The Philippines

Agno and Allied Rivers Urgent Rehabilitation Project

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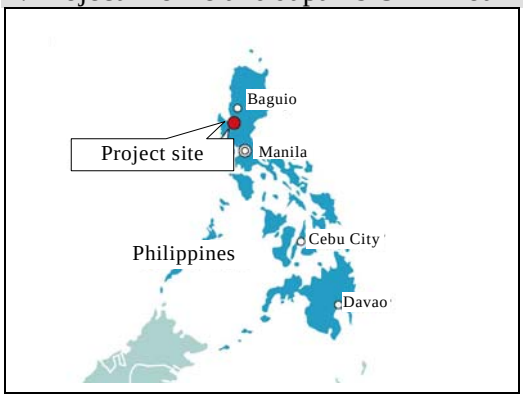
Field Survey: November 2007

## 1. Project Profile and Japan's ODA Loan




Map of project area

Bugallon short-cut channel

### 1.1 Background

The Agno River runs through the western part of the central Luzon region and flows into the Lingayen Gulf in the hinterland of the vast alluvial plain of Pangasinan. The square area of the river basin ranks second on Luzon Island and fifth nationwide. In this basin, flooding due to typhoons occurred repeatedly, frequently resulting in damage to houses and farmland, etc. In addition, due to the earthquake in July 1990 and the volcanic ash and lahars from the eruption of Mount Pinatubo in June 1991, the riverbed rose, resulting in damage to the flood control facilities as well.

### 1.2 Objective

The objective of this project is to reduce flood damage by rehabilitating existing flood control facilities for which urgent measures are necessary on the lower reaches of the Agno River and the upper reaches of the Sinocalan River, thereby contributing to the stability of people's livelihoods and the development of the regional economy.

### 1.3 Borrower/Executing Agency

Government of the Republic of the Philippines / Department of Public Works and Highways (DPWH)

1.4 Outline of Loan Agreement

| | |
|---|---|
| Loan Amount / Loan Disbursed Amount | 8,312 million yen / 8,280 million yen |
| Exchange of Notes / Loan Agreement | July 1995 / August 1995 |
| Terms and Conditions<br>-Interest Rate<br>-Repayment Period (Grace Period)<br>-Procurement | <br>2.5%/year (consultant 2.1%/year)<br>30 years (10 years)<br>General untied |
| Final Disbursement Date | June 2005 |
| Main Contractors | Toyo Construction Company Ltd., Philippine National Construction Corporation (Philippines) |
| Consulting Services | Nippon Koei Co., Ltd., CTI Engineering Co. Ltd., Basic Technology & Management Corporation (Philippines), PKII Engineers (Philippines) |
| Feasibility Study (F/S), etc. | M/P and F/S: 1989–1991 JICA<br>E/S (D/D): 1988 E/S loan (PH-P88) |

## 2. Evaluation Result (overall evaluation: B)

### 2.1 Relevance (rating: a)

This project was consistent with the national plan, etc., both at the time of appraisal and at the time of ex-post evaluation, and so the relevance of the project implementation was and remains extremely high.

#### 2.1.1 Relevance of the plan at the time of appraisal

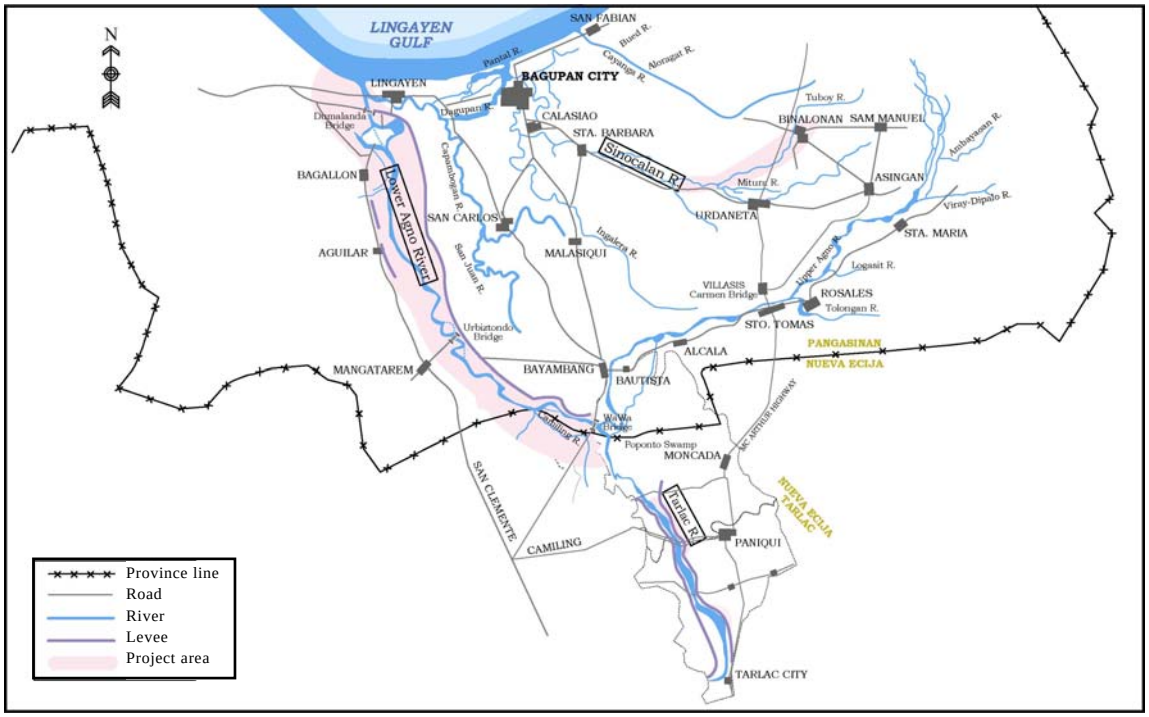
In the project region, flooding due to typhoons occurred repeatedly, frequently resulting in damage to houses and farmland, etc. In the water resource sector of the Medium-Term Philippine Development Plan (1993–1998) at the time of the appraisal, one of the objectives was to place priority on flood control projects in the 12 major river basins, in order to improve agricultural productivity and minimize loss of human life and property. Flood control and management of the major rivers is the responsibility of DPWH, and a comprehensive water resource development programs has been underway since the 1960s for seven rivers including the Agno River.

