Republic of the Philippines

Ex-Post Evaluation of Japanese ODA Loan

"KAMANAVA Area Flood Control & Drainage System Improvement Project"

External Evaluator: Akemi Serizawa, Sanshu Engineering Consultant

0. Summary

The objective of this project was to improve flood control and drainage systems in KAMANAVA area, Metro Manila by constructing or rehabilitating flood control facilities including a polder dike, river walls, pumping stations, flood gates, control gates, a navigation gate and drainage channels and by procuring hydrological and meteorological observation instruments, thereby contributing to the reduction of floods and improvement of living conditions and environmental health as well as economic development in the area.

This project has been highly relevant with the Philippines' development plan and development needs, as well as with Japan's ODA policies. Therefore its relevance is high. While the project outputs were produced as planned, both the project cost and project period significantly exceeded the plan. Therefore, efficiency of the project is low. This project has reduced floods to a certain extent and produced impacts such as the improvement of living conditions in the project target area, development of regional economy, improvement of waste management and enhanced awareness of residents about flood control. In total, effectiveness and impact of the project are high as it has largely achieved its objectives. No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system of the Department of Public Works and Highways (DPWH), which is currently responsible for the operation and maintenance of the project facilities, and those of Metro Manila Development Authority (MMDA), the organization to which the project facilities will be transferred in the second half of 2015 or in 2016. Therefore, the sustainability of the project effects is high.

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

1. Project Description

Project location

Pumping station constructed by this project

1.1 Background

The Philippines experiences frequent floods due to typhoons and heavy rains. Back in 1999 when this project was designed, annual death from floods was about 800 on average and the economic loss was about 0.4% of its Gross National Product (GNP). The target area of this project is in the basin of Malabon River and Tullahan River and located in the cities of Kalookan, Malabon and Navotas in Metro Manila. These three cities and neighboring Valenzuela City are called KAMANAVA. The project target area is only 0-1.5 meters above sea level and particularly prone to flooding. It was urgently sought to take measures to reduce floods in the area.

1.2 Project Outline

The objective of this project was to improve flood control and drainage systems in KAMANAVA area, Metro Manila by constructing or rehabilitating flood control facilities including a polder dike, river walls, pumping stations, flood gates, control gates, a navigation gate and drainage channels and by procuring hydrological and meteorological observation instruments, thereby contributing to the reduction of floods and improvement of living conditions as well as economic development in the area.

The project site is shown in Figure 1 and 2 below.

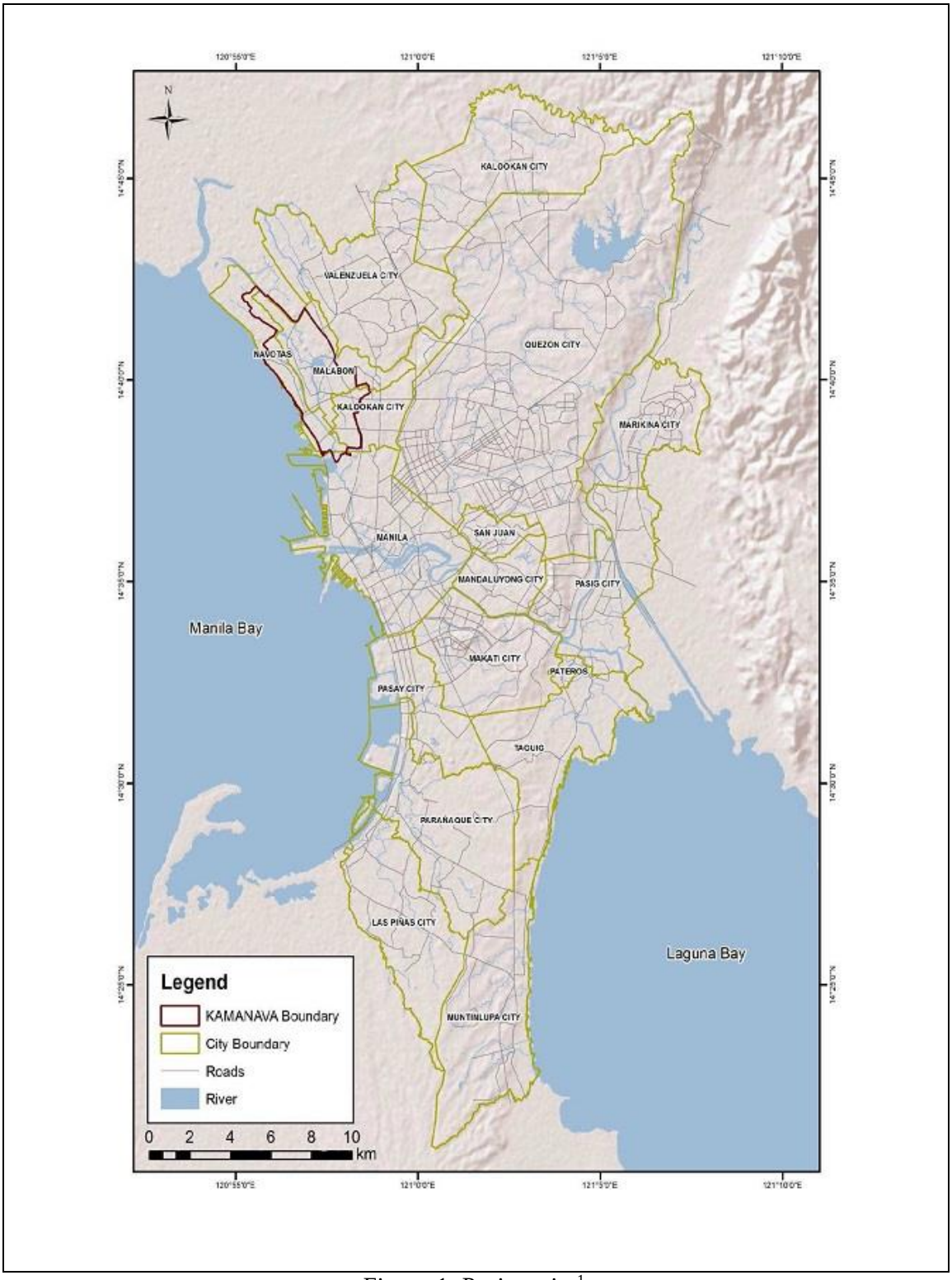

Figure 1. Project site[1]
(Source: JICA documents)

[1] "KAMANAVA Boundary" of the maps of Figure 1 and Figure 2 means the target area of this project and not KAMANAVA area in the usual sense.

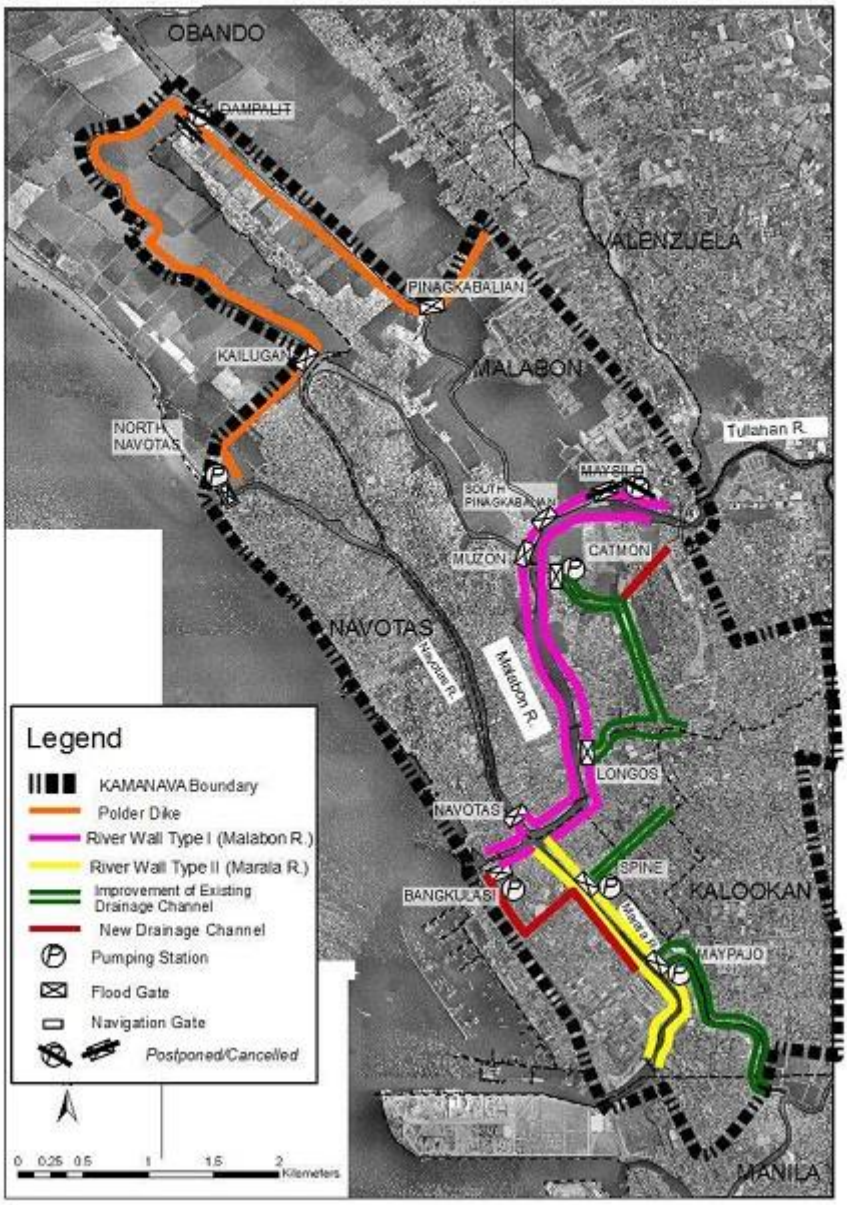

Figure 2. Project site
(Source: JICA documents)

