The Republic of the Philippines

# Ex-Post Evaluation of Japanese ODA Loan Project
## Metro Manila Flood Control Project – West of Mangahan Floodway

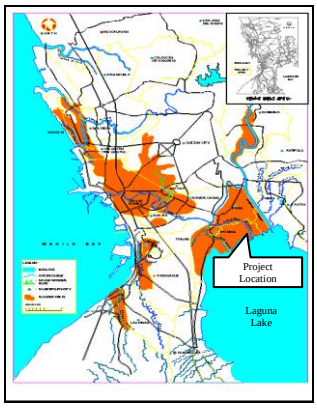
External Evaluator: Kinuko Mitani, IC Net Limited

## 0. Summary

The project objective is to mitigate flood damages which are caused by the high water level of Laguna Lake, by improving the inland drainage system, dike, and bridge near the Lake, thereby contributing to the enhancement of the living conditions of Metro Manila and the Rizal Province.

The project is highly relevant to the Philippines's development plan and development needs. It is also in line with Japan's official development assistance policy for the Philippines, thus increasing its relevance. The project, which has reduced the flood damages in the project area, has been effective and has had a positive impact on local communities: 93% (response rate) of the residents in the project area claimed that their living conditions have improved because of the project. Thus the project's impact is high. The project cost slightly exceeded the planned cost, while the project period significantly exceeded the planned period; therefore, the project efficiency is low. Moreover, the project sustainability is considered fair owning to certain problems related to the organizational and financial aspects of operation and maintenance. Overall, the project, which was jointly evaluated by the Japan International Development Cooperation and the National Economic and Development Authority of the Philippines, is rated as partially satisfactory.

## 1. Project Description




Project location

Developed bridge in the project

Developed pumping station in the project

### 1.1 Background

Metro Manila is the economic and political center of the Philippines, and hit by typhoons and floods every year, which rapidly increase rainfall level. As a result, floods are developed in the area. The Japan International Cooperation Agency (JICA) has implemented projects in the areas of flood control and drainage system, with high priority given to Metro Manila. Particular examples are projects related to flood control and drainage system and flood forecast and warning system.

The water level of Laguna Lake, which is located southeast of Metro Manila, rises during the rainy season, particularly during heavy rainfall due mainly though not limited to typhoons in the West of the Mangahan area (land area of approximately 39km$^2$, population of approximately 500,000, land use classification of residential, commercial, and agricultural). As a result, this area suffers from frequent inundation damage.

Metro Manila was greatly affected by a typhoon occurred in November 1988. Extensive flooding was created due to a typhoon in November 1995, and severely damaged the Mangahan area. During this flooding, 150,000 residents were affected by over 1 meter of inundation.

To improve the situations highlighted above, the need to implement projects on flood control targeting Metro Manila was very high. Therefore, the Government of the Philippines (GoP) petitioned JICA for loan assistance given the experience and knowledge of flood control, which the Government of Japan (GoJ) has.

### 1.2 Project Outline

The project objective is to mitigate flood damages by developing lakeshore dike, pumping stations and bridge(s) in the West of Mangahan area located in the north side of Laguna Lake, Metro Manila, thereby contributing to the enhancement of the living conditions of residents in the area.

| | |
|---|---|
| Loan Approved Amount/ Disbursed Amount | 9,411 million yen/ 8,958 million yen |
| Exchange of Notes Date/ Loan Agreement Signing Date | March 1997/ March 1997 |
| Terms and Conditions | Interest Rate: 2.5%<br>Repayment Period: 30 years（Grace Period: 10 years）<br>Condition for Procurement: General Untied |
| Borrower/ Executing Agency | The Government of the Republic of the Philippines/ Department of Public Works and Highways |
| Final Disbursement Date | June 2008 |
| Main Contractor | Kubota Cooperation (Japan)・Shimizu Corporation (Japan)(JV), Taisei Corporation (Japan)・Ebara Corporation (Japan)(JV), |

| | |
|---|---|
| | Daewoo Engineering and Construction Co. Ltd. (Korea), China International Water and Electric Corp. (China) |
| Main Consultant | CTI Engineering Co., Ltd. (Japan)・Regional Planning International Co., Ltd. (Japan)・Basic Technology and Management Corporation (Philippines) ・Wood Fields Consultants, Inc. (Philippines)(JV) |
| Related Studies (Feasibility Study：FS）etc. | The Metro Manila Flood Control Master Plan (1990) and the feasible study of prioritized projects |
| Related Projects | <Yen loan project><br>• North Laguna Lakeshore Urgent Flood Control and Drainage Project<br>• Post Ondoy and Pepeng Short-Term Infrastructure Rehabilitation Project |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kinuko Mitani, IC Net Limited

For this project, a joint evaluation was conducted with the National Economic and Development Authority (NEDA), the Philippines.

### 2.2 Duration of Evaluation Study

Duration of the Study: January- December 2011

Duration of the Field Study: March 29-April 20, June 13-July 12, September 25-October 4, 2011

### 2.3 Constraints during the Evaluation Study

During the ex-post evaluation, the external evaluator attempted to collect data related to flood damages (inundated area, affected population, damage costs, etc) in the project area from the Department of Public Works and Highways (DPWH), Metro Manila Development Authority (MMDA), local government units (LGUs) in the project area, and other relevant organizations. However, these organizations do not retain any detail record of the flood damages limited to the project area. Therefore, the evaluator relied on the results of the interviews with LGUs and residents in the project area to evaluate the project's effectiveness. The evaluator also reflected the limited data that were available related to flood damages in the project area. The physical conditions of the facilities developed by the project such as four pumping stations, floodgates, bridges, dikes, etc. were evaluated by visual inspection and interviews as well as the interview with the Operation and Management (O&M) responsible persons. Owing to the limited study and budget, structural deterioration and disturbance were not assessed in a quantified manner.

## 3. Results of the Evaluation (Overall Rating: C[1])

### 3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of the Philippines

At the time of the appraisal, the Medium-Term Philippine Development Plan (1993-1998) gave high priority to infrastructure development and disaster management as ways to reduce flood damages. The Metro Manila Flood Control Plan was developed in 1990 by the DPWH, including project formation and implementation of flood control and drainage development in the West of Mangahan area. The plan to reduce flood damages comprising three stages spread across thirty years for project implementation. The first stage (1991-2000) consists of four projects; the second stage (2001-2010), seven; and the third stage (2011-2020), five.