#### 2.1.2 Relevance of plan at the time of ex-post evaluation

In the environmental and natural resource sector of the Medium-Term Philippine Development Plan (2004–2010) at the time of the evaluation, one of the objectives was to mitigate the occurrence of natural disasters in order to prevent the loss of human life and property. Development of suitable flood control and drainage facilities, including

rehabilitation and improvement of existing facilities, across the entire area affected by flood damage was mandated as a countermeasure. Furthermore, in the DPWH's current Medium-Term Development Plan (2005–2010), continuation of the comprehensive plan for priority major river basins and development of suitable flood control and drainage facilities in regions affected by flood damage are mandated as strategy.

Figure 1: Project Area




2.2 Efficiency (rating: b)

In this project, the project cost was basically as planned, but the project period exceeded the plan by 48%. Therefore, the efficiency of the project was evaluated as moderate.

2.2.1 Outputs

A comparison of the planned output and the actual output is shown on Table 1. The main changes in the plan and the reasons for them are as follow.

Agno River

- As the result of a detailed design review,[1] the total dredging amount increased because it became necessary to dredge for bank protection works and there was the addition of construction of a channel to supply water for fish farming.

[1] As a result of the detailed design review, it was ascertained that there was more actual sediment than the assumed amount, and conversely, the flow could be secured without dredging after all.

- The total length of bank protection sites increased due to design changes because of alterations in the topography of the riverbed and river banks and due to additional sites requiring repair because of flood damage in August 1999.
- As the result of an elevation study, it was ascertained that the sites for levee raising (3,000 m) in the original plan exceeded the designed flood level.[2] Instead, construction for levee raising was conducted in three locations (total of 540 m). Moreover, a setback dike[3] was installed to protect the levee at Guelew where it was damaged during the wet season in 1998.
- The right-bank levee was paved to ensure all-weather access to deal with levee sites which are damaged.

Sinocalan River

- Embankments were planned, but because land acquisition was necessary and since the river meanders, the bank protection works were switched to riverbank locations near residential areas and existing roads.

Tarlac River

- The implementation of TRIIW (Tarlac River Interim Improvement Works) was added as a condition when the Region III Local Development Council approved the Agno River Flood Control Project (II).
- It became necessary to repair levee sites (Colibanban, Maleyep) which were damaged by the typhoon in August 2004.

Consulting Services

- Accompanying the addition of components to the civil works, the following were added: detailed design and construction supervision and monitoring of TRIIW; necessary studies, design, and construction supervision and monitoring of the Domalandan Bridge area construction; and TOR for flood analysis, etc.

Table 1: Comparison of Output Planned at Time of Appraisal and Actual Output

| | Plan | Actual |
|---|---|---|
| 1) Civil Works | | |
| a) Agno River | i) Dredging: 8,626,690 $m^3$<br>Low channels<br>Short-cut channels in 3 locations<br>ii) Bank protection works<br>Low-water embankments: total 9,100 m<br>iii) Levees<br>Raising of existing levees: 3,000 m | i) Dredging: 11,494,521 $m^3$ (35.51 km)<br>Low channels: 6,616,000 $m^3$ (21.08 km)<br>Short-cut channels in 3 locations: 4,805,600 $m^3$ (7.2 km)<br>Water supply channel for fish farming: 72,921 $m^3$(7.23 km)<br>ii) Bank protection works<br>Low-water embankments: total 13,730 m |

[2] The water level of the flood for which the project is designed (a 10-year flood in this case).
[3] This refers to a levee built a certain distance from the main levee in the event that the strength of the main levee is insufficient to protect important areas. In the case of Guelew, rocks, stones, and sand were built up immediately beside the existing levee.