Loan Approved Amount/ Disbursed Amount	8,929 million yen / 8,786 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	April 2000 / April 2000
Terms and Conditions	Interest rate 1.0% (0.75% for consulting services) Repayment period 40 years (Grace period 10 years) Conditions for procurement: Tied (Special Terms for Economic Partnerships (STEP))

Borrower / Executing Agencies	The Government of the Republic of the Philippines / Department of Public Works and Highways (DPWH)
Final Disbursement Date	September 2009
Main Contractor (Over 1 billion yen)	Nishimatsu Construction Co., Ltd. (Japan)
Main Consultant (Over 100 million yen)	CTI Engineering Co., Ltd. (Japan) / Nippon Koei Co., Ltd. (Japan) / Philkoei International Incorporated (Philippines) / Pertconsult (Philippines) / Woodfields Consultants, Incorporated (Philippines)
Feasibility Studies, etc.	F/S "Study on Flood Control Planning in Metro Manila"(1988-1990) Special Assistance for Project Sustainability (SAPS) for KAMANAVA Area Flood Control and Drainage System Improvement Project (2014)
Related Projects	JICA technical cooperation: Expert on flood control (DPWH) Study on Flood Control Planning in Metro Manila (1990) The Project for Enhancement of Capabilities in Flood Control and Sabo Engineering of the Department of Public Works and Highways (2000-2005) Strengthening the Flood Management Function of DPWH (2005-2010) JICA loan projects: Pasig River Flood Warning System Project (1983) Flood Control and Drainage Project in Metro Manila (II) (1987) Metro Manila - West Manggahan Flood Control Project (1996) Pasig Marikina River Improvement Project (I) (1999), (II) (2007), (III) (2012) Special Assistance for Project Sustainability (SAPS) for KAMANAVA Area Flood Control and Drainage System Improvement Project (2014) International Organizations: World Bank: Flood management master plan for Metro Manila and surrounding areas

2. Outline of the Evaluation Study

2.1 External Evaluator

Akemi Serizawa, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study: October 2014 - October 2015

Duration of the Field Study: January 4-23 and April 5-23, 2015

3. Results of the Evaluation (Overall Rating: B[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance to the Development Plan of the Philippines

The Medium Term Philippine Development Plan 1999-2004 that was valid at appraisal of this project stated that the central government and Local Government Units (LGUs) needed to construct flood control facilities, promote waste management and adequate operation of existing drainage facilities in order to reduce floods in Metro Manila.

The Philippine Development Plan 2011-2016 at the time of ex-post evaluation aims to reduce floods by maintaining watersheds and providing efficient and adequate infrastructure. Its four strategies to reduce floods are as follows:

・Prioritize the construction of flood control facilities in highly vulnerable areas.

・Apply Climate Change Adaptation (CCA) and Disaster Risk Reduction Management (DRRM) strategies in the planning and design of flood control facilities.

・Develop a mechanism to expedite immediate financing for the rehabilitation of flood control facilities.

・Increase local government and community participation.

From the above, at appraisal and at ex-post evaluation, the implementation of the project conforms to the development policies of the Philippines.

3.1.2 Relevance to the Development Needs of the Philippines

The Philippines experiences frequent floods due to typhoons and heavy rains. At appraisal of this project, annual death from floods was about 800 on average and the economic loss was about 0.4% of its GNP. Metro Manila is in low and flat land and is frequently inundated due to high tide or overflow of the rivers. The target area of this project in the basin of Malabon River and Tullahan River, located in the area called KAMANAVA, is particularly prone to flooding because it is only 0-1.5 meters above sea level. It was urgently sought to take measures against floods in the area (source: JICA documents).

According to DPWH, among 29 major typhoons and heavy rains experienced in the Philippines since 2001, ten events flooded Metro Manila as shown in Table 1.

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

[3] ③: High, ② Fair, ① Low

Table 1. Typhoons and heavy rains which affected Metro Manila

(The losses/damages are about the whole nation)

Month/year	Financial losses (million pesos)	Human suffering (person)
11/2004	2,226	42 dead, 77 injured, 34 missing
9/2006	3,973	184 dead., 536 injured, 47 missing
6/2009	137	10 dead, 6 injured, 5 missing
9/2009 (Typhoon Ondoy)	41,000	464 dead, 529 injured, 37 missing
7/2010	478	102 dead, 91 injured, 46 missing
6/2011	647	12 dead, 18 missing
7/2012	404	51 dead, 6 missing
8/2012	3,056	109 dead, 14 injured, 14 missing
8/2013	3,056	109 dead, 14 injured, 4 missing
9/2014	144	10 dead、7 injured

(Source: DPWH's answer to the questionnaire)

Among the events listed above, Typhoon Ondoy in September 2009 and the monsoon in August 2012 caused massive floods in KAMANAVA (the details of losses/damages in the project target area are shown in the section of Effectiveness). According to the Philippine Development Plan 2011-2016, Metro Manila is the seventh most susceptible to flooding among all provinces in the Philippines according to the percentage of flood-prone area, since 33.2% of its land area is flood-prone.

From the above, at appraisal and ex-post evaluation, the project area is very vulnerable to flooding. This project is in line with the development needs of the Philippines at the time of appraisal and ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

The high-level mission of the Government of Japan on economic and technical cooperation sent to the Philippines in March 1999 chose disaster prevention including flood management as one of the priority areas of assistance. Japan's Country Assistance Policy for the Philippines at appraisal also prioritized environment conservation and disaster prevention in the disaster-prone areas. Therefore, this project conformed to Japan's assistance policies for the Philippines at appraisal.

This project has been highly relevant with the Philippines' development plan and development needs, as well as with Japan's ODA policies. Therefore its relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

3.2.1.1 Civil works and procurement of equipment

Identification of the project components to be evaluated in the ex-post evaluation

Four activities were identified as "related activities" of this project to be carried out by the Philippines. They were 1) dredging of Malabon river bed, 2) raising bridges, 3) improvement of secondary and tertiary drainage channels and 4) solid waste management. They were not included in the cost calculation of this project and it was not clear whether they had to be evaluated as a part of it. JICA documents at appraisal mentioned that "the secondary and tertiary drainage channels have to be improved by LGUs in coordination with this project so that this project can produce the expected outcomes. Illegal waste disposal should be controlled so that the drainage channels of this project can keep functioning", and that "some bridges on Malabon River are not high enough and they might prevent safe flow of flood water from upstream. JICA requested DPWH to raise the bridges as the work is not covered by JICA funding."[4] The study of "Special Assistance for Project Sustainability (SAPS) for KAMANAVA Area Flood Control and Drainage System Improvement Project" in 2014 confirmed that JICA and DPWH had agreed through the discussions and the detailed design before the commencement of this project that these "related activities" were prerequisite for achievement of the project objectives and to sustain project outcomes. In this ex-post evaluation, it was examined through the review of the documents at appraisal and interviews of the persons involved in the project whether the "related activities" were indispensable for the achievement of the project objectives and whether they should be included in the project components to be evaluated. The conclusion is that the portions to be evaluated should be only those funded by JICA and the "relevant activities" of the Philippines are not included. The reasons are as follows:

According to the DPWH staff and Japanese consultants involved in this project and the JICA flood control expert dispatched to DPWH, this project were originally designed as one of the prioritized "drainage improvement" projects in the target area following the JICA Study on Flood Control Planning in Metro Manila (1988-1990). "Drainage improvement" aims at rapid drainage of flood water caused mainly by inland water (heavy rains in the area). This project had "drainage improvement" components such as construction and rehabilitation of drainage channels and construction of pumping stations. These "drainage improvement" facilities were designed based on the rainfall with a 10-year return period in the project target area. In addition to the drainage improvement, the project also had "flood control" components such as polder dike, elevation of river walls and construction of flood gates and a navigation gate to protect the target area from floods by external water, which means high tide and overflow of rivers due to heavy rains in the upstream. These "flood control" facilities were designed based on the one-day or two-day rainfall with a 30-year return period in

[4] This document did not mention about dredging of riverbed.

the upstream. The “relevant activities” by the Philippines were designed in order to reinforce both “drainage improvement” and “flood control” in addition to the expected protection by this project against rainfall with a 10-year return period in the project target area (drainage improvement) and one-day or two-day rainfall with a 30-year return period in the upstream (flood control). Improvement of secondary and tertiary drainage channels is a part of “drainage improvement” to reduce the incidence of localized inundations and to shorten the time for the flood water to drain. The scope of the improvement of secondary and tertiary drainage channels was not identified either at appraisal or ex-post evaluation, and the LGUs are supposed to design and implement it. This activity is to reinforce drainage improvement in addition to what this project provided. The dredging of Malabon River and raising bridges are a part of “flood control” to increase the volume of river flow. Therefore, these three “relevant activities” are to provide additional drainage improvement and flood control capacity to the protection provided by this project. Waste management, including garbage collection from rivers and awareness raising activities for the communities about waste disposal, aims at maintaining appropriate functioning of the flood gates, pumping stations and drainage channels. It is difficult to evaluate waste management as one of the project outputs in the ex-post evaluation as it is daily and continuous maintenance activities and its scope and degree of work are not fixed. The LGUs in the project target area are not able to fully control the garbage because many of them are from upstream or the sea (LGUs’ waste management activities are mentioned in detail in the section of Sustainability). In conclusion, these four “relevant activities” by the Philippine are not included in the project components to be evaluated.