During the ex-post evaluation, the current Medium-Term Philippine Development Plan (2011-2016) states that the total flood-prone area is approximately 2,780,000 hectares (ha), equivalent to 9% of the Philippines' total land area[3]. The GoP has set the goal that 50% of the flood-prone area be converted to flood protected area by 2016 (see Table 1). According to the plan, the DPWH sets the following goals for infrastructure development:

- Place adequate flood control and drainage facilities;
- Pursue nonstructural measures for flood mitigation (flood forecasts, early warning system, evacuation plan, etc); and
- Coordinate with LGUs and secure flow-down capacity of river channel, floodways, and so on by protecting flood control and drainage facilities.

Table 1: Data related to flood control in the Philippines

| Indicator | Amount |
|---|---|
| Total flood prone area (ha) | 2,778,692 |
| Flood protected area (ha) (2003) | 579,264 |
| Target flood protected area (ha) | 1,393,312 |

Source: Medium-Term Philippine Development Plan (2011-2016)

The DPWH was implementing other Japanese loan projects in the field of flood control in Metro Manila at the time of the ex-post evaluation. Specifically, the DPWH has been involved in the Post Ondoy and Pepeng Short-Term Infrastructure Rehabilitation Project since 2009, and Pasig-Markina River Channel Improvement Project (II) since 2007.

Therefore, the project has been consistent with the development policy of the GoP from the time of the appraisal to the time of the ex-post evaluation. At the time of the ex-post evaluation, the current Medium-Term Philippine Development Plan also illustrated the importance to continue assisting matters related to flood control.

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

[2] ③: High, ②: Fair, ①: Low

[3] When 2,780,000 hectares is converted to square kilometer, it becomes 27,800. According to the Ministry of Foreign Affairs, Japan, the total Philippines' land area is 299,404 square kilometers.

### 3.1.2 Relevance with the Development Needs of the Philippines

At the time of the appraisal, Metro Manila was hit by typhoons and heavy rainfall every year. As a result, the area developed large-scale flooding. As shown in Table 2, the floods that occurred in the project area between 1990 and 1996 not only caused significant loss of lives and damage to property but also affected the development and economic viability of the project area. Therefore, the necessity and urgency of assistance in the field of flood control was severe.

Table 2: Flood damages during 1990's in the project area

| Flood damage | | 1990 | 1992 | 1994 | 1996 |
|---|---|---|---|---|---|
| No. of typhoons occurred in the Philippines | | 10 | 7 | 13 | 10 |
| In the project area | No. of typhoon hit | 5 | 4 | 2 | 2 |
| | No. of affected houses | All: 222,831<br>Partly: 634,676 | All: 222,066<br>Partly: 630,855 | All: 14,596<br>Partly: 44,472 | All: 715<br>Partly: 6,809 |
| | No. of affected families | 1,135,433 | 296,453 | 70,107 | 182,112 |
| | No. of affected persons | 6,092,959 | 1,464,989 | 343,849 | 878,901 |
| | No. of death due to floods (person) | 660 | 86 | 48 | 77 |
| | Damages amount (million peso) | 12,457 | 3,974 | 1,433 | 2,120 |

Source: National Disaster Risk Reduction and Management Council (August 2011)

At the time of the ex-post evaluation, flood damages were reduced to some extent in the project area; therefore, the relevance of the development needs in the field of flood control in the project area was severe at the time of appraisal as well as ex-post evaluation.

### 3.1.3 Relevance with Japan's ODA Policy

The Country Assistance Program (1997) stated that the GoJ would give high priority to 1) basic economic infrastructure development, 2) strengthening of industrial structure and agricultural development, 3) poverty alleviation and improvement of basic living conditions, and 4) environmental protection. In particular, disaster mitigation was addressed as an important issue in environmental protection. Similarly, the Country Assistance Program (2000) emphasized environmental protection and disaster management as one of the four most critical areas for assistance. The objective was to provide assistance in disaster management in the Philippines so that communities and the environment in affected areas were protected from frequent natural disasters.

Similarly, the Japan Bank for International Cooperation[4] (1999) gave high priority to environmental projection including disaster management as well as the strengthening of the Philippines economy toward achieving sustained growth and overcoming growth constrains. Hence, the project has been consistent with the GoJ and JICA's policy for assistance to the Philippines at the time of the appraisal.

For the above reasons, the project has been highly relevant with the Philippines' development plan and development needs, as well as Japan's ODA policy. Therefore, its

[4] At the time of the project appraisal, JICA and JBIC were not yet merged. Hence, JBIC document was referred.

relevance is high.

### 3.2 Efficiency (Rating: ①)

#### 3.2.1 Project Outputs

Civil works and consulting services were planned and implemented in the project. These components were covered by the Japanese loan portion. The DPWH was the executing agency of the project. The following are the actual outputs per component.

(1) Civil Works

The civil works consisted of four packages and resettlement site development. Table 3 shows the planned scope and actual outputs. Packages 1 and 2 include changes, and Packages 3 and 4 include additional works. Description and reasons for the changes are as follows:

- Package 1: Length was added to the Lakeshore Dike. Capacity of two regulations ponds was reduced. These changes were made to reduce the number of affected residents in the project area. The DPWH contracted the National Hydraulic Research Center, which is attached to the University of the Philippines as a third party to study the community needs in the project area and to prepare an alternative plan of the scope based on the findings of the study. Additionally, a decision was made to upgrade the Napindan River Bridge instead of the Mangahan Floodway Bridge in line with the above change in the scope.
- Package 2: Within the scope of the Napindan River Dike, the east bank of the earth dike was reduced by approximately one-half, and the parapet wall was reduced to 88%. The rationale for the changes was the same as that for Package 1, namely, to reduce the number of affected residents in the project area.
- Package 3: Construction of a small fishermen's wharf next to the Taguig Pumping Station was added based on the request of a local fishermen's group in the project area. According to the interviews with the DPWH, LGUs, and local fisherman's group, the DPWH and fishermen's group were consulted regarding the design of the wharf[5].
- Package 4: Construction of the San Agustin Pumping Station was added as per the request of local LGUs in the project area. The additional scope in Packages 3 and 4 was realized in response to the requests expressed by the local LGUs and the residents in the project area.

[5] There was no memorandum between the DPWH and the fisherman's group. Hence, whereabouts of equipment procured and O&M structure of the wharf agreed could not be reviewed. During the ex-post evaluation, there was no longer any wharf where it was constructed during the project implementation. According to the fisherman's group, it was destroyed by typhoons.