| | | |
|---|---|---|
| | (left bank)<br>iv) Bridges<br>Bugallon Bridge: extension 393 m; width: 9.3 m | iii) Levees<br>Raising of existing levees: 540 m (left bank)<br>Construction of setback dike on right bank (Guelew)<br>iv) Bridges<br>Bugallon Bridge: extension 393 m; width: 7.3 m<br>v) Coffering: 6 locations, total 1,366 m<br>vi) Sluice and drainage ditch<br>vii) Paving of right-bank levee: 31.6 km (Lingayen–Wawa) |
| b) Sinocalan River | High-water embankments in 6 locations, total 1,500 m | Low-water embankments in 7 locations, total 1,280 m |
| c) Tarlac River | | i) TRIIW (interim improvement works) (right-bank embankment/raising): 4,974 m<br>ii) Repair work on right-bank levee (Colibanban, Maleyep): 1,650 m |
| 2) Consulting Services | | |
| | Foreign 172 MM, Local 138 MM<br>Detailed design review; bidding assistance; construction monitoring and supervision | Foreign 244 MM, Local 333 MM<br>Detailed design review; bidding assistance; construction monitoring and supervision; project completion activities (PCR, preparation of O&M manual); detailed design and construction monitoring and supervision of TRIIW; necessary studies, design, and construction monitoring and supervision of construction around the Domalandan Bridge; study of the existing Urbiztondo Bridge and initial design of new bridge; flood analysis; preparation of detailed diagrams, quantity specifications, and construction monitoring/supervision assistance for the repair of the right-bank levee on the Tarlac River |

Figure 2: Raising the left-bank levee of the Agno River

Figure 3: TRIIW current works

2.2.2 Project period

The planned project period was from August 1995 to March 2002 (80 months), but the actual project period was from August 1995 to May 2005 (118 months), or 148% of the planned period. The main reason for the extension was the addition of components including repairs of places damaged by typhoons during construction (repair of the

Guelew levee, bank protection in the area of the Domalandan Bridge, paving of the levee on the right bank of the Agno River, construction of a channel to supply water to a fish farm, TRIIW, and repairs to the right-bank levee on the Tarlac River). The civil works were planned to be conducted from September 1997 to March 2002 (54 months), but in fact were conducted from April 1998 to May 2005 (86 months), an extension of 32 months. The construction for the originally planned components was also delayed due to design changes necessitated by changes in the condition of the riverbed and diversion of construction equipment for use in the additional components. Land acquisition was significantly delayed, from the planned timeframe of June 1995 to November 1996 (18 months) to the actual timeframe of July 1998 to July 2002 (49 months).

2.2.3 Project cost

Whereas the original project cost was a total of 8.312 billion yen (ODA loan portion),[4] the actual project cost was 8.28 billion yen, so the original budget was almost entirely spent. The project's civil works were contracted as a single package, but because the initially contracted amount (ODA loan portion) was less than half of the planned amount, spending remained within the planned amount even after components were added. Moreover, because the contract was denominated in pesos and the peso/yen exchange rate was fixed, there was no impact due to exchange rate fluctuations.

2.3 Effectiveness (rating: a)

Overall, the planned effects of this project are deemed to have been realized, and the project's effectiveness is high.

(1) Flood control and alleviation of damage

According to the flood analysis conducted by this project, the damage estimates for 5-year floods and 10-years floods were as follow.[5] This project is supposed to reduce the damage to zero.

Table 2: Flood Damage Estimates

| | 5-Year Flood | 10-Year Flood |
|---|---|---|
| Flooded (submerged) area ($km^2$) | 91.3 | 130.4 |
| Number of damaged buildings (residences) | 18,654 | 24,491 |
| Number of damaged buildings (other than residences) | 5,738 | 6,920 |
| Number of injured residents (persons) | 130,465 | 169,150 |

[4] Whereas the total planned project cost was 11.083 billion yen, the actual project cost was 11.378 billion yen. The total project costs slightly exceeded the original budget (see page 18 for itemization) because construction conducted using only Philippine government funds without ODA loan assistance (with domestic currency equivalent to 669 million yen) was included in the project cost under the fund management system of the executing agency.

[5] The analysis assumes maximum damage in the event of levee failure.

| | | |
|---|---|---|
| Damaged farmland (ha) | 5,559 | 8,397 |

Source: PCR

The major flooding and damage due to typhoons is shown on Table 3. The flooded area following the project completion is smaller than the area calculated in the flood analysis. However, a simple comparison is not appropriate because, while the flood analysis assumes maximum damage in the event that the Agno River levee failed, the levee of the main river did not fail in the actual flooding but rather the flooding was caused by overflow from related rivers and poor drainage.[6] However, following the completion of the project, the fact that no flooding occurred due to levee failure on the main Agno River during the main typhoon season[7] may be said to be an effect of this project.