(1) Civil works

The civil work components had minor modifications from the original plan during the detailed design, and were completed accordingly. The revisions were mainly about the size of the facilities to conform to the actual physical condition of the project target area as shown in Table 2, and were relevant. Some works originally funded by this project were incomplete at the expiry of the loan period in September 2008, and DPWH continued the work with their own funding until they were complete in January 2012.

Table 2. Civil works (plan and actual) funded by the JICA loan

	Original design at appraisal	Revised plan after detailed design	Completed portions as of expiry of loan period (September 2008)	Completion (January 2012)	Reasons for revision
Polder Dike	8.0 km	8.6 km	3.4km completed	8.6 km (as planned)	Based on the detailed design, the polder dike

				The balance was complete by the local contractors by January 2012.	was extended to include the northwest part of the project target area.
River Walls Raisings	12.4 km	10.5km (Malabon River 6.6km, Malala River 3.9km)	Those along Malala River were complete. Those along Malabon River were partially complete.	10.5km (as planned) The remaining parts were completed by the local contractors by January 2012.	Based on the detailed design, the length was reduced as some areas already had appropriate river walls or had sufficient altitude.
Navigation lock / Navigation gate (Navotas River North)	1 navigation lock (Boats can pass even during the high tide)	1 navigation gate (Boats can pass only during low tide)	Complete	1 navigation gate (as planned)	Boat users and DPWH agreed on the navigation gate. Boats can pass the navigation gate only during low tide (closed during high tide). Therefore navigation gate is more effective for flood control than the navigation lock.
Pumping station without flood gates incorporated with navigation lock (Navotas River North)	1 (next to the navigation lock)	1 (next to the navigation gate)	Complete	1 (next to the navigation gate) (as planned)	
Independent flood gates	6	6	Complete	6 (as planned)	
Control gates	2	0	None	None	They were cancelled because it was confirmed by the detailed design that there were no major development plans in the area, and that the polder dike and the existing control gates could provide sufficient protection.
Pumping station with ancillary flood gates	6	4	Complete	4 (as planned)	Two pumping stations were cancelled as the control gates above were cancelled.
Rehabilitation of existing drainage channels	6.4 km	5.6 km	Incomplete	5.6 km (as planned) Completed by the Philippine funding	Based on the detailed design, distance was reduced.
Construction of drainage channels	1.8 km	2.1 km	Complete	2.1 km (as planned)	Based on the detailed design, distance was increased.

(Source: JICA documents)

Flood gate of a pumping station constructed by the project

Flood gate constructed by the project

Pumping station constructed by the project

Waste processing machine in a pumping station constructed by the project

The plan and actual implementation of the "relevant activities" by the Philippines are shown in Table 3. Raising bridges is complete about two among four, and the remaining are under construction or under preparation as of the ex-post evaluation. The scope of other activities is not fixed and the works are ongoing.

Table 3. "Relevant activities" funded by the Philippine (plan and actual)

	Plan	Status as of April 2015	Cost (not included in the cost of this JICA-funded project)
Raising bridges (DPWH)	Bangkulasi Tonsuya Lambingan Tenejeros	Bangkulasi: under preparation of design Tonsuya: under construction Lambingan: completed in 2014 Tenejeros: reinforcement was complete in 2014	Approximately 43million pesos
Secondary and tertiary drainage channels (cities)	Scope of work is not fixed	Partially implemented	No information available
Waste management (cities)	Scope of work is not fixed	Being implemented by the relevant cities	Budget of waste management of Malabon City: 95 million pesos per year Budget of waste

			management of Navotas City: 19.2 million pesos per year
Dredging of Malabon River (DPWH)	Scope of work is not fixed	DPWH is to dredge 2.86km of the river in 2015 using the budget of 2014. The remaining parts are under examination and to be dredged in 2015 or after, using the budget of 2015.	Budget of 2014: 202 million pesos Budget of 2015: 124 million pesos

(Source: JICA documents. DPWH answer to the questionnaire and interviews about current status)

In the project target area, the following flood control activities were carried out using the Philippines' funds without direct relationship with this project (source: JICA documents).

・Raising of river walls (from 12.6m to 13.5m above sea level for 2,954m length in total along Malabon River), construction of banks of Catmon Creek (1,800m in total), improvement of Longos Creek (36.6m) and U-shape open channels of concrete (64.4m). They were designed after the major flood in 2012 and constructed in 2013.

・Installation of 39 pumps in Navotas City

・Construction of river walls (13.5m above sea level) along Meycauayan River, stretching to 3.2km in total

・Construction of river walls (13.5m above sea level) along Palasan and Meycauayan Rivers, stretching to 9.0km in total

・Exfoliation of sludge of Meycauayan River

・Rehabilitation of river walls along Meycauayan River

・Construction of dikes around Navotas City (500m)

(2) Procurement of equipment

The following equipment was procured as planned:

・Hydrological and meteorological observation instruments

・Dust removal equipment for pumping stations

3.2.1.2 Consulting services

Consulting services as follows were carried out as planned:

・Basic study of topography and soils, and review of the basic design of flood control facilities

・Detailed design of flood control facilities

・Assistance for bidding

・Environmental management including monitoring of observation of Environmental Compliance Certificate and supervision of contractors

・Assistance for report preparation on resettlement and land acquisition and for the

activities about livelihood of resettled persons

3.2.1.3 External monitoring of resettlement and land acquisition

External monitoring of the following was carried out as planned:

・Monitoring of resettlement and land acquisition processes by DPWH

・Monitoring of social and economic conditions of the resettled persons and of related activities by the relevant governmental agencies

・Advice for the relevant governmental agencies

(Source: JICA documents)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost was significantly higher than planned. The planned project cost was 11,786 million yen. The actual project cost was 17,858 million yen in total, which was 152% of the plan.

Table 4. Project cost

(Unit: million yen)

	Planned						Actual					
	Foreign currency		Local currency		Total		Foreign currency		Local currency		Total	
	Total	JICA loan	Total	JICA loan	Total	JICA loan	Total	JICA loan	Total	JICA loan	Total	JICA loan
Civil works and procurement of equipment	5,863	5,863	1,281	1,281	7,144	7,144	4,987	4,987	5,468	2,670	10,455	7,657
Contingencies	586	586	128	128	714	714	-	-	-	-	-	-
Consulting services	714	714	357	357	1,071	1,071	799	799	445	321	1,244	1,120
Land acquisition and compensation	0	0	2,576	0	2,576	0	0	0	2,977	0	2,977	0
Administration cost	0	0	242	0	242	0	0	0	477	0	477	0
Tax	0	0	39	0	39	0	0	0	2,696	0	2,696	0
Service charges	0	0	0	0	0	0	9	9	0	0	9	9
Total	7,163	7,163	4,623	1,766	11,786	8,929	5,795	5,795	12,063	2,991	17,858	8,786

(Source: JICA documents)

At appraisal: US$1=JPY114、Philippines Peso1=JPY3

Price escalation: 1.2% per year for foreign currency and 1.2% per year for local currency

Contingencies: 10% per year

Cost calculation: August 1999

Average exchange rate in the project implementation period (from January 2000 to January 2012): Philippines Peso1=JPY2.16

The total project cost includes the cost for the portions which were not complete at the expiry of loan period in 2009 and were completed by the funding of the Philippines. They were remaining parts of the polder dike and elevation of river walls as well as rehabilitation of drainage channels. All costs of the civil works and procurement of

equipment were to be funded by this project in the original plan, but 2,798 million yen were funded by the Philippines to cover these remaining works[5]. According to DPWH, while the land acquisition process finished physically, final cost of land acquisition is not fixed because some land owners took legal action demanding increase of compensation based on the increase of land price and the process would take several years. The figures in Table 4 and Table 13 (land acquisition) were estimate as of the ex-post evaluation, and therefore the final project cost might increase.

The reasons for the increase of the project cost were as follows[6].

- Cost for civil works increased due to price escalation during the extended project period. Because of the expiry of loan period in September 2008 and the change of contractors to finish the incomplete works, extra cost was incurred for the installation and removal of the construction machines compared to the case that the same contractor completed all works. The reason for the change of contractors was that the works by the international contractor was delayed and its contract finished with some incomplete portions (it is explained in the section of Project Period below). The portions that would not be complete by the end of contract were excluded from the contract of the international contractor one year before its termination. Therefore, the revised contract was totally accomplished.
- The flood in September 2009 damaged some facilities of this project. The local contractors repaired them and it led to the increase of the project cost. Exact cost for these repairs is not known because their account did not separate repair and construction costs.

3.2.2.2 Project Period

The project period was significantly longer than planned. The original project period was from April 2000 (L/A[7]) to December 2006 (completion of civil works) of 81 months in total. The actual project period was from April 2000 (L/A) to January 2012 (completion of civil works) of 142 months in total, which was 175% of the plan.

Table 5. Project Period

	Plan	Actual
Selection of consultant	November 1999-October 2000	November 1999-October 2000
Detailed design	November 2000-October 2001	November 2000-October 2001

[5] Actual cost for the civil works and procurement of equipment was 5,468 million yen, among which 2,670 million yen was funded by the Japanese loan. The balance was funded by the Philippines.
[6] From JICA documents, DPWH's response to the questionnaire and interviews.
[7] Resettlement of informal settlers and land acquisition had started before L/A and the relevant cost was also included in the project cost. L/A is defined as the commencement of this project as other ex-post evaluations because exact commencement dates of resettlement and land acquisition are not known.