Table 3: Civil works – plan and actual

| Facility | Plan | Actual |
|---|---|---|
| ＜Package 1＞ | | |
| Lakeshore Dike | Length 9.5km<br>Crest elevation: EL15m | Length 10.8km<br>As planned ( partly constructed at 14m according to the change in scope) |
| 2 Bridges | 1) Mangahan Floodway Gates<br>2) Napindan River Bridge | 1) Omitted<br>2) As planned |
| 4 Regulation Ponds - Capacity | 1) Tapayan 141,000$m^3$<br>2) Labasan 80,000$m^3$<br>3) Taguig 101,000$m^3$<br>4) Hagonoy 58,000$m^3$ | 1) 119,000$m^3$<br>2) As planned<br>3) 99,000$m^3$<br>4) As planned |
| ＜Package 2＞ | | |
| Napindan River Dike | 1) Earth dike: 0.3km (East bank)+0.1km (West bank), EL14.6m<br>2) Parapet: 5.8km, EL14.1m | 1) 0.12km (East bank)+0.1km (West bank), EL14.6m<br>2) 5.16km, EL14.1 |
| Floodgates | 4 | As planned |
| ＜Package 3＞ | | |
| Tapayan Pumping Station | Submersible motor pump 3$m^3$/s（3 units, 9$m^3$/s capacity） | As planned |
| Labasan Pumping Station | Submersible motor pump 3$m^3$/s（3 units, 9$m^3$/s capacity） | As planned |
| Floodgate | 2 | As planned<br>(Additional Scope)<br>Fisherman's wharf near the Taguig Pumping Station |
| ＜Package 4＞ | | |
| Taguig Pumping Station | Submersible motor pump 3$m^3$/s (4 units, 12$m^3$/s capacity) | As planned |
| Hagonoy Pumping Station | Submersible motor pump 3$m^3$/s (2 units, 6$m^3$/s capacity) | As planned |
| Floodgate | 2 | As planned<br>(Additional scope)<br>San Agustin Pumping Station |

Source: Executing agency

The changes in the scope of the civil works, as previously outlined, were made to reflect the requests expressed by the communities in the project area, such as the fishermen's groups and the informal settlers. The DPWH placed importance on the social impact of the project within the project area. As a result, the number of individuals negatively affected by the project was reduced, and no negative effects were found.

Resettlement site development was planned as part of the civil works, but was not implemented. According to the DPWH, the followings are the status of the resettlement site development. During the project implementation, the DPWH announced the project to allot the resettlement site already developed for use. The DPWH explained that the need to develop a new resettlement site was greatly reduced, and it was omitted. At the same time, the DPWH financially compensated the residents as indicated in Table 4. Thus the need to provide a resettlement site was eliminated (451 households were eligible for compensation).

Compensation was made to 154 households before project completion. The remaining 297 households have not yet received compensation due to a shortage in DPWH funding. Of the 922 households that were subject to relocation, 919 households received compensation. Compensation was only available to households who could provide legal land titles.

Regulating informal settlers before and during the project implementation period was a difficult task. A major challenge for the executing agency was to determine the most efficient method to relocate and resettle this population in a humane manner[6].

Table 4: Resettlement compensation payment status

| Items subject to compensation | Eligible Households for compensation | Households received compensation |
|---|---|---|
| Land acquisition | 451 | 154 |
| Constructions | 922 | 919 |

Source: DPWH (September 2011)

(2) Consulting Services

The consulting services were composed of 1) a review of the detailed design and tender documents, 2) assistance in tendering, 3) construction supervision, 4) study on the land development plan, and 5) transfer of technology and experience. The services were provided as planned. Owing to an extension of the civil works component, the consulting services were also extended. As shown in Table 5, the Man/Month (M/M) of the national consultants was significantly higher when compared with the M/M of the international consultants.

Table 5: Consulting services – plan and actual

| M/M | International | National |
|---|---|---|
| Plan | 245 | 1,375 |
| Actual | 251 | 1,994 |
| Ratio (%) | 102 | 145 |

Source: DPWH's responses to the questionnaire (July 2011)

3.2.2 Project Inputs

3.2.2.1 Project Cost (Sub-rating: ②)

The planned project cost was 12,548 million yen (of which 9,411 million yen corresponds to the yen loan portion). The actual project cost was 13,188 million yen, and exceeded by 5% against originally planned.

When examined the project cost in Philippine peso, the actual cost for civil works significantly exceeded the planned and the revised planned cost. The actual cost for land acquisition was slightly higher, although the actual cost for administration was slightly lower. Overall, the actual project cost significantly exceeded the planned cost in peso. However, the

[6] According to the DPWH, no further information is available related to the households, which were not yet paid as shown above.

actual project cost overrun was minimum in yen[7] owing to yen appreciation during the project period.

As shown in Table 5 above, the international portion of the consulting services was most likely provided as planned. Although the national portion of the services significantly exceeded the planned M/M, the negative influence to the project was minimized due to yen appreciation.

The civil works of the project was reduced to 73% of the original plan. Additional scope was implemented in Packages 3 and 4. Thus it is appropriate to revise the planned project cost and compare the actual cost against the revised planned project cost. The reduced project cost was 402 million yen, and the additional cost was 122 million yen. The revised planned project cost was 12,268 million yen as the result of reflecting the changes above. When compared to the actual project cost of 13,188 million yen (8,958 million yen as yen loan portion), the actual cost exceeded by 7% from the original plan, thereby, slightly exceeded the revised project cost.

3.2.2.2 Project Period (Sub-rating: ①)

The planned project period was from March 1997 to January 2004 (83 months). The actual period was from March 1997 to August 2007 (126 months). Hence, the actual period exceeded by 52% from the original plan, thereby, significantly exceeded the planned period.

The project was suspended for six months from November 2001 to April 2002. According to the DPWH, issues related to a rapid increase of informal settlers in the project area had to be resolved in a participatory manner. Public hearings were organized to understand better the community needs, and an alternative design of the Lakeshore Dike was proposed. Other factors that delayed and extended the project included procurement of contractors, land acquisition as well as bad weather conditions, which interrupted construction works. Similarly, natural calamities such as typhoons, heavy rains, floods, and natural disasters were identified as the cause of extension and delay of the project period. As shown in Table 6, the main reasons for the extension of the project period were the delayed procurement of contractors and prolonged implementation period of the civil works Package 1. The extension of the project period caused a delay in securing and enhancing the flood control capabilities of the project area.

Table 6: Project period – principal reason for delay/extension

| Scope | Plan | Actual | Principal Reasons | Gap |
|---|---|---|---|---|
| Procurement of contractor | February 1998-January 1999 (12 months) | June 1998-March 2001 (34 months) | Selection of contractors | 22 mos. |
| Civil works (Package 1) | February 1999-September 2004 (68 months) | August 2000-August 2007 (85 months) | Change in the scope | 17 mos. |

Source: DPWH (July 2011)

[7] The exchange rate applied in calculating the actual cost, average rate from 1997 to 2007 was 1 peso=2.58 yen. The exchange rate was 1 peso=4 yen at the time of the project appraisal. During the project period, yen was significantly appreciated.