Table 3: Major Flooding and Damage due to Typhoons

| Month/year of occurrence | Typhoon name | Flooded area ($km^2$) | Flood depth (m) | Flooded period (days) | Number of houses flooded | Casualties due to flooding /inundation | Monetary damage due to flooding /inundation (peso) |
|---|---|---|---|---|---|---|---|
| September 1998 | Gading | 90.12 | 0.3-0.7 | 5 | 11,770 | 35 | 2,029,129 |
| July 2000 | Edeng/Ditang | 18.05 | 0.3-1.2 | 4 | 102 | 8 | 102,351,002 |
| October 2000 | Reming | 65.20 | 0.3-1.0 | 6 | 41 | 2 | 602,211,003 |
| July 2001 | Feria | 19.20 | 0.3-1.6 | 4 | 381 | 14 | 123,300,081 |
| July 2002 | Gloria/Hambalos | 19.00 | 0.3-1.0 | 4 | 6 | 12 | 176,712,555 |
| May 2003 | Chedeng | 15.00 | 0.3-1.2 | 3 | 59 | 11 | 112,085,225 |
| July 2003 | Harurot | 8.80 | 0.3-1.0 | 4 | 87 | 4 | 39,265,079 |
| August 2003 | Nina | 3.50 | 0.3-0.7 | 4 | 0 | 0 | 13,125,550 |
| June 2004 | Igma | 5.80 | 0.3-2.0 | 4 | 0 | 2 | 3,255,000 |
| August 2004 | Marce | 39.10 | 0.3-1.2 | 4 | 28 | 10 | 312,183,343 |
| July 2006 | Florita | 16.80 | 0.3-1.2 | 4 | 0 | 0 | 2,859,103 |
| July 2006 | Henry | 14.00 | 0.3-0.8 | 5 | 0 | 0 | 13,330,280 |
| October 2006 | Paeng | 4.96 | 0.3-1.0 | 3 | 0 | 0 | 4,000,000 |

Source: DPWH, PDCC (Provincial Disaster Coordinating Council)

[6] PAGASA (the meteorological agency of the Philippines) and DPWH have a duty to measure the maximum flow amount to establish a standard for the scale of floods, but due to lack of funds and personnel, measurements are not being carried out.

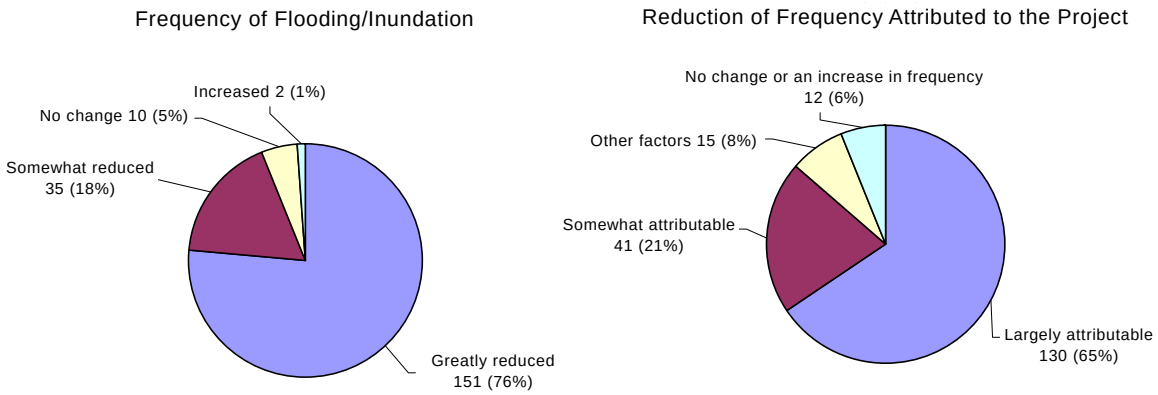
[7] Another factor in the non-occurrence of flooding is the flood control effect of the San Roque Dam. The San Roque Dam (facility capacity 345 MW), which was constructed on the upper reaches of the Agno River, began commercial operation in May 2003. The flood regulating capacity of the dam reservoir is 140 million $m^3$. The flow amount is regulated so that flooding does not occur downstream by opening or closing the flood gate appropriately during typhoons.

(2) Changes in local residents' perception of flooding and inundation

According to the beneficiary survey (sample size: 198 persons; target: residents living near the project site [Agno River and Tarlac River] who have experienced flooding/inundation in the past 15 years[8]), 1) 86% (171 persons) responded that the project reduced the frequency of flooding/inundation, 2) 87% (173 persons) responded that the project lightened the scale of flooding/inundation, and 3) 87% (173 persons) responded that the project reduced the damage from flooding/inundation. Thus, the large majority of residents perceive the project as having reduced the frequency, scale, and damage of flooding/inundation.

Figure 4: Beneficiary interview survey

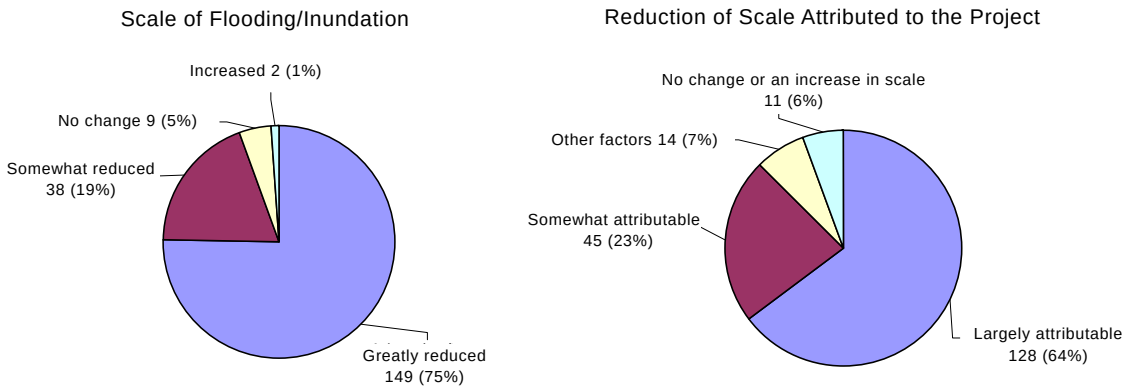
Figure 5: Reduction of Frequency of Flooding/Inundation