Tendering	November 2001-October 2002	November 2001-June 2003
Civil works	(Whole process) November 2002-April 2006	(Whole process) June 2003-January 2012
Contract 1 (international contractor)		June 2003-September 2008
Contract 2 (local contractor)		February-August 2009
Contract 3 (local contactor)		May-October 2010
Contract 4 (local contactor)		September 2011-January 2012
Procurement of equipment	May 2003-July 2005	May 2003-July 2005
Resettlement of informal settlers	-December 1999	-January 2000[8]
Land acquisition	-October 2001	Physical acquisition was complete, but the compensation was not complete as of April 2015.
Supervision of works and technical assistance	February-August 2000, November 2002-December 2006	June 2003-December 2009
External monitoring	Every August between 2000-2004	Three times between 2000-2004

(Source: JICA documents)

The reasons for the delay were as follows according to JICA documents:

- Tendering was delayed for eight months because DPWH needed long period for Pre-Qualification of contractors and confirmation of bidding criteria.
- While the resettlement of informal settlers had almost been complete when the project started, new informal settlers came in during the delay of the tendering process. It took time for DPWH to make decision on the resettlement of the new settlers and to obtain budget, and some civil works started late as a result.
- The civil works were to be carried out by one international contractor during the period between June 2003 and June 2007. They were delayed as there were problems such as not being able to prevent fishing boats from entering into the construction sites and difficulty in relocation of electricity and water supply facilities, and it took time to agree with the local communities on these matters. The contract with the international contractor was extended until September 2008, which was the original expiry date of the Japanese loan. This contract was revised in June 2007 to cancel the portions that were difficult to complete by September 2008. After the end of this contract, three local contractors completed the remaining

[8] The situation of informal settlers was examined in 1997. The persons to be resettled were identified by February 1998, and DPWH and LGUs agreed on the resettlement and support activities in November 1998. Resettlement was complete by January 2000 (JICA documents).

portions. In July 2008, the expiry of loan period was extended for 12 months until September 2009.

3.2.3 Results of Calculations of Internal Rates of Return

The Economic Internal Rate of Return (EIRR) calculated at appraisal was 10.8%. The conditions for the calculation were as follows:

Cost: Construction and rehabilitation cost and operation and maintenance cost of flood control facilities.
Benefit: Estimated reduction of losses/damages due to floods (30-year return period) and benefit on the community by the improvement of living conditions
Project life: 30 years
The construction and rehabilitation cost would to be incurred from the first year to the eighth year of the project life.
The operation and maintenance cost would be incurred from the sixth year, and annual operation and maintenance cost would be 22.5 million pesos from the eighth year.
The benefit would be produced from the second year, and annual benefit would be 330.3 million pesos from the fifth year.
(Source: JICA documents)

After the project completion, DPWH re-calculated EIRR as 16.1% taking the delay of construction and price escalation into account, without obtaining actual data of benefits.

・The project was complete in January 2012.
・The construction and rehabilitation cost was incurred for 13 years between 1998 and 2010.
・The annual operation and maintenance cost was estimated as 21 million pesos from 2009 to 2029. 742 million pesos would be needed in 2013 for a large repair and regular operation and maintenance. The annual operation and maintenance cost would be 31.6 million pesos after that.
・The benefit would be produced in 2009 (11th year of the project life) and would increase every year. The annual benefit would be 1,442.3 million pesos from 2011. The expected benefit would be larger than the calculation at appraisal because of price escalation.
・Project life: 45 years, based on the service life of the facilities.
(Source: JICA documents)

The EIRR calculated at project completion (16.1%) was higher than that at appraisal (10.8%) because of the increased benefits due to price escalation during the extended construction period. It is not possible to calculate exact EIRR because actual data of benefits are not available.

The project outputs were produced as planned. Both the project cost and project period significantly exceeded the plan. Therefore, efficiency of the project is low.

3.3 Effectiveness[9] (Rating: ③)

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

3.3.1 Quantitative Effects (Operation and Effect Indicators)

No indicators were set at appraisal to measure the reduction of floods.

3.3.1.1 Operation Indicators

No operation indicators were set. In order to give some ideas on the number of beneficiaries, Table 6 shows the population data of the cities in the project target area, which is composed of seven drainage areas. The cities and drainage areas are not necessarily the same, and there are no population data per drainage area. The maximum number of beneficiaries is around 1.2 million.

Table 6. Population of the cities in the project target area

City	Area (ha)	Population (persons)		
		2000	2007	2010
Kalookan	5,580	1,177,604	1,378,856	1,489,040
Southern Kalookan	1,370	(included in Kalookan above)	570,665	578,851
Malabon	1,976	338,856	363,681	353,337
Navotas	894	230,403	245,344	249,131

(Source: DPWH's response to the questionnaire)

Note: The table above separates Kalookan and Southern Kalookan because Southern Kalookan is an enclave surrounded by other cities and the target drainage areas of this project were located only in Southern Kalookan.

The cities have following project target drainage areas.

Southern Kalookan: Spine, Maypajo

Malabon: Catmon, Spine, North Navotas, Dampalit, S.Pinagkabalian

Navotas: Bangkulasi, North Navotas

3.3.1.2 Effect Indicators

While no indicators to measure the achievement of project objective (reduction of floods) were set at appraisal, the SAPS study in 2014 confirmed that JICA and DPWH had agreed on the project targets as follows as recorded in the minutes of discussions dated October 20, 1999.

(a) Protect the area from high tide and riverbank overflows in extreme weather events where tide level is at or below the highest observed as at the planning stage and river flows are at or below the estimated flood flow with a 30 year return period[10].

[10] Rainfalls of return periods were assumed as follows at the detailed design in 2001 (JICA documents).

	Two-day rainfall (mm/2days)	One-hour rainfall (mm/hour)
500 years	750.6	131.4
100 years	601.4	109.8
50 years	536.8	100.5
30 years	489.0	93.6
20 years	450.8	88.1
10 years	384.2	78.4
5 years	314.8	68.4
2 years	210.0	53.3

(b) Decrease the affected area of the inland flooding (inundation) from 90% (the baseline value at appraisal) of the area to less than 15% during a 10-year rainfall/flood event with water depths exceeding 20 cm. (c) Reduce the flood damages by 500 million Pesos in every year. The "target year" for the above planning was year 2020.

The project facilities were designed as follows in 2001 based on the above assumptions:

High tide	Highest observed: 1.625m above the Mean Sea Level (MSL) = DPWH Datum 12.10m
River flow	Rainfall: 30-year return period (two-day rainfall in the upstream of Tullahan and Malabon Rivers: 489.0mm/2days) River flow: between 290m^3/s and 450 m^3/s (varying from place to place)
Inundation	10-year return period (one-hour rainfall in the project target area: 78.4mm)

(Source: JICA documents)

As there were no indicators set at appraisal, the following indicators were examined for the ex-post evaluation based on the agreement between JICA and DPWH mentioned above.

(1) Reduction of inundated areas

According to DPWH and the cities in the project target area, KAMANAVA were flooded three times after the commencement of this project. They were Typhoon Ondoy in September 2009, the monsoon (habagat) in August 2012 and the heavy rains in September 2014. During Typhoon Ondoy, most part of the project target area was inundated because the tide and river flow from the upstream exceeded the assumptions at the facility design while the rainfalls in the project target area did not exceed the assumption of 10-year return period. During the monsoon in August 2012, most part of the project target area was inundated because the rainfalls in the project target area, tide and river flow from the upstream exceeded the assumptions at the facility design. These were two major flood events (detailed data are shown in (5) With-Without analysis by SAPS study). By the heavy rains in September 2014 during which the one-hour rainfall exceeded the 10-year return period in the project target area, some places were inundated in the depth between 6cm and 50cm, which was not as serious as the other two events. There is no evidence to show that flooding did not occur in other times, because the losses/damages are not examined when the residents do not report the incidence. However, it can be concluded that the losses/damages were likely to be none or minor in other weather events as there were no reports on incidence.

The first target in the JICA-DPWH minute (a) "Protect the area from high tide and

riverbank overflows in extreme weather events where tide level is at or below the highest observed as at the planning stage and river flows are at or below the estimated flood flow with a 30-year return period" was achieved because the area were not flooded by high tide or overflow from the rivers except for the two major events (Ondoy and the monsoon August 2012) which exceeded the assumptions of facility design. The flood by the heavy rains in September 2014 was due to inland flooding caused by the rainfalls in the target area that exceeded the assumption at facility design (the second target in the JICA-DPWH minute (b)), and does not contradict with the achievement of target (a).

Regarding the target (b) "Decrease the affected area of the inland flooding (inundation) from 90% of the area to less than 15% during a 10-year rainfall/flood event with water depths exceeding 20 cm", it was assumed that 84% of the total surface of the project target area (1,472.1ha out of1,750.5ha) was flood-prone before the project started, and the flood-prone areas would be reduced only to 10.7% (187.6ha) by the contribution of the project facilities (Table 7). However, the reduction of flood-prone areas could not be confirmed due to lack of actual data. No systematic examination is carried out after floods to classify flooded areas according to flood depth, while ad-hoc interviews with the affected people and observation of inundated houses have taken place after major flood events.