For the above reasons, the project cost slightly exceeded the planned costs, and the project period significantly exceeded the planned project period. Therefore, the project's efficiency is evaluated low.

### 3.3 Effectiveness[8] (Rating: ③)

#### 3.3.1 Quantitative Effects

##### 3.3.1.1 Results from Operation and Effect Indicators

It is ideal to compare and analyze flood damages on the project area before and after the project to assess the project effectiveness. Indicators such as number of affected families and properties, damage situation, lake water level, and inundated area are appropriate to evaluate effectiveness. According to the DPWH, the MMDA and LGUs in the project area at the time of the ex-post evaluation, no record of flood damages such as the indicators listed above specific to the project area was available. Therefore, flood damages due to typhoons in the project area before and after the project were examined using available data of the National Risk Reduction and Management Council. As shown in Table 7, the numbers of affected families prior to the project intervention were 4,186 in 1995, 632 in 1998, and 61,942 in 2006. Upon termination of the project in 2007, the number was 200[9]. In the years following the termination of the project the numbers of affected families were 54 in 2008, 9,315 in 2009, 826 in 2010, and 3,358 in 2011. Scale and intensity of typhoons vary from one to another, making comparison by random selection difficult. It is possible, however, to observe a general tendency. For example, the total number of families affected by the two typhoons prior to the project (2006) was 61,942 whereas the number of families affected by two typhoons posterior to the project (2011) was 3,358. According to an explanation by a local expert in flood control, *61,942* families affected in 2006 could have been reduced by half should a measure similar to the project had been taken. As for the flood in 2011, damages could have been larger without the project intervention. This allows us to consider that the project has had enough effect.

The scale of Typhoon Ondoy, which hit the project area in 2009, was far beyond the expected scale of flooding that the facilities developed in the project cope with. Hence, the damages related to Typhoon Ondoy are not reflected in Table 7.

[8] Dimension of the project's impact is added when rating the project's effectiveness was determined.
[9] Both the project completion and two floods developed in the project area were taken place in August 2007.

Table 7: Recent flood damage in the project area

| Year | No. of Typhoon occurred | No. of affected barangay | No. of affected family | No. of affected house | No. of casualty |
|---|---|---|---|---|---|
| 1995 | 1 | No data* | 4,186 | No data | 0 |
| 1998 | 3 | No data | 632 | No data | 0 |
| 2006 | 2 | 29 | 61,942 | 31,329 | 5 |
| 2007 | 2 | 7 | 200 | 0 | 0 |
| 2008 | 1 | 2 | 54 | 0 | 0 |
| 2009 | 3 | 8 | 9,315 | No data | 0 |
| 2010 | 1 | 5 | 826 | 0 | 2 |
| 2011 | 2 | 5 | 3,358 | No data | 0 |

Source: National Disaster Risk Reduction and Management Council (August 2011)
*No data indicates no data was recorded since levels of damages were minimal.

The following is an analysis of flood damages in the project area due to Typhoon Ondoy as a case study (see Table 8). The typhoon caused 1,030 casualties, affected 185,004 houses, and created 11 billion peso[10] in damages. Typhoon Ondoy was one of the worst typhoons to ever hit in the Philippines and severely affected the country from both economical and human view points.

Table 8: Flood damages due to Typhoon Ondoy in the project area

| Indicator | Situation at the time of Typhoon Ondoy in the project area | Project impact – if the project was not implemented |
|---|---|---|
| Lake water level | The expected maximum lake water level for the project was elevation 13.8 meters. When Typhoon Ondoy hit the project area, the level was recorded as elevation 14 meter. The crest elevation of the lakeshore dike was 15 meters*, so that extra 1 meter was secured. Hence, damages caused by flooding in the project owing to overflow of Laguna Lake was reduced. | Typhoon Ondoy brought large-scale rainfalls, which was described as one in 150-year event. Therefore, the flood damages could have been much worse without the project, particularly so in the project area including Metro Manila, the nation's political and financial center. |
| Situation after flooding | Main reason for flooding was overflow of Markina River, which runs through the project area including Metro Manila, as well as lack of adequate drainage system in the project area. | As illustrated above, the scale of flood damages would have been larger without the project. |
| | Inundation period was approximately 2 weeks. | Inundation period could have been up to 6-7 months without the project. |

*In some areas the crest elevation of the lakeshore dike is 14 meters.

For the above reasons, the facilities developed in the project are contributing factors for reducing the loss of lives in the project area. Similarly, the project was considerably effective for the reduction of flood damages in the project area even when the volume of rainfalls was much more than the GoP predicted.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

The Economic internal rate of return (EIRR) at the time of the appraisal was 17.7%. When it

[10] Source: Situation Report No. 50, National Disaster Coordinating Council

was re-calculated at the time of the ex-post evaluation, it had increased to 21.3%. The increase is most likely due to the increased population and houses in the project area, as well as the increased price of real estate, which contributed to improvement of the economic benefits. The conditions of the recalculation were the same as those conditions at the time of the appraisal:

- Life of project: 40 years
- Cost: project cost
- Benefit: reduced flood damages amount (discharge level of below 40-year return period)

### 3.3.2 Qualitative Effects

The qualitative effect of the project was to mitigate flood damages in the project area by developing dikes, bridges and pumping stations. The results of the interviews with the LGUs in Pasig City and Taguig City and a beneficiary survey[11] that targeted the communities in the project area were studied to evaluate the project effectiveness and impact.

Interviews were conducted on the basis of the questionnaire prepared for the communities in the project, who were the project beneficiaries. Participants chose from two to five optional responses on the questionnaire. With regard to the question "What is the extent of improvements in living conditions in the project area because of the project?," 46% of the respondents selected improved considerably, 47% selected improved slightly, and 7% selected no change. In other words, 93% of the respondents considered the effect of the project to be high. The main factors that accounted for the project's effectiveness were the development of the facilities identified as needs in the communities in the project area and reduced flood damages due to improved O&M effectiveness of the facilities, to some extent. The main qualitative impacts of the project which were confirmed during the beneficiary survey are shown below.

| Indicator | Response |
|---|---|
| Observed number of annual flooding from Laguna Lake | Decreased considerably 61%<br>Decreased slightly 28%<br>No change 6%, Increased 5% |
| Extent of flooded area | Decreased considerably 53%<br>Decreased slightly 32%<br>No change 10%, Increased 5% |
| Observed flooding duration in days | Decreased considerably 58%<br>Decreased slightly 30%<br>No change 8%, Increased 4% |
| Extent of damages of lives and properties | Decreased considerably 55%<br>Decreased slightly 33%<br>No change 8%, Increased 4% |
| Improvement in access to market/ basic services | Yes 94%<br>No 6% |

[11] Beneficiary survey was conducted in the project area, using random sampling approach. 125 persons were interviewed during the survey. The questionnaire used during the survey was developed by the external evaluator, and the response style was a combination of multiple choice and narrative form.