Source: Beneficiary survey

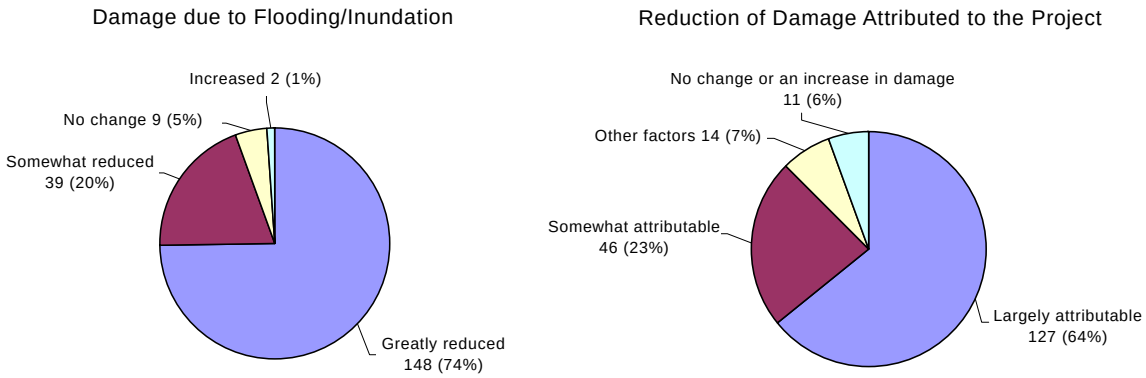
[8] As part of this evaluation, a beneficiary survey targeting residents near the project area was implemented. The sample size was 188 persons near Agno River, 30 persons near Tarlac River, and 15 persons near Sinocalan River. In the case of Sinocalan River, only bank protection works (low-water embankments) along the riverbanks were implemented. The purpose of low-water embankments is to prevent erosion of the riverbanks, maintain the river's original role, and protect structure. Because low-water embankments have no technological relation to flood control, the Sinocalan River was excluded from questions in the beneficiary survey concerning flooding and inundation. Because it is appropriate to direct questions concerning changes in perception of flooding inundation toward residents who have experienced flooding/inundation, the targets of these questions were 198 residents (168 persons near the Agno River and 30 persons near the Tarlac River) who have experienced flooding/inundation in the past 15 years.

Figure 6: Reduction of Scale of Flooding/Inundation




Source: Beneficiary survey

Figure 7: Reduction of Damage from Flooding/Inundation




Source: Beneficiary survey

Moreover, 87% (173 persons) responded that the project reduced the erosion of the riverbanks.[9]

(3) EIRR

As a result of recalculation, the EIRR is 21.65%, up from 16.71% at the time of appraisal. The reasons for the rise in EIRR are an increase in the estimated damage since the time of planning, such as the value of buildings, etc.,[10] and an increase in the benefit of reducing the damage.

2.4 Impact

[9] In interviews of residents near the Sinocalan River (15 persons), 5 persons mentioned prevention of erosion as an effect of the project.

[10] Flood analysis techniques used for damage estimates became more detailed than what they were prior to the beginning of the project.