Table 7. Expected reduction of flooded areas

(Unit: ha)

		Without this project				With this project (expectations)			
Drainage area	Whole area	No flood	Flood of 0-0.5m	0.5-1m	1m or more	No flood	Flood of 0-0.5m	0.5-1m	1m or more
Bangkulasi	75.4	16.9	23.7	34.8	0.0	68.3	7.1	0.0	0.0
Catmon	355.5	160.3	21.5	92.4	81.3	326.6	28.9	0.0	0.0
Spine	173.1	42.5	69.0	61.2	0.4	156.7	16.4	0.0	0.0
Maypajo	241.2	50.2	95.4	95.6	0.0	227.9	13.3	0.0	0.0
North Navotas	417.6	8.5	107.4	193.0	108.7	380.3	37.3	0.0	0.0
Dampalit	233.1	0.0	0.0	38.4	194.7	188.0	45.1	0.0	0.0
S.Pinagkabalian	254.6	0.0	0.0	66.3	188.3	215.1	39.5	0.0	0.0
Total	1,750.5	278.4	317.0	581.7	573.4	1,562.9	187.6	0.0	0.0

(Source: JICA documents)

(2) Average duration of inundation

Such data were not available. However, staff of Malabon City stated that currently it takes only several hours for flood water to drain while it used to take about three days before the completion of this project.

(3) Number of flooded houses

DPWH provided data on losses/damages by city caused by major weather events (shown from Table 8 to Table 11). Due to lack of sufficient data, it is not possible to examine the relationship between the scale of the events and number of flooded houses or to capture the contribution of this project to the reduction of losses/damages.

(4) Financial losses/damages by flood

DPWH reported that this project contributed to the reduction of financial losses/damages by flood by at least 500 million pesos per year, but without sources of calculation. It is not possible to confirm it as the data shown in Table 8 to Table 11 are not sufficient.

From the above, there were no data of these indicators such as reduction of flooded areas, average time of inundation, number of flooded houses and financial losses/damages by flood. Therefore, it is not possible to show the contribution of this project to the reduction of losses/damages by flood.

Table 8. Losses/damages in the project target area by Typhoon Ondoy, September 2009

	Number of people affected			Number of damaged houses		Financial losses/damages (million pesos)
	Barangay[11]	Number of household	Number of people	Totally damaged	Partially damaged	
Kalookan	23	18,116	90,580	0	0	No data
Malabon	11	1,381	8,736	159	0	No data
Navotas	3	62	355	6,748	85	No data
Metro Manila	No data	No data	No data	No data	No data	1,128

Table 9. Losses/damages in the project target area by the monsoon in August 2012

	Number of people affected			Number of damaged houses		Financial losses/damages (million pesos)
	Barangay	Number of household	Number of people	Totally damaged	Partially damaged	
Kalookan	13	5,371	26,761	No data	No data	No data
Malabon	18	4,613	20,474	No data	No data	No data
Navotas	12	1,630	7,698	No data	No data	No data
Metro Manila	No data	No data	No data	No data	No data	412

Table 10. Losses/damages in the project target area by the heavy rains in August 2013 (rainfall: 30mm/hour, 290 mm/day)

	Number of people affected	Number of damaged houses	Financial losses/damages (million pesos)

[11] Barangay is the smallest local government unit in the Philippines. It is under a City or Municipality.

	Barangay	Number of household	Number of people	Totally damaged	Partially damaged	
Kalookan	9	5,162	25,171	0	0	No data
Malabon	17	7,631	35,406	0	0	No data
Navotas	2	86	365	0	0	No data
Metro Manila	No data	No data	No data	No data	No data	No data

Table 11. Losses/damages in the project target area by the heavy rains in September 2014 (rainfall: 84.6 mm/hour, 688.7mm/day)

	Number of people affected			Number of damaged houses		Financial losses/damages (million pesos)
	Barangay	Number of household	Number of people	Totally damaged	Partially damaged	
Kalookan	No data	1,886	10,969	No data	No data	No data
Malabon	No data	936	3,582	No data	No data	No data
Navotas	No data	33	142	No data	No data	No data
Metro Manila	No data	No data	No data	No data	No data	No data

Seven barangays in Malabon city were flooded with depth between 6cm and 50cm.
(Source: DPWH's response to the questionnaire)

(5) With-Without analysis by SAPS study

Because the project target area was flooded by the monsoon in August 2012 despite of the facilities of this project, the residents were skeptical about the effects of the project. JICA carried out a SAPS study from October 2013 to January 2014 in order to show the effects of the project to the residents. The methodology of the study was with-without analysis to compare the possible losses/damages in these two major events "with" and "without" the facilities of this project. The results of the study are shown below.

<u>Flood by Typhoon Ondoy, September 2009 (September 23-30, 2009)</u>

Situation in the project target area

This project had completed the polder dike, and partially completed the raising of river walls (some parts were elevated up to 12.6m). Dredging had not been implemented.

- Rainfall in the project target area: 371.9mm (two-day rainfall between midnight of September 25-26 and midnight of September 27-28, 2009) (approximately equal to rainfall of 10-year return period)
- Tide: +12.2m (September 27, 2009). It exceeded DPWH Datum 12.1m.
- River flow from the basin of Tullahan River: 600 m^3/s, capacity of Malabon River: 100 m^3/s-600 m^3/s. They exceeded the river flow of 30 year return period of the two rivers (290 m^3/s-450 m^3/s, varying place to place).

Most part of the project target area was flooded because the tide and river flow exceeded the assumptions at facility design while the rainfall in the area was within the assumed 10-year return period. The SAPS study concluded that in six drainage areas among seven, the volume of flood was 20%-80% lower by the effects of the polder dike, river walls, flood gates and pumping stations constructed or rehabilitated by the project

compared to the hypothetical situation without these facilities. The river walls had been elevated up to 12.6m and protected effectively the downstream of Malabon River and the area along Malala River from the high tide of 12.2m. The polder dike also protected some of the project target area from flooding, but its northern section was flooded because some parts of the polder dike were lower than 12.6m.

Navotas City in monsoon, August 3, 2012
(Source: Inquirer)

Malabon City in monsoon, August 7, 2012
(Source: Reuters/Stringer)

Flood by monsoon in August 2012 (August 1-8, 2012)

Situation in the project target area

This project was complete.

・Rainfall in the project target area: 737.5 mm (two-day rainfall between 17hours of August 6, and 17 hours of August 8, 2012) (approximately equal to rainfall of 500-year return period)

・Tide: +12.65 m (August 2, 2012). It exceeded DPWH Datum 12.1m.

・River flow from the basin of Tullahan River: 600 m^3/s, capacity of Malabon River: 350 m^3/s-600 m^3/s. They exceeded the river flow of 30 year return period of the two rivers (290 m^3/s-450 m^3/s, varying place to place).

Most part of the project target area was flooded because the rainfall, river flow and tide exceeded the assumptions at facility design. However, the SAPS study concluded that the volume of flood was 10%-80% lower by the effects of the polder dike, river walls, flood gates and pumping stations constructed or rehabilitated by the project compared to the hypothetical situation without these facilities. It also estimated that the average flood volume was reduced by 68% in the project target area, and the project delayed reaching of the flood water to the dangerous elevations by one day at most.

Some areas were protected from flood by the river walls and polder dike. However, the river walls were 12.6m above sea level and could not prevent the tide of 12.65m from entering into the area. As some parts of the polder dike were lower than 12.6m, three parts of the walls were destroyed and allowed flood water to overflow (source: JICA documents).

From the results of With-Without analysis of the SAPS study, it can be confirmed that the floods were reduced to a certain extent even though the scale of events exceeded the assumptions at the facility design. The Philippine also has implemented flood control projects using their own funding, which also have contributed to the reduction of floods.

(6) Beneficiary surveys

Beneficiary surveys were carried out in Malabon and Navotas Cities, which were the main target LGUs of this project. One hundred persons in total, 50 from each city[12], participated in the surveys.

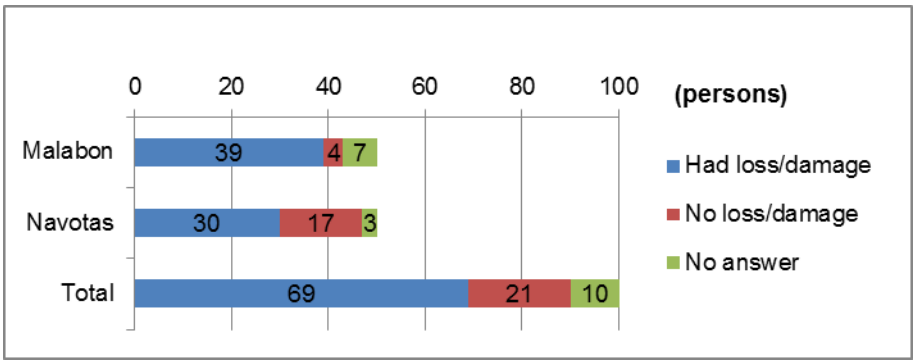

Figure 3. Losses/damages by flood by Typhoon Ondoy, September 2009

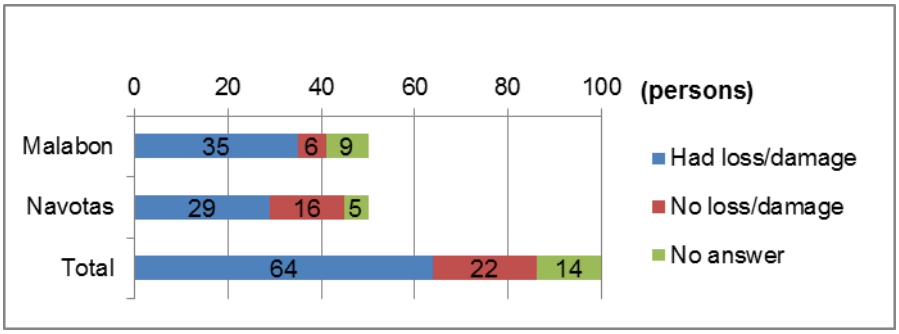

Figure 4. Losses/damages by flood by monsoon in August 2012

[12] The respondents were 50 from Malabon (men 17, women 29, unknown 4), and 50 from Navotas (men 34, women 10, unknown 6).