Based on the results of interviews with LGUs, it was verified that the project has clearly contributed to reducing flood damages in the project area to large extent. In particular, loss of lives and properties in the outside area of the lakeshore dike (inland side) has decreased. Even when flooding occurred, the project has significantly reduced the inundation period. The satisfaction level with the project was very high among the LGUs in the project area. The project has complimented the LGUs' flood management efforts, such as the issuing of warnings and setting up of evacuation centers in the project area. However, flooding has not completely stopped in the project area (inland side) owing to external factors such as an insufficient/under-developed drainage system, solid waste accumulated in the waterways, limited capacity to absorb rainwater in the project area.

In summary, the project has largely achieved its objectives: therefore, its effectiveness is high.

## 3.4 Impact

### 3.4.1 Intended Impacts

According to the results of interviews with LGUs and beneficiary survey conducted in the project area, the project's impact was assessed and illustrated as follows. The LGUs and communities in the project area indicated that their communities are safer and more assured during rainy season owning to the facilities developed in the project. Majority of the beneficiaries in the project area indicated that flood damages were reduced after the project completion; therefore, they no longer faced major difficulties in carrying their daily economic activities. As a result, negative impact due to flood damages was mostly prevented.

The following responses indicated that the project brought positive impact to the project area.

(1) Improvement of living conditions owing to reduced flood damages in the project area

The beneficiary survey conducted in the project area showed that 46% (response rate) felt that their overall living conditions had considerably improved because of the project, 47% felt it had improved to some extent, and 7% felt there was no change. The following figure outlines other questions and the beneficiaries' responses. These responses also indicated an improvement in the living conditions in the area, thus, the project is considered to have had a positive impact on the project area.

| Question | Response |
|---|---|
| How do you feel safe/assured from fear from flooding after the project completion? | Highly assured 64%<br>Slightly assured 30%<br>Not assured 6% |
| How were your risks reduced during flooding after the project completion? | Highly reduced 49%<br>Slightly reduced 44%,<br>Not reduced 7% |

| | |
|---|---|
| Was flood risk reduction leading to increase your income after the project completion? | Substantially increased 52%<br>Slightly increased 34%<br>No increase 14% |
| Was your access to market/basic services improved after the project completion? | Yes 94%<br>No 6% |
| Was there any improvement in health situation in the area after Flood Control Project completion (i.e., sanitation and reduction of incidence in water borne diseases, etc)? | Yes 72%<br>No 28% |

(2) Economic growth of the project area

According to the results of interviews with LGUs and beneficiary survey conducted in the project area, the project's impact was as follows.

Based on the result of interview to Pasig City, which is one of the cities in the project area, classification of land use has changed since 1990. In 1990, there was 10% increase in land use as residence and commercial buildings, as a result, the percentage increased from 65 to 75. Such percentage is expected to increase to 87 by 2020. Hence, it can be said that land value as residence and commercial buildings in Pasig City is increasing.

Figure 1 showed that 54% felt disruption of economic activities after the project was *decreased considerably*, 35% felt *decreased slightly*, 9% felt *no change*, and 2% felt *increased*.

In regard to net household income, more than half of the respondents felt *increased to some extent*. According to the DPWH and Metro Manila Development Authority (MMDA[12]) that accompanied the external evaluator when site inspection of the facilities developed in the project was conducted, number of small shops and taxi service providers has been increased. Although this increase is not realized owning to any planned land use, observed phenomenon evidences the development of residence and commercial facilities.

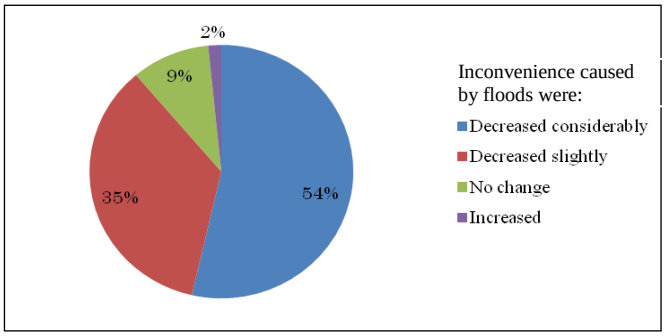



Figure 1: Responses to the beneficiary survey on the living environment in the project area

Source: Beneficiary survey at ex-post evaluation (September 2011)

As the result of interviews with LGUs and beneficiary survey conducted in the project area, the lakeshore dike constructed in the project has been utilized as a communal road among the

[12] MMDA is an organization, which is responsible for planning and implementation of development projects for 17 government organizations belong to Metro Manila. In particular, the MMDA provide assistance in the field of traffic, water management, climate change, and disaster managements. Time to time, roles of the MMDA and LUGs were unclear.

local communities as unexpected impact of the project. DPWH has been planning to construct a ring road (named C-6). At the time of the ex-post evaluation, such road had not been constructed. The communities in the project area are using the dike as a road. Hence transportation time has been reduced within the project area; thereby distribution of goods has become easier.

Had the project not been implemented, reduction of loss of lives and properties would not be realized. Hence negative impact on economic growth in the project area would have been found. Therefore, it can be said that the project reduces flood damages such as loss of lives and properties, thereby is contributing to economic growth in the project area.

### 3.4.2 Other Impacts

The other impacts of the project are as follows.

(1) Impact on the natural environment

The interviews were conducted with the LGUs, Laguna Lake Development Authority (LLDA), Department of Environment and Natural Resources, and the communities. Based on the responses from the interviews, no major environmental hardship was found related to noise, dust, or vibration caused by the civil works. That is, no negative impact was reported regarding noise, vibration, or pollution from traffic after the project completion. However, the increase in traffic in the project area may be considered a future air pollution threat from an environmental view point.

Laguna Lake Environmental Monitoring Report 2007[13], which is annually published by LLDA stated that there was no problem with the water quality of Laguna Lake when dissolved oxygen[14] was analyzed from 2004 to 2006. At the time of the project appraisal, an environmental protection group raised desalinization of the Lake as a potential concern.