(1) Residents' living conditions and environment

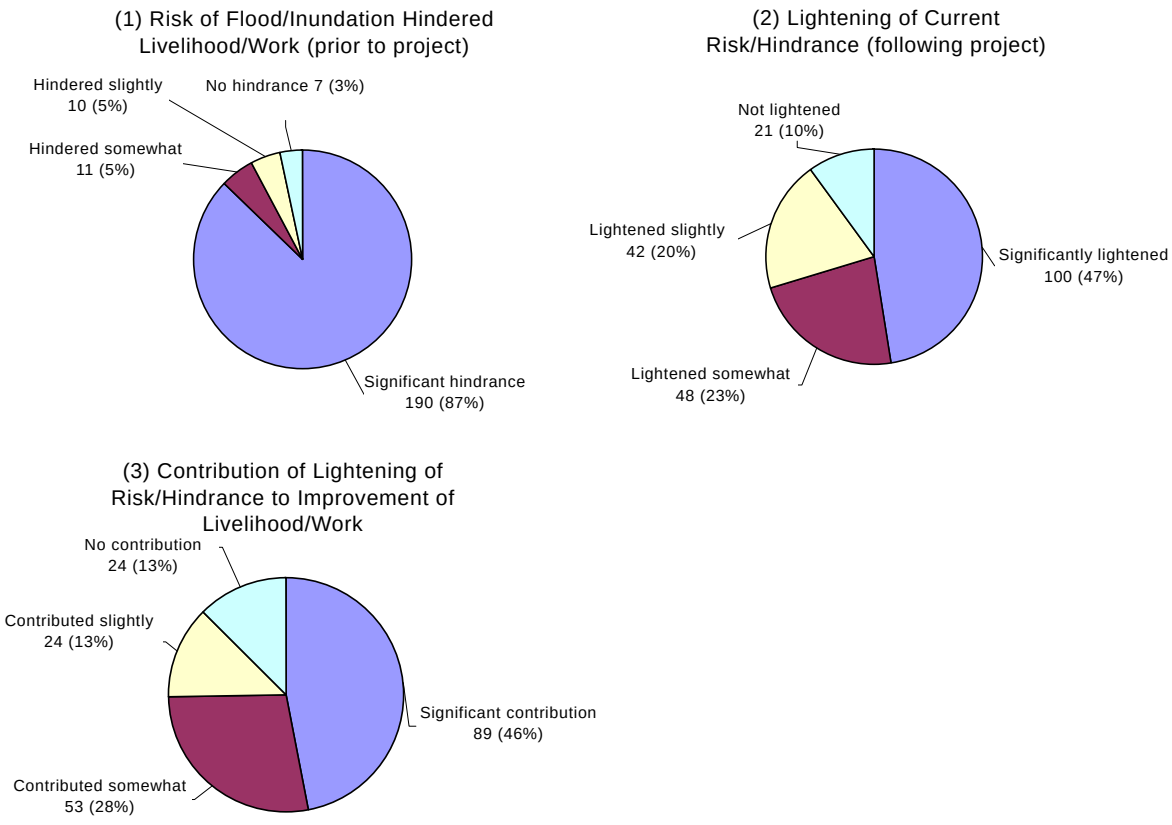
a) Residents' sense of assurance

According to the beneficiary survey (total sample size: 218 persons[11]), the majority (175 persons, 80%) responded that their concerns over flooding/inundation have been lightened compared to prior to the project.

b) Changes in livelihood

According to the beneficiary survey (total sample size: 218 persons), 97% (211 persons) perceive the risk of flooding/inundation as hindering their livelihood and work. Of those, 90% (190 persons) think that the hindrance is now lightened since the completion of the project. Furthermore, of those, 87% (166 persons) responded that the reduction of the hindrance posed by flood/inundation risk has contributed to the improvement of the livelihood and work.[12]

Figure 8: Improvement of Livelihood/Work




Source: Beneficiary survey

[11] The total sample size was 218 (188 residents near Agno River and 30 residents near Tarlac River) including residents who had not experienced flooding/inundation in the past 15 years.

[12] As signifiers of improvements in livelihood and work, 105 persons mentioned increased production capacity and 40 persons mentioned increased income.

Of the residents who participated in the beneficiary survey, 117 persons were engaged in farming and fishing. Sixty-five persons (56%) responded that production volume has increased following the project, and 61 persons (52%) responded that profits had increased following the project. As the reason, 51 persons (44%) mentioned reduction of flooding.

c) Improvement of the health environment

According to the beneficiary survey (total sample size: 218 persons), 86% (187 persons) responded that the community health condition has improved compared to prior to the project. Of these, 95% (178 persons) think that the effect of this project is a factor in the improvement.

d) Improvement of access

In this project, asphalt pavement was laid on the Lingayen–Wawa segment of the levee on the right bank of the Agno River. According to the beneficiary survey (total sample size: 188 persons; target: residents near Agno River), 89% (160 persons) responded that access to other areas was improved due to the asphalt pavement.

Figure 9: Paved levee
(right bank of Agno River)

(2) Impact on local society and economy

a) Beneficiary population

Strict designation of beneficiaries was difficult, and so the population of the project site area, including latent beneficiaries, was designated as the beneficiary population. There are eight local government units (LGUs) along the lower reaches of the Agno River, and their total population is approximately 550,000 persons (2000). Meanwhile, there are four LGUs along the upper reaches of the Sinocalan River, and their total population is approximately 260,000 (2000).

b) Job creation

Workers were employed in relation with the civil works of this project. However, there were no respondents in the beneficiary survey who mentioned creation of employment opportunities as an effect of this project, and the unemployment rate of Pangasinan

Province has not particularly improved.[13]

c) Land usage and change in price

According to the beneficiary survey (total sample size: 218 persons), 39% (84 persons) responded that land usage in the area changed during and after the project implementation.[14] Fifty-nine percent (129 persons) responded that land prices rose, but only a few (5%, 11 persons) mentioned the impact of the project (i.e., repair of levees, reduction of floods) as a factor in the price increase.

(3) Environmental impact

The Environmental Impact Assessment (EIA) for this project was implemented in 1994. In the EIA, the impact during and following completion of the project was verified from the standpoint of air quality, water quality, the ecosystem, hydrology, geology, and socioeconomic factors. Together with concluding that the project is environmentally suitable, mitigation measures and a monitoring program were proposed. Based on the results of this assessment, in October 1995 the Philippines' Department of Environment and Natural Resources issued an Environmental Compliance Certificate (ECC). An environmental study (completed in March 2001) was implemented also for TRIIW which was added following the start of the project, and in April 2001 the ECC was issued.

An environment monitoring team was formed by DPWH (PMO, EIAPO,[15] and the consultant) and the Environment Management Bureau of the Department of Environment and Natural Resources (DENR-EMB), and monitoring was conducted 15 times between March 2000 and March 2006 (after January 2003, monitoring was conducted together with Phase II). In this monitoring, the impact on water quality, the ecosystem, and society and the economy was checked, and no significant impact from the project was found. Recommendations were made for restoration of plants in sediment disposal sites, addition of bank protection works, and early completion of construction of the short-cut water channels, and steps were taken to implement these recommendations.