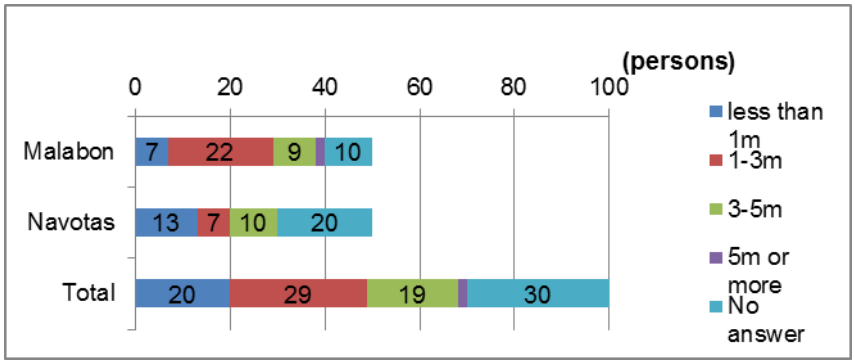

Figure 5. Inundation by Typhoon Ondoy in September 2009

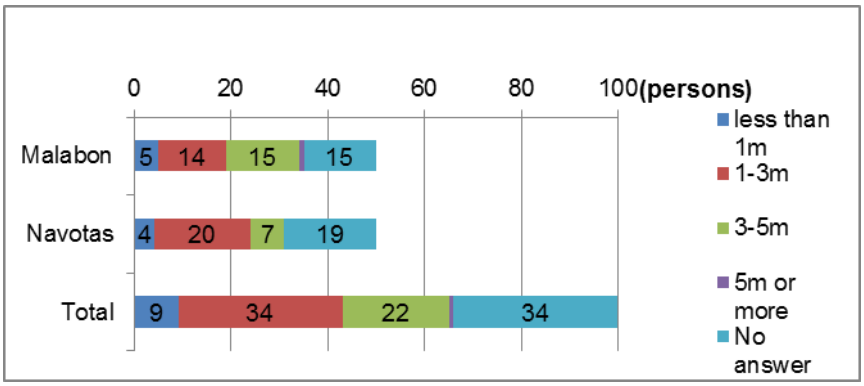

Figure 6. Inundation by monsoon in August 2012

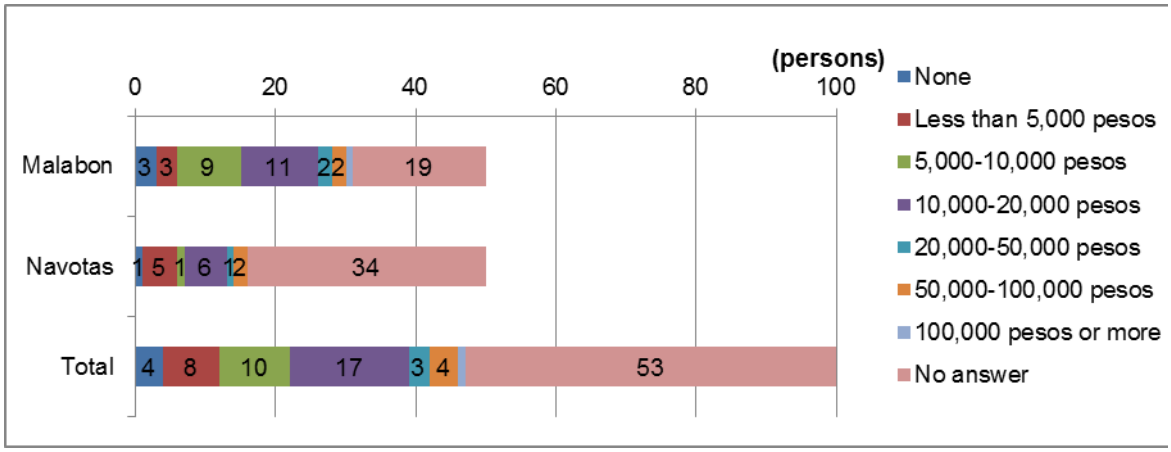

Figure 7. Financial losses/damages by Typhoon Ondoy in September 2009

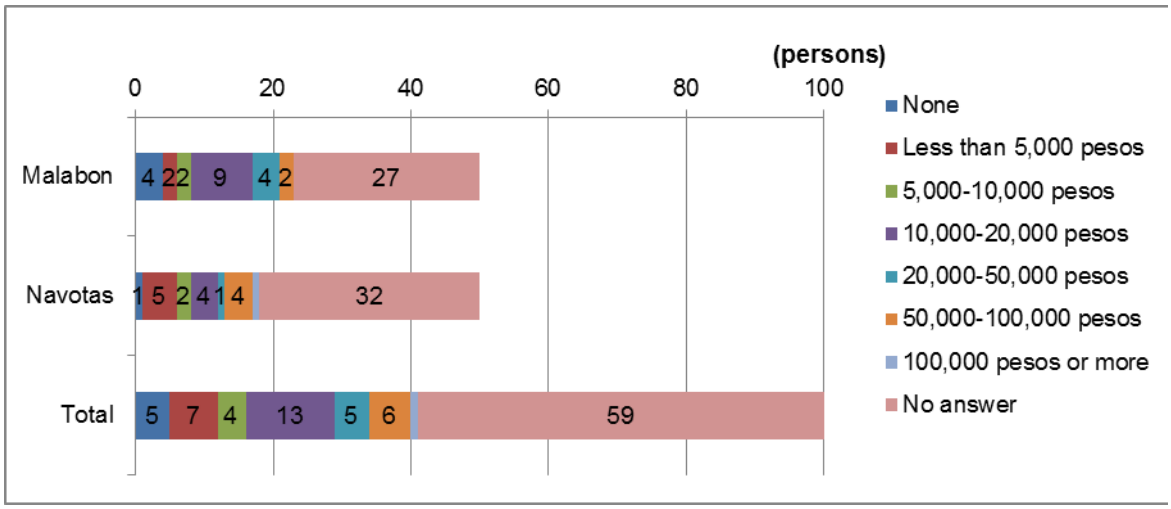

Figure 8. Financial losses/damages by monsoon in August 2012

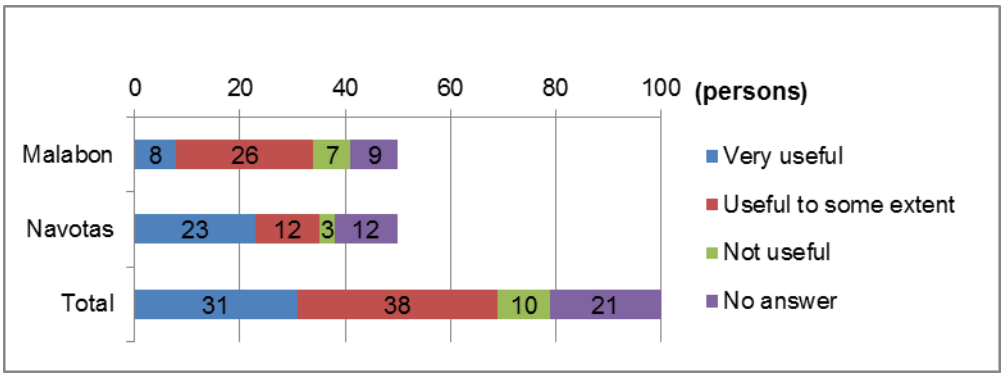

Figure 9. Observation whether the flood control facilities constructed/rehabilitated by this project were useful for the reduction of flood

There were no significant differences between the two events in 2009 and 2012 regarding the losses/damages by flood, inundation and financial losses/damages as shown in Table 3-Table 9. However, it can be concluded that the project facilities, which had been completed before the monsoon in August 2012, contributed to the reduction of losses/damages by flood to a certain extent because the scale of the event was larger in August 2012 than that in September 2009.

About 70% of the participants in the beneficiary surveys felt that the flood control facilities of this project contributed to the reduction of floods to a large or certain extent. Many chose “to a certain extent” because they were likely to be aware of the other flood control activities and of the fact that flood could never be zero despite of the facilities. The respondents in Navotas tended to be more positive than those in Malabon, the reason of which could be that Navotas is located downstream and the residents might be more conscious about the effect of the project facilities on the

reduction of floods than Malabon residents.

3.3.1.3 Other effects (qualitative effects, etc.)

According to the results of the beneficiary surveys, about 40-50% of the respondents were aware of the improvement of the safety in the areas, landscape, waste management and community participation in flood control activities.

