

57. The construction of about 20,040 ha of newly irrigated land at the Sidareja-Cihaur area and rehabilitation of about 1,370 ha of irrigated land in Central Java were successfully completed under the Project. In addition, rural roads and water supply systems as well as a water management training component were satisfactorily implemented. The irrigation structures and facilities provided under the Project are well maintained and have contributed to increased food production. At full development, paddy production from Project areas substantially exceeded the appraisal target of 114,000 tons per annum. The Project has also brought about substantial socioeconomic benefits in terms of increased farm incomes, better living conditions, disappearance of malnutrition and cholera, and rapid economic development in the Project areas. The Project had converted a previously waterlogged and flood and tidal-prone area into one with diversified and rapid economic development. Domestic water supply is available to all households. Farmer incomes and employment opportunities have significantly increased. The Project also benefited local institutions and farmer groups in terms of gaining experience in irrigation and river basin development.

58. On the less positive side, ongoing further development works are needed to prevent recurrent flooding during the wet season as siltation in the rivers has raised the river beds and clogged up the drainage system. This has also led to higher O&M costs. Siltation is causing problems in the downstream areas of the rivers as well as in the Segara Anakan Lagoon where mud flaps are being formed gradually resulting in disappearance of the lagoon. Although the siltation problem is caused directly by the upstream erosion which is beyond the Project's control, the irrigation system constructed at the Project areas has aggravated the siltation problem because the levees prevented the deposition of river alluvial material in the previously flooded plains. There are concerns regarding sustainability of Project benefits in the longer term if the situation regarding river siltation continues to be aggravated. Concerted efforts to control erosion and an effective

conservation program should be implemented in the upstream watershed areas.

59. Overall, the Project is considered successful. The Project has achieved the objectives as set out at appraisal. The reevaluated EIRR is about 10.7 percent. In view of the Government's commitment to continue investment in the upstream watershed area to control erosion and further engineering works to protect the lagoon, Project benefits are expected to be sustained.

B. Lessons Learned

60. The Project design focused largely on the technical and engineering aspects of flood control and irrigation system construction. Inadequate attention was given to political, institutional, and the social environment of the irrigation sector and Project beneficiaries. The technical and human resources as well as the management capabilities of DGWRD were not analyzed. These inadequacies resulted in the initial long delay in Project implementation, created logistic problems with consultant inputs, and subsequent revision in Project scope. Project design should, therefore, incorporate aspects concerning political and institutional factors, cross-cutting issues and other socioeconomic considerations, absorptive capacities of beneficiaries and local institutions, human resources, and management capabilities of the executing and implementation agencies.

61. The Project was implemented as part of the Citanduy river basin development. The upper watershed conservation component was implemented independently by other agencies while the preservation and conservation of the lagoon was not effectively carried out. The Project design by straightening channels and erecting flood dikes along rivers simply delivered the sediment to areas further downstream and filled up the river bed and the Segara Anakan Lagoon. Although the Project itself was successfully implemented, erosion from upstream became severe and the siltation problem posed a threat to future benefits of the Project. In designing river basin development projects, an integrated and coordinated approach involving upper watershed management and conservation, and downstream rural development must be simultaneously and effectively carried out.

62. The Project Management Office continues to manage the Project facilities until 1994 because of the need to provide further investment in the area to alleviate the threat of flood recurrence and continued O&M. The susceptibility of irrigation facilities to rapid deterioration on account of siltation and sedimentation resulted in high O&M costs to the Government. Future Project design needs to adopt an improved and effective O&M strategy involving beneficiary participation. Farmers should be involved from the early stage of Project design and develop a sense of ownership of the irrigation system and the willingness to pay for the water charges.

63. The timing for turnover of facilities from the project implementation unit to local authorities needs to take into consideration the latter's technical, management, and financial capabilities in assuming the management of the project. A phased approach which allows smooth devolution of responsibility in the O&M of irrigation facilities from the project implementation unit to local authorities helps to ensure the sustainability of project activities and benefits.

C. Follow-up Actions

1. For the Government

64. Numerous studies were conducted independently by different Government agencies on upstream watershed conservation, downstream siltation and sedimentation and at the lagoon. The Government should initiate a coordinated effort to review all these studies, analyze and formulate an effective master plan for the entire Citanduy river basin development and management. There is an urgent need to improve watershed management and reduce erosion/siltation in the entire river system. As an interim measure, the Project Management Unit should initiate coordination meetings with actors/agencies currently having an impact on the siltation problems of the irrigation command area and its drains. The object of this coordination is to devise and implement effective measures to mitigate the erosion and siltation problem.

65. To reduce the O&M burden on the Government, the Project Office should make efforts to provide supervision and recommendations to authorities concerned to collect ISF from Project beneficiaries and initiate collection of ISF in villages where the system of collection has not been established. The ISF should be set at a level adequate to sustain the O&M of the entire irrigation system to eliminate the need for further Government funding. A timetable of two years should be set to achieve full collection of ISF for O&M of the system.

2. For the Bank

66. The Bank should continue policy dialogue with DGWRD on the development of a master plan for the Citanduy river basin development. The Bank is currently considering assistance for a project to alleviate the siltation and sedimentation problem of the Segara Anakan Lagoon. Consideration should be given to adopting an integrated and coordinated approach under the proposed project (Segara Anakan Conservation and Development Project), especially the need for a comprehensive conservation and erosion control plan in the upstream watershed area. Although the proposed project includes a piggybacked TA to study upstream watershed degradation, more concrete steps or action-oriented measures should be included in the proposed project. The Bank should ensure that the proposed project should not only focus on technical and engineering aspects of solving the siltation and sedimentation problem in the downstream and lagoon areas, but also that the socioeconomic environment in the project area and the source of erosion are effectively addressed.