(4) Land acquisition

Land acquisition was conducted by PMO-AFCS (Agno Flood Control System Project

[13] The unemployment rate (%) in Pangasinan Province is as follows.

| Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|
| Unemployment Rate (%) | 9.21 | 7.85 | 10.77 | 10.34 | 10.64 | 10.47 | 11.49 | 13.46 |

[14] The main example given of change in land usage was the reduction of farmland due to construction of the short-cut water channel (47 persons).

[15] Staff of the EIAPO (Environmental Impact Assessment Project Office), which is DPWH's environment management unit, also participate as members of the monitoring team.

Management Office), which is DPWH's regional management office, in cooperation with LGUs, in accordance with DPWH's standard land acquisition procedures and compensation system. The provincial government formed a screening committee and determined the price of land and buildings. Based on this, PMO conducted land acquisition negotiations and procedures with the residents involved. In this project, compensation for land, buildings, and crops was conducted as shown on the table below.

Table 4: Compensated Land, Buildings, and Crops

| | Land | | Buildings | Crops |
|---|---|---|---|---|
| | Number of Lots | $m^2$ | Number of Claims | Number of Claims |
| Bugallon Bridge Construction | 29 | 63,146 | 29 | 18 |
| Bugallon Short-cut Channel Construction | 73 | 477,598 | 63 | 57 |
| Agno River Dredging (Bugallon) | 11 | 101,505 | - | 11 |
| Urbiztondo Short-cut Channel Construction | 155 | 71,015 | 83 | 113 |
| Bayambang Short-cut Channel Construction | 60 | 240,991 | 36 | 62 |
| Total | 328 | 954,255 | 232* | 436 |

Note: Of the 232 buildings, 177 were residences.
Source: DPWH PMO-AFCS

In this project, cash compensation was paid for all land and buildings, and since relocation was done by the residents themselves, no relocation site in particular was prepared.[16]

According to a study of residents who sold land and buildings (total sample size: 32 persons), 84% (27 persons) were satisfied with the explanation of PMO/LGU concerning the land acquisition procedure and compensation. Moreover, 72% (23 persons) responded that they were satisfied with the amount of the compensation. However, dissatisfactions were also heard such as time was required for processing (18 persons), too many documents were required (8 persons), and document preparation entailed expenses (5 persons).

2.5 Sustainability (rating: b)

There are financial problems in the operation and maintenance of this project, and overall the project sustainability is evaluated as moderate.

2.5.1 Executing agency

2.5.1.1 Operation and maintenance system

The executing agencies for this project are PMO-Major Flood Control and Drainage Project Cluster II: MFCDP (Manila) and PMO-AFCS (Tomana, Pangasinan), which are both under DPWH.

[16] Neither were there any cases of compulsory expropriation.

Operation and maintenance of the Agno River and related rivers is handled by the Construction & Maintenance Section of PMO-AFCS (6 engineers, 2 assistance engineers, 1 testing engineer, 1 clerical staff, and 1 driver). There are no particular problems in the system.

2.5.1.2 Technical capacity

During the implementation of this project, the consultant prepared an O&M manual (May 2005) and recommended the preparation of an O&M schedule, periodic inspection tours and examinations, operation and maintenance methods for the facilities, and preparation of an O&M report. There is no particular problem in the technical level of the persons engaged in operation and maintenance; however, due to inadequate operation and maintenance funds, such activities are not being sufficiently implemented, and because of this, the staff is not accumulating experience.

2.5.1.3 Financial status

Each year, an on-site inspection of the facilities is conducted, a list of the facilities' conditions is prepared, and an estimate is made of the cost required for operation and maintenance. Based on this, the request for the operation and maintenance budget and the budget allocation are made. PMO-AFCS's operation and maintenance budgets for the past 10 years are shown on Table 5, and in a number of the past several years, the amount decreased dramatically (e.g., in 2006 whereas the budget request was for 75 million pesos, the actual allocation and expenditure was 4.9 million pesos).[17] However, the sites which were repaired by this project do not require very much operation and maintenance including repairs, and so the objects of the budget request are mainly sites which were not repaired by this project. In the allocation/expenditure budget of 2007 and the budget request of 2008, there are visible signs of improvement in the securing of an operation and

Table 5: PMO-AFCS's Operation and Maintenance Budget

| Year | (1,000 pesos) |
|---|---|
| 1998 | 10,336 |
| 1999 | 16,544 |
| 2000 | 24,600 |
| 2001 | 49,200 |
| 2002 | 29,164 |
| 2003 | 14,582 |
| 2004 | 2,431 |
| 2005 | 4,903 |
| 2006 | 4,903 |
| 2007 | 30,100 |
| 2008* | 70,000 |

Note: Figures up to 2007 are actual budget allocations and expenditures; the figure for 2008 is the budget request amount.
Source: DPWH PMO-AFCS

[17] The operation and maintenance budget of DPWH overall consisted of allocation/expenditure of 98.01 million pesos/year from 2003 to 2006. The actual budget was 5.6% to 10% of the request budget. However, the actual allocation/expenditure for 2007 was 521.01 million pesos, and the requested budget for 2008 was 1.1 billion pesos. So, there are visible signs of improvement in the securing of the operation and maintenance budget.

maintenance budget.