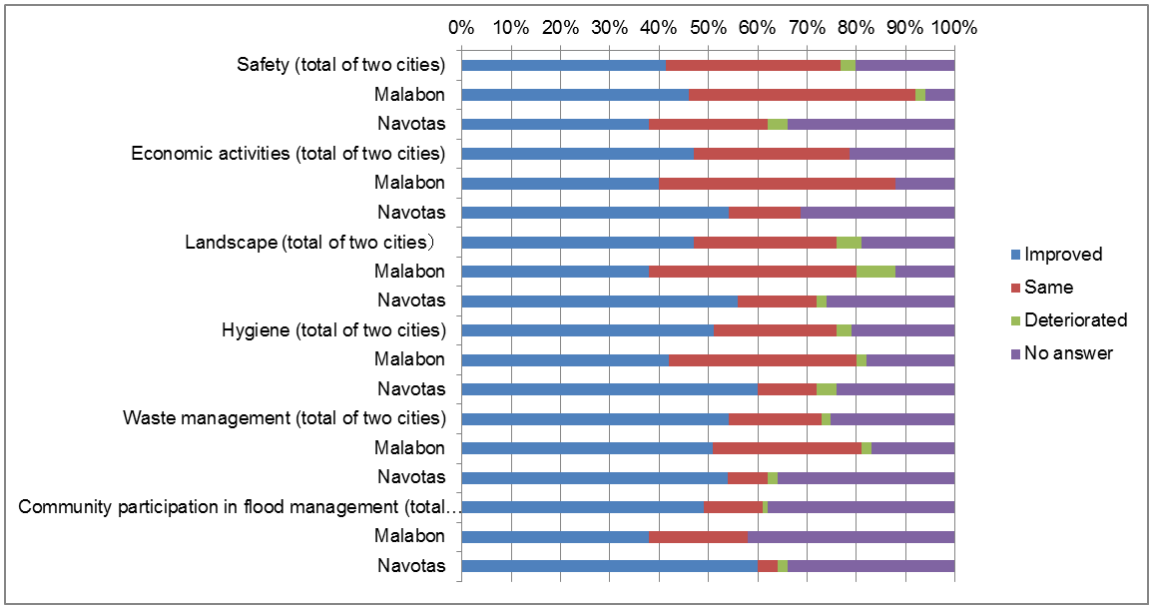

Figure 10. Improvements brought about by this project

From the above, effectiveness of this project is high. Flood did not occur or was minor during the weather events of the scale below the assumptions at the facility design. In addition, the project facilities contributed to the reduction of floods to a certain extent even in the major weather events exceeding the assumptions at the facility design compared to the hypothetical situation without these facilities.

3.4 Impacts

3.4.1 Intended Impacts

(1) Improvement of living conditions

According to the results of the beneficiary surveys above, about 40-50% of the respondents were aware of the improvement of hygiene status, waste management and landscape.

(2) Development of regional economy

According to DPWH's response to the questionnaire, people in the project target area

are more willing to participate in the economic activities and investment as well as in the development of residential areas compared to the period before the project. As the project target area is in downtown of Metro Manila where many houses and shops are congested, there are no large development projects. Nonetheless, people feel safer to operate businesses as the flood risks were reduced. About 40-50% of respondents in the beneficiary surveys feel that economic activities are more active in the area than before.

3.4.2 Other Impacts

(1) Impacts on the natural environment

At appraisal, this project was classified as Category B of "JBIC Guidelines for Confirmation of Environmental and Social Considerations" (April 2002), as its potential adverse environmental impact was not considered serious. Initial Environmental Examination (IEE) was carried out, and the Department of Environment and Natural Resources issued an Environmental Compliance Certificate of the Philippines.

To avoid negative impacts on environment, following actions were planned and implemented (source: JICA documents, DPWH).

- Removal of trees were minimized and trees were replanted in nearby vacant public lands. Some areas in the pumping stations were landscaped.
- In order to prevent noise, sound absorbent materials were provided. Traffic was eased by using service roads. Roadways and construction sites were sprinkled with water during dry seasons.
- In order to prevent water pollution due to reduced exchange of water by the construction of the polder dike, sluice gates were incorporated to promote exchange of water.
- Construction debris and dredged materials were properly disposed. After the completion of dredging, dredging sites were closed quickly and adequately.
- In order to minimize smokes from heating up of diesel engines, operation of the pumping stations were performed only in intense rains. Smoke vents were installed high enough to prevent smokes from affecting people. Sound-deadening materials were installed to reduce noise from the pumping stations.
- Temporarily removed facilities such as water supply, sewerage, roads, electric power and telephone lines were restored to their original positions after construction works without reduction of scale or level of services.

According to DPWH and the project target cities, the volume of waste in and around the rivers and channels were reduced because the waste management was strengthened and there were less illegal disposal of waste after the relocation of informal settlers.

However, waste keeps arriving from the sea or upstream. The waste management activities of the project target cities are described in detail in the section of Sustainability.

No specific negative impacts on environment were observed. Only one respondent to the beneficiary surveys pointed out the noise from the flood control facilities.

(2) Land Acquisition and Resettlement

Resettlement

DPWH relocated all identified informal settlers (6,206 households) by January 2000 in accordance with the laws and regulations of the Philippines to the three sites prepared by the government[13]. According to JICA documents, however, some of these persons returned and new informal settlers were identified since then, and the number of households to be resettled increased to 7,200 by April 2000 (at L/A), including those who had once been resettled. DPWH developed the "comprehensive resettlement follow-up plan" on May 2001. Skill training for resettled persons was conducted by NGOs in the areas such as sewing to enhance their employability in consideration of main industries in the relocation sites and the skills and educational attainment of the resettled persons.

The consultants employed by DPWH conducted surveys of resettled persons three times during the project period. The result of the last survey in May-June 2004 was shown in Table 12. The surveyed persons were 22.5 years old on average, less than one third of them had completed secondary education or above, and many of them were unskilled workers. Many of them felt that housing conditions, environment and peace and order of life had improved after relocation. On the other hand, they were negative about the access to transport and other facilities as well as about level of income after relocation. The reasons were as follows:

- The relocation sites were far from the workplaces in Metro Manila. People had to pay more for transportation.
- Employment opportunities in the relocated sites were limited. There were factories such as sewing plants, but academic qualifications and skills of the resettled persons limited their options. The majority of them were in the early twenties with children, and could not allocate enough time for work.
- For self-employed, the market size and number of customers were smaller in the relocated sites than in Metro Manila.
- If they were given lands only, they had to pay for construction of houses. The payment was large even in cases of lease contracts.

[13] They were Pabahay2000, Towerville and North Hill, which were all outside of the project target area.

DPWH had lost contact with the resettled persons by the time of ex-post evaluation and it did not know their current situations.

Table 12. Perceptions of resettled persons
(comparison before and after relocation)

(Unit: %)

	Better	Same	Worse
Housing	79.6	6.7	13.8
Water supply	37.8	30.4	31.8
Electricity	29.3	38.2	32.4
Transport	12.4	12.4	75.3
Access to schools	36.0	26.9	37.1
Access to health facilities	8.7	39.8	51.6
Peace and order	74.7	12.4	12.9
Income	7.8	19.1	73.1
Quality of environment	94.2	3.3	2.4
Quantity and quality of foods	11.6	34.0	54.4
Health situation	35.8	51.6	12.7

(Source: Socio-economic survey of Project Affected Persons, 2004)
One hundred fifty household per site were surveyed (may-June 2004).

Land acquisition

According to DPWH, land acquisition was implemented in accordance with the laws and regulations and physically completed. There was no problem in acquisition itself or its process. However, the final compensation is not fixed because some land owners took legal actions demanding increase of compensation based on the increase of land price and the process would take several years. The figures in Table 13 were estimate as of the ex-post evaluation (the actual project cost of Table 4 in section 3.2.2.1 “Project Cost” is based on this amount).

Table 13. Cost of land acquisition and compensation

		Cost of land acquisition and compensation
Land acquisition	288 lots[14]	248,270.96 pesos per lot x 288 = 71,502,037 pesos
Compensation	495 houses	21,632.61 pesos per house x 495 = 10,708,144 pesos

(Source: DPWH’s response to the questionnaire)

(3) Other positive and negative impacts

The social survey in the SAPS study (implemented in November 2013) found out that 76% of respondents were willing to participate in the activities to improve flood control

[14] The land acquisition process for all 288 lots was complete physically by April 2015. Compensation was also complete for 176 lots, but the remaining 112 lots received partial payment. All 495 houses received compensation (interview of DPWH).

in the project target area. Also at the ex-post evaluation, they were active in flood control activities (other than construction or rehabilitation of flood control facilities) such as awareness raising in prevention of waste disposal into the rivers (source: DPWH's response to the questionnaire).

This project has reduced floods to a certain extent, and produced impacts such as improvement of living conditions in the project target area, development of regional economy, improvement of waste management and enhanced awareness of residents about flood control. In total, effectiveness and impact of the project are high as it has largely achieved its objectives.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

DPWH Unified Project Management Office-Flood Control Management Cluster (UPMO-FCMC) is responsible for the operation and maintenance of the facilities of this project. The unit has four teams consisting of several engineers, and each team is responsible for several projects. The team responsible for the operation and maintenance of the facilities of this project has six engineers. The pumping stations and flood gates are operated and maintained by the National Capital Region-Pumping Stations and Floodgates Division (NCR-PSFGD) of DPWH. The pumping stations and flood gates are functioning for 24 hours by the operators working at three shifts (eight hours each), with about three persons in one shift.