Reasons for finding no relationships between the project and desalinization are as follows:

- No floodgate was neither planned nor conducted along the Pasig-Markina River in the project. Thus, there was no factor to lower functionality of the Mangahan Floodway, which connects Laguna Lake and Pasig as well as Markina River.
- Napindan Hydraulic Control Structure (NHCS) was developed with assistance of the Asian Development Bank, and its objective is different from this project. The objectives of NHCS are 1) to improve water quality of Laguna Lake by preventing backflow of saltwater and sewage from Pasig River, 2) to manage passing and draining of the lake water, and 3) to reduce flood damages in Manila city by preventing flow of water from Laguna Lake to Pasig River when Pasig River gets flooded.
- The floodgates constructed in the project were closed only when flooding. Frequency of the

[13] It was published in 2006.

[14] Dissolved oxygen is oxygen, which soluble in bodies of water. Dissolved oxygen volume is affected by pressure (low), water temperature (high), salinity (high), and so on. In bodies of highly contaminated water, oxygen gets reduced, which is required for organic compounds to consume oxygen. As a result, lives of fish and shellfish are threatened (source: weblio dictionary – translated from Japanese to English by the external evaluator).

gate closure was low.

The Environmental Compliance Certificate (ECC), reissued in October 2005 in accordance with the project's scope of public works, introduced modifications such as changes in the project name and amplification of soil range for rehabilitation of flood and drainage system from 10.9 km to 11.7 km.

(2) Land Acquisition/Resettlement

The project required land acquisition and resettlement in the project area. Land was acquired using a phase approach, and land acquisition began after the project's implementation was initiated. The affected population in Lupang Arenda, which is within the project area, significantly increased when compared with the plan. As a result, land acquisition in the area became extremely difficult. According to the DPWH, approximately 2,000 families were expected to be affected by the project. After project implementation, however, more than approximately 20,000 families were affected by the project. The rapid increase may be related to the compensation payment offered to affected families. The significant increase may also be due to the wide coverage of the project area, which is along Laguna Lake. The executive agency is held responsible for creating such situation. However, it was thought that this situation could not be easily solved or sorted out

A local university, being a third party to the project, was invited by DPWH to warrant impartiality as well as accountability for the local resident by providing accurate explanation on the project objectives. The involvement of a third party was appropriate as understanding and consent were obtained from the residents. Although unexpectedly lengthy process of land acquisition negatively affected the efficiency in project implementation, it led to conservation of livelihood in the project area and a smooth completion of public works thereafter. The efforts of attaching importance to the social concerns are worth noting as being adequate.

The DPWH decided that legal residents are subject for relocation owing to land acquisition. Compensation was paid, according to the asset values of lands and constructions, to residents who could provide land titles as required condition. Compensation was made according to the DPWH, 154 out of 451 cases have been subject to compensation and the remaining 297 are expected to be in the future. As for buildings, compensation to 919 out of 922 cases has been conducted[15]. Insufficient funding is among the principal reasons for the uncompensated cases. No follow-up study is made by DPWH on the resettlement of compensated households. Hence, no data is available in regard to these unpaid households.

[15] The DPWH did not know whether any compensation was paid to the remaining three cases. Hence, the actual status of compensation payment to these 3 cases could not be found.

(3) Land development use

The project prepared a Land Use Development Plan (draft) as part of the consulting services. The plan suggested that 10 hectares of available land be set aside for development into recreational grounds to provide a place for the population of Metro Manila to relax it. According to the LGUs in the project area, the population in the project area is increasing; however, whether this phenomenon is related to the project is unclear. In addition, according to the interviews with the DPWH and the MMDA, unplanned and unauthorized development is taking place in the project area. Both the DPWH and the MMDA do not hold any legal rights either to authorize or restrict land use in the project area. Thus, the DPWH and the MMDA, along with the LGUs, must develop a platform that addresses unplanned development. If unplanned development continues to proceed in the project area, the scale of flood damages will most likely rise.

For the above reasons, the project has reduced flood damages in the project area, thereby, has contributed to the improvement of living conditions within the communities in the project area.

### 3.5 Sustainability (Rating: ②)

#### 3.5.1 Structural Aspects of Operation and Maintenance

At the time of the appraisal, the regional office (National Capital Region or Region IV-A) of the DPWH was slated to be responsible for O&M on the project completion. According to the O&M plan, it was expected that the DPWH's knowledge, technology, and equipment would be utilized. However, responsibilities related to flood control operation in Metro Manila were re-defined according to the presidential order. As a result, management responsibility of flood control in Metro Manila, which was under the regional office of the DPWH, was moved to the MMDA umbrella. Thereafter, the whole O&M responsibilities of the facilities developed in the project were shifted to the MMDA at the time of the project completion.

The O&M status was studied at the time of the project ex-post evaluation. The external evaluator found out that the MMDA was not conducting O&M on the dikes and bridges as shown in Table 9. The reason was thought was inadequate human capacity and material resources to carry out O&M activities of the lakeshore dike and the bridge[16]. As one of the tentative solutions to this problem, the DPWH may be able to assist in O&M of the dike and bridge.

LGUs in the project area are not part of the O&M structure. Thus, their role in the project is unclear. As a result, no collaboration with LGUs in waste management ever occurred. Specifically, the MMDA does not own trucks to collect waste from the pumping stations;

[16] As a related background, there is also a fact that the administrative jurisdiction of MMDA is limited to Metro Manila. Hence, MMDA was not able to carry out O&M activities in Rizal Municipality, which is a part of the project area. MMDA had also limited funds for the O&M of the flood control facilities turned-over by DPWH, which affected its O&M activities.

therefore, it cannot dispose waste collected at the pumping stations. Improvised waste collections with borrowed DPWH trucks have been reported in the past. In conclusion, the roles and responsibilities of the DPWH, the MMDA, and concerned LGUs in the field of flood control in Metro Manila have not been cleared. It is therefore pertinent to specify each organization's responsibilities to secure an efficient O&M structure.

As previously discussed, the memorandum of agreement (MOA) signed between the DPWH and MMDA had not been realized at the time of the ex-post evaluation. Primarily, the O&M activities are expected to be conducted as per the MOA. If it is difficult to enforce the agreed O&M structure, collaboration in O&M of the facilities between the DPWH and the MMDA is thought as acceptable.

Table 9: Plan and the current situation of O&M Structure

| Facility | At completion (2007) | At ex-post evaluation (2011) |
|---|---|---|
| Dikes | MMDA | No O&M conducted |
| Bridges | MMDA | No O&M conducted |
| Regulation Ponds | MMDA | MMDA |
| Floodgates | MMDA | MMDA |
| Pumping Stations | MMDA | MMDA |

Source: Executing agency

### 3.5.2 Technical Aspects of Operation and Maintenance

According to the DPWH and the MMDA, officers dispatched to the pumping stations have basic day-to-day O&M technology skills and knowledge. These officers were trained on O&M by the DPWH before the project completion; therefore, their technical expertise is likely to be at the required level.