2.5.2 Operation and maintenance status

On low channels (riverbank) in sites where no bank protection was built by this project, erosion is occurring. Even in sites where bank protection was built (low channel, levees), damage to wire netting was visible, but there was no major damage or erosion.

As operation and maintenance machinery and materials, PMO-AFCS possesses 4 dredging boats, 1 road leveler, 1 backhoe, and 1 dump truck. Currently there is only 1 dredging boat that is in operable condition.[18]

## 3. Conclusion and Lessons Learned/Recommendations

### 3.1 Conclusion

Given the above, this project is evaluated to be satisfactory.

### 3.2 Lessons Learned

In this project, there was no new construction of flood control facilities such as levees, but rather the main purpose was to respond urgently to damage of existing flood control facilities due to an earthquake and volcanic ash and lahars from the eruption of Mount Pinatubo. Flood damage is reduced through dredging and levee repair, etc., such as was performed in this project, but it is difficult to quantitatively judge the type and extent of the impact of flood damage reduction on the stability of people's livelihoods, the stability of farm income, and the improvement of the living environment. Therefore, when implementing urgent rehabilitation and repair projects, consideration should be given to the fact that rehabilitation to the pre-damage condition is an important project objective, and careful study should be made for indicators and target levels used to measure the project effects.[19]

### 3.3 Recommendations

Although signs of improvement can be observed in the securing of operation and maintenance funds for PMO-AFCS, including for this project, the necessary amount was not secured for several years in the recent past, which posed an obstacle to carrying out operation and maintenance activities. To sustain the effects of the project, it is necessary not only to suitably operate and maintain the sites repaired by this project but also to

[18] Two boats are being repaired, and one requires repairs.

[19] In cases such as this project, study should be made, upon consideration for whether or not the data can be acquired, of indicators of project effects that are directly expressed in a relatively short period of time, such as the total extension of the damaged levee, the total extension of the riverbank which requires bank protection works, the maximum flow and maximum water level of Agno River, and damage due to failure of the levee on the main river (square area inundated, number of damaged houses, etc).

conduct suitable operation and maintenance including repairs to the concerned rivers overall. For that purpose, it is necessary to secure an appropriate level of operation and maintenance funds henceforth.

Given that it is extremely difficult to actually measure the effects of the reduction of flood damage, the executing agency, DPWH, should collect and manage data related to the scale and damage of actual floods/inundations in collaboration with related agencies.

Comparison of Original and Actual Scope

| Item | Plan | Actual |
|---|---|---|
| 1. Output<br>1) Civil works<br>a) Agno River | i) Dredging: 8,626,690 $m^3$<br>Low channels, short-cut channels in 3 locations<br>ii) Bank protection works<br>Low-water embankments: total 9,100 m<br>iii) Levees<br>Raising of existing levees: 3,000 m (left bank)<br>iv) Bridges<br>Bugallon Bridge: extension 393 m, width 9.3 m | i) Dredging: 11,494,521 $m^3$<br>Low channels, short-cut channels in 3 locations, water supply channel for fish farming<br>ii) Bank protection works<br>Low-water embankments: total 13,730 m<br>iii) Levees<br>Raising of existing levees: 540 m (left bank)<br>Construction of setback dike on right bank (Guelew)<br>iv) Bridges<br>Bugallon Bridge: extension 393 m; width: 7.3 m<br>v) Coffering: 6 locations, total 1,366 m<br>vi) Sluice and drainage ditch<br>vii) Paving of right-bank levee: 31.6 km (Lingayen–Wawa) |
| b) Sinocalan River | High-water embankments in 6 locations, total 1,500 m | Low-water embankments in 7 locations, total 1,280 m |
| c) Tarlac River | | i) TRIIW (interim improvement works) (right-bank embankment/raising): 4,974 m<br>ii) Repair work on right-bank levee (Colibanban, Maleyep): 1,650 m |
| 2) Consulting services | Detailed design review; bidding assistance; construction monitoring and supervision | Detailed design review; bidding assistance; construction monitoring and supervision; project completion activities; detailed design and construction monitoring and supervision of TRIIW; necessary studies, design, and construction monitoring and supervision of construction around the Domalandan Bridge; study of the existing Urbiztondo Bridge and initial design of new bridge; flood analysis; preparation of detailed diagrams; quantity specifications; and construction monitoring/supervision assistance for the repair of the right-bank levee on the Tarlac River |
| 2. Project period<br><br>Consultant selection | August 1995–March 2002 (80 months)<br>August 1995–June1996 | August 1995–May2005 (118 months)<br>August 1995–September 1996 |

| | | |
|---|---|---|
| Contractor selection | June 1996–September 1997 | October 1996–March 1998 |
| Civil work | September 1997–March 2002 | April 1998–May 2005 |
| Land acquisition | June 1995–November 1996 | July 1998–July 2002 |
| 3. Project cost | | |
| Foreign currency | 5,877 million yen | 8,280 million yen |
| Local currency | 5,207 million yen<br>(1,261 million pesos) | 3,098million yen<br>(869 million pesos) |
| Total | 11,083 million yen | 11,378 million yen |
| ODA loan portion | 8,312 million yen | 8,280 million yen |
| Exchange rate | 1 peso = 4.13 yen<br>(as of January 1995) | 1 peso = 3.565 yen<br>(rate applied in civil works contracts) |