Metro Manila Development Authority (MMDA) was created by Republic Act No. 7924 in 1994 and mandated to plan and implement flood control policies and strategies in Metro Manila. According to this Act, the facilities of this project should also be under MMDA. Therefore, on July 2002, DPWH and MMDA agreed on the transfer of the project facilities from DPWH and MMDA. However, DPWH continued to be the executing agency until the project completion based on the agreement of this project. According to DPWH and MMDA, the project facilities will be transferred from DPWH to MMDA in the second half of 2015 or in 2016, and the first discussion took place in February 2015. They are going to continue discussions on transfer including preparation of inventory of the facilities and equipment. In MMDA, the Flood Control and Sewerage Management Office (FCSMO) will be responsible for the operation and maintenance of the project facilities. The mandate of MMDA-FCSMO is to prevent flooding in Metro Manila and ensure all roads to be passable any time (source: DPWH's response to the questionnaire). MMDA-FCSMO manages 54 pumping stations in Metro Mania and has 13 staff, 139 pumping station operators and 215 workers. When the project facilities are

transferred from DPWH, all DPWH operators working there (about 30 persons) would also be transferred to MMDA. The pumping stations of MMDA are also functioning for 24 hours by the operators working at three shifts (eight hours each), with two or three persons in one shift (source: interview of MMDA).

From the above, no major problems were observed in the institutional aspects of DPWH in the operation and maintenance of the project facilities, as well as those of MMDA.

3.5.2 Technical Aspects of Operation and Maintenance

DPWH UPMO-FCMC has about 90 staff and it has operated flood control projects for long years even before the commencement of this project. There is no problem in the number and skill levels of the staff. UPMO-FCMC has conducted training for the operation and maintenance staff, including one-week instruction session by the project contractor during the project period on operation of facilities and troubleshooting training for four days after the completion of the project. DPWH uses operation and maintenance manuals of the pumping stations and flood gates (source: JICA documents, DPWH's response to the questionnaire).

There is no problem with the skill levels of MMDA's operation and maintenance staff as they operate its existing flood control facilities without particular troubles.

3.5.3 Financial Aspects of Operation and Maintenance

DPWH's budget is shown in Table 14. Its whole and flood control budgets both have increased.

Table 14. Budget of DPWH

(Unit: billion pesos)

	2011	2012	2013	2014	2015
Roads	68.0	78.1	100.9	129.4	170.4
Flood control	11.3	10.8	15.9	33.6	45.9
Others	11.3	10.6	27.6	27.9	57.7
Total	90.7	99.5	144.3	190.9	273.9

(Source: DPWH documents)

DPWH's budget for operation and maintenance of the project facilities is shown in Table 15. From 2011 to 2013, the annual budget was 40 million pesos (20 million pesos each for operation and maintenance), and the expenditures were almost within the budget. The budget of 2014 was increased to 70 million pesos (35 million pesos each for operation and maintenance), and the expenditure was within the budget. The budget of 2015 largely increased compared to those of the previous years. The budget of 2016 is

50 million pesos, which is about a half of the 2015 budget, expecting the transfer of the facilities to MMDA.

Table 15. DPWH budget and expenditure for operation and maintenance of the project facilities

(Unit: million pesos)

	2011	2012	2013	2014	2015	2016
Budget	40.0	40.0	40.0	70.0	100.0	50.0
Expenditure	54.6	72.0	40.0	70.0	-	-
(Operation)	18.0	19.3	18.0	22.0	-	-
(Maintenance)	36.6	52.7	22.0	48.0	-	-

(Source: JICA documents, interviews of DPWH)

MMDA is planning to allocate 100 million pesos for operation and maintenance of the facilities of this project in 2016 after they are transferred from DPWH. This budget is likely to be sufficient in view of the actual expenditures in the past years and the 2015 budget of DPWH. MMDA's annual budget for operation and maintenance of its existing pumping stations is about 250-300 million pesos, which does not include cost for expanding capacities of the pumping stations or the operation and maintenance budget of the facilities of this project.

From the above, no particular problem is observed about the financial aspects of operation and maintenance.

3.5.4 Current Status of Operation and Maintenance

DPWH

The facilities of this project are functioning without major problems. Some spare parts are available only in Japan, but DPWH has experienced no problem to purchase them.

According to their interviews and response to the questionnaire, the following items were broken and repaired:

- Navigation gate: the link rods were found broken in February 2011, and replaced by the temporary spare parts in March 2012 while waiting for the authentic parts. They were finally replaced by the authentic link rods in July 2013 at about 32 million pesos[15]. The navigation gate was not functioning as of January 2015 for the maintenance dredging work. The dredging was to be complete and the navigation gate was to resume operation by the rainy season when the gate needs to open and close frequently.
- Catmon pumping station: the generator was broken due to continuous use. Four

[15] Commission on Audit Report, Pilot Audit 1: KAMANAVA Flood Control Project (2013)

backup generators were installed in 2014 at about 30 million pesos.

MMDA

Three among four pumping stations in West Manggahan (Taguig City, Metro Manila) constructed by a JICA loan project and transferred from DPWH to MMDA were visited during this ex-post evaluation. All three pumping stations are functioning without major problem. MMDA plans to enhance the capacity of all three, and allocated budget of about 420 million pesos to install new pumps and generators.

MMDA's pumping station
West Manggahan

Pumps in a MMDA's pumping station,
West Manggahan

MMDA's flood gate, West Manggahan

MMDA's waste processing machine,
West Manggahan

LGU

Malabon City is active in flood control as it is considered prerequisite for the development of the city. It has about 60 pumping stations including those constructed by this project. The city constructed 29 among these 60 pumping stations. Its annual operation and maintenance budget of the flood control facilities is about 20 million

pesos. The city receives about 400 million pesos per year from the central government for flood control, including funding from development partners. The city is implementing flood control projects formulated by the World Bank's masterplan project and is to rehabilitate its existing pumping stations. The flood control facilities in Navotas City, including those constructed by this project, are also functioning without major problems. According to the interview with Navotas City, it is planning to construct 42 additional small pumping stations by its own funding.

Regarding waste management, both cities have installed garbage traps in the rivers and major channels. As garbage from upstream still comes in, the cities requested upstream LGUs to reduce waste disposal into the rivers. Also, based on the resolution of the Supreme Court dated February 15, 2011 for the improvement of environment in and around Manila Bay[16], MMDA continues relocation of informal settlers along the rivers and channels in cooperation with LGUs in the area. Malabon and Navotas have installed garbage collection points in the cities and implemented the antilittering ordinance (source: JICA documents). Malabon City collects garbage three times a week, and raises awareness in the community through the waste management campaigns at schools and clean barangay contests. Malabon City's annual budget for waste management is about 95 million pesos. According to the interview with Navotas City, it cleans the rivers and channels once or twice per month. It has a 10-year Solid Waste Management Plan (2007-), and its budget for the year 2014 was 19.2 million pesos.

From the above, no major problems were observed about the current situations of the facilities constructed by this project as well as the facilities operated by MMDA to which the project facilities will be transferred. Malabon and Navotas Cities continue flood control and waste management activities by their own funding, and there is no problem about the sustainability of these activities.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

4. Conclusions, Recommendations and Lessons Learned

4.1 Conclusions

The objective of this project was to improve flood control and drainage systems in

16 http://www.law.pace.edu/sites/default/files/IJIEA/PhilippineSupremeCourt_2-15-2011_per_recommendation_of_Manila_Bay_Advisory_Committee.pdf

KAMANAVA area, Metro Manila by constructing or rehabilitating flood control facilities including a polder dike, river walls, pumping stations, flood gates, control gates, a navigation gate and drainage channels and by procuring hydrological and meteorological observation instruments, thereby contributing to the reduction of floods and improvement of living conditions and environmental health as well as economic development in the area.

This project has been highly relevant with the Philippines' development plan and development needs, as well as with Japan's ODA policies. Therefore its relevance is high. While the project outputs were produced as planned, both the project cost and project period significantly exceeded the plan. Therefore, efficiency of the project is low. This project has reduced floods to a certain extent and produced impacts such as the improvement of living conditions in the project target area, development of regional economy, improvement of waste management and enhanced awareness of residents about flood control. In total, effectiveness and impact of the project are high as it has largely achieved its objectives. No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system of DPWH, which is currently responsible for the operation and maintenance of the project facilities, and those of MMDA, the organization to which the project facilities will be transferred in the second half of 2015 or in 2016. Therefore, the sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agencies

None.

4.2.2 Recommendations to JICA

None.

4.3 Lessons learned

Flood control facilities could reduce floods, but they are not able to alleviate floods completely. However, the residents tend to expect the facilities to make the area flood-free. When the project target area was flooded in the recent major weather events, some people were skeptical about the effects of the project facilities as they had expected more. The SAPS study showed the flood control effects to the residents and they were convinced. In the design phase of flood control projects, it would be necessary to explain to the target populations about the expected degree of reduction of floods and the assumptions at the facility design (such as scale of rainfalls) and the fact that the flood

could be effectively controlled in coordination with other flood control activities by the relevant stakeholders such as LGUs.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs		As planned with slight modification from the original plan as a result of the detailed design.
Civil engineering	・Polder Dike: 8.0km ・River Walls Raisings: 12.4km ・Navigation lock: 1 ・Pumping stations without flood gates incorporated with navigation lock: 1 ・Independent flood gates: 6 ・Control gates: 2 ・Pumping stations with ancillary flood gates: 6 ・Rehabilitation of existing drainage channels: 6.4km ・Construction of drainage channels: 1.8km	・Polder Dike: 8.6km ・River Walls Raisings: 10.5km ・Navigation gate 1: (replaced Navigation lock) ・Pumping