With regards to the electronics of the equipment installed in the pumping stations (i.e., engines and control panel) by the project, the O&M system is designed as such that the providers of the equipment facilitate necessary services. Therefore, the MMDA immediately requests the provider for reparation and/or parts exchange when malfunction is reported as a way of the O&M of the pumping stations.

Up to the time of ex-post evaluation, the MMDA conducted exchange/repair works when breakage occurred to the facilities developed in the project. This reactive approach of the O&M system works only when minimum repair work is required. According to the MMDA, there had not been very few repair works required from the project completion to the time of the ex-post evaluation. To be prepared for unexpected malfunctioning of the facilities, it is best to enhance risk management capacity by improving technical skills.

### 3.5.3 Financial Aspects of Operation and Maintenance

The MMDA agreed to be fully responsible for the O&M of the facilities developed in the project at the time of project completion. The MMDA allocated the Flood Control and Sewerage

Management Office funds for O&M from 2008 to 2012 as shown in Table 10. At the time of the ex-post evaluation, the MMDA was responsible for the O&M of fifty-four pumping stations including the four stations developed by the project.

Table 10: MMDA annual budget summary – O&M for flood control

Unit: 1,000 peso

| Year | O&M | Capital outlay | |
|---|---|---|---|
| | Flood control | Urgent disaster | Flood control (NCR) |
| 2008 | 42,818 | 50,000 | 53,863 |
| 2009 | 25,397 | 36,199 | 52,283 |
| 2010 | 238 | 38,724 | 147,013 |
| 2011 | 8,958 | 50,000 | 58,000 |
| 2012 | 7,406 | 50,000 | 58,000 |

Source: MMDA (July 2011)

As shown above, the capacity of the O&M budget for flood control has been decreasing every year except for 2010. The O&M budget for 2012 amounted to approximately 17% of that of 2008. The MMDA does not allocate O&M funding exclusively for the fifty-four pumping stations that it is fully responsible for. The MMDA transfer of funds from other O&M funds when conducting repair works to the pumping station(s) is necessary. Only because no major repair works have been requested up to now, has the MMDA not faced any major issues. It was verified that no budget is allocated to promptly attend the troubles detected at the pumping facilities. The external evaluator detected that an approval for equipment procurement has been put on hold for more than half-a-year within MMDA, and found that no budget has been allocated for the purchase.

### 3.5.4 Current Status of Operation and Maintenance

According to an assessment by the MMDA and the visual inspection of the facilities, the conditions of the facilities are mostly in good condition. The areas for improvement are as follows.

(1) Pumping stations (including the floodgates and regulation ponds)

According to the visual inspection of the pumping stations, the facilities are in good conditions for the most part, although some equipment needs to be replaced with new equipment. Although the MMDA is expected to attend to the issue as soon as possible, procurement of equipment (i.e., request for purchase of equipment) is a long process, beginning with approval within the MMDA[17]. Fortunately, since 2009, there has not been a typhoon of the scale of Typhoon Ondoy[18] to hit the project area. In addition, no major flood damages have

[17] The request for purchase of equipment was submitted for approval in February 2011, and was not yet approved in July 2011.

[18] The scale of Typhoon Ondoy exceeded the project's projection considerably. Hence, damages caused by Typhoon Ondoy would be considered as exception, thereby, detail review of such damages was not conducted during the ex-post evaluation.

occurred owing to malfunctions in the pumping station(s), which has reduced the critical need to procure equipment. The MMDA has used alternative goods to temporarily fix the problems, which has been a positive factor in reducing risk.

The number of water hyacinth has increased enormously in the regulation ponds as shown in the photo below. Because of the water hyacinth, the ponds' capacities have reduced, which now poses a problem. Further, waste from the nearby areas of the pumping stations also flows into the regulation ponds. During the rainy season, the MMDA had to collect and remove the waste, which was more than the designed capacity, affecting the regular functionality of the pumping stations. At the time of the ex-post evaluation, it was found that a coordination mechanism in waste management had not been arranged and established. This problem is severe, and the MMDA is expected to attend to it.

Generally, LGUs are responsible for waste management in the Philippines. However, the LGUs in the project area had not been collecting waste from the waterways and the regulation ponds regularly. The MDMA has been collecting it instead. The MDMA and Taguig City, located in the project area within Metro Manila, have a good relationship. Taguig City collects waste from the Taguig Pumping Station. This arrangement can be adopted to Pasig City and other areas. MMDA needs to enhance the collaboration with the LGUs to raise the awareness of the communities in flood control, information exchange, and update status.

Figure 2: Water hyacinth grown in the regulation pond

Based on the responses from interviews with MMDA, the water level has been measured based on a fixed method by officers at the pumping stations. MMDA closes the floodgate when the water reaches 12 meters. Some members of the communities and LGUs have requested a revision to the level at which the floodgate is closed. After consultation with DPWH on this matter, DPWH explained the relevance of the water level according to its experiences in flood control. The pumping stations outside the project area of this project also follow the same water level for closure of floodgates. The engineer of MMDA responsible for O&M of the pumping facility explains that operating the pumping facility at 12 meter-high water level is not optimum for preventing flood in the project area. Rather, releasing the flood control at 11.5 meter is considered adequate. A scientific study had not been conducted at the time of the ex-post evaluation; therefore, the relevance of the set water level cannot be confirmed. The adequacy of the water level may be modified if necessary.

(2) Lakeshore Dike

According to the LGUs in the project area, the Lakeshore Dike was partly collapsed when Typhoon Ondoy hit the area in 2009. The damage caused the worst flood damages in Pasig City. Typhoon Ondoy hit the project area at the scale at which the GoP was not prepared, because it

was beyond the designed capacity of flood control facilities in the Philippines and elevated the water of the rivers and lakes to very high levels. DPWH has been implementing the Post Ondoy and Pepeng Short-Term Infrastructure Rehabilitation Project.

(3) Service road

Big pot holes were found along the service road developed in the project due to deterioration of the road conditions. The road was designed to connect the four pumping stations in the project area, but is currently utilized as an essential road for the community members[19]. The road is also used to transport construction goods by private companies for building houses and commercial buildings in the area. This has led to traffic volume beyond planned capacity, which is the reason of its deterioration. The DPWH is expected to assess the road's conditions and complete repair work as necessary.

Figure 3: Service road developed in the project

For the above reasons, some minor problems have observed in terms of the structural and financial aspects of the O&M. Therefore, the project's sustainability of the project effectiveness is fair.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

The project objective was to improve the living conditions of residents in the in the project area by reducing the flood damages caused by typhoons and heavy rains that occur every year in West Mangahan. West Mangahan is located in Metro Manila. Therefore, the relevance of the project implementation in the area is high. The efficiency, however, is low because the actual project cost was slightly higher than originally planned, and the actual project period was significantly longer than originally planned. Because of the facilities developed by the project, flood damages have been reduced in the project area, therefore the effectiveness is high. As a result, the living conditions of the project area have also been improving; therefore, the impact is high as well. Some unstable factors have been observed in terms of the structure and finance of the O&M of the project; therefore the sustainability of the project effect is fair. In the coming months, discussion on confirmation and/or re-establishment of the most adequate O&M structure(s) in the project area shall be immediately organized between the DPWH and MMDA, additionally with concerned LGUs.

In light of these factors, the project is evaluated to be partially satisfactory, since the project period significantly exceeded the plan, although the expected outputs were mostly realized.

[19] The DPWH paved the road independently.

## 4.2. Recommendations

### 4.2.1 Recommendations to the Executing Agency

As discussed in 4.1. Conclusion, there are some problems have been observed in terms of the structure and finance of the O&M of the project. Therefore, between the DPWH and MMDA, additionally with concerned LGUs, discussion on confirmation and/or re-establishment of the most adequate O&M structure(s) in the project area shall be organized. Similarly, it is expected that not only roles of these organizations shall be clearly defined, but also these organizations shall be held responsible for the given roles.

Furthermore, the DPWH is expected to work with MMDA who is responsible for O&M as follows:

- Secure adequate budget specific to O&M of the flood control facilities, including risk management of pumping stations (i.e., preventive maintenance, purchase and storage of spare parts).
- Expedite necessary internal procurement procedures and promptly procure parts that need to be replaced at pumping stations.
- Establish a coordinated mechanism with LGUs: 1) work with MMDA and Pasig City to establish a coordinated mechanism in waste management in the project area; 2) work with MMDA and Taytay Municipality to form a joint coordination mechanism in water hyacinth management in the regulation pond(s).

Similarly, it is important to establish a supporting system upon discussion that meets financial, personnel, and material needs, at least at minimum level with involvement of the LGUs in the project area, so that the project's sustainability is secured.

### 4.2.2 Recommendations to JICA

It is recommended that JICA, jointly with the Philippines side, monitors the progress of the O&M structure (including financing) enhancement for the facilities developed in the project.

## 4.3 Lessons Learned

(1) Land acquisition and resettlement

When any executing agency of project(s) require consensus-building related to land acquisition and resettlement, appropriate explanation to concerned community members and organization of public hearing(s) at an early stage of project implementation are relevant. It is important to involve academia/expert(s) such as local university, and is essential to invite a large number of beneficiaries to public hearing(s) for information sharing. In the project, the DPWH requested that the University of the Philippines conduct a study to understand better the needs of the communities in the project area. Because of the study, part of the scope of the civil works was modified. This is a good example of the executing agency giving high importance to social

consolidations in the project area.

(2) Sustainability

- Establishing an appropriate O&M structure at the time of project completion is very important. It is especially critical to plan and establish a new and sustainable O&M structure by careful analysis of consequences when an executive agency of project goes through organizational reform during project implementation.
- Conducting O&M activities of facilities developed under project(s) more effectively, not only the LGU whose technical and financial capacities are not stable, but the central government of the Philippines shall also take part when necessary.

(3) Flood related data

Adequate indicators shall be set when a project in the field of flood control is formulated in the future. Necessary data according to the indicators set shall be monitored and recorded regularly.

## Comparison of the Original and Actual Scope of the Project

| Item | Plan | Actual |
|---|---|---|
| 1.Project Outputs | | |
| Package 1 | | |
| Lakeshore dike | Length 9.5km<br>Crest elevation EL15m | Length 10.8km<br>Crest elevation EL15m |
| 2 bridges | ①Mangahan Floodway Bridge<br>②Napindan River Dike | ①Omitted<br>②As planned |
| 4 regulation ponds - capacity | ①Tapayan - 141,000$m^3$<br>②Labasan - 80,000$m^3$<br>③Taguig - 101,000$m^3$<br>④Hagonoy - 58,000$m^3$ | ①Tapayan - 119,000$m^3$<br>②Labasan - As planned<br>③Taguig - 99,000$m^3$<br>④Hagonoy - As planned |
| Package 2 | | |
| Napindan river bridge | ①Earth dike<br>②Parapet | ①Earth dike<br>②Parapet |
| Floodgate | 4 | As planned |
| Package 3 | | |
| Tapayan pumping station | Submersible motor pump 3$m^3$/s<br>(3 units, 9$m^3$/s capacity) | As planned |
| Labasan pumping station | Submersible motor pump 3$m^3$/s<br>(3 units, 9$m^3$/s capacity) | As planned |
| Floodgate | 2 | As planned<br>(Additional scope)<br>Fisherman's wharf near Taguig Pumping Station |
| Package 4 | | |
| Taguig pumping station | Submersible motor pump 3$m^3$/s<br>(4 units, 2$m^3$/s capacity) | As planned |
| Hagonoy pumping station | Submersible motor pump 3$m^3$/s<br>(2 units, 6$m^3$/s capacity) | As planned |
| Floodgate | 2 | As planned<br>(Additional scope)<br>San Agustin Pumping Station |
| ＜Resettlement Site Development＞ | | |
| No. of resettlement sites<br>Total resettlement area<br>Water supply<br>Electric supply<br>Road network<br>Housing unit requirement | 4 sites (maximum)<br>4 ha (maximum)<br>20 units deepwell (maximum)<br>For 142 housing units (maximum)<br>3.5km long and 5-7 wide (maximum)<br>142 units (maximum) | Omitted |
| ＜Consulting Services＞ | | |
| M/M | International: 245M/M<br>National: 1,375M/M | International: 251M/M<br>National: 1,994M/M |
| 2. Project Period | March 1997-January 2004<br>(83 months) | March 1997-August 2007<br>(126 months) |
| 3. Project Cost | | |
| Foreign currency | 8,541 million yen | 8,589 million yen |
| Local currency | 4,008 million yen<br>(Local currency 1,002 million peso) | 4,600 million yen<br>(Local currency 1,783 million peso) |
| Total | 12,548 million yen | 13,188 million yen |
| Japanese ODA loan | 9,411 million yen | 8,958 million yen |
| Exchange rate | 1 peso＝4 yen<br>(As of May 1996) | 1 peso＝2.58 yen<br>(Average during of March 1997～August 2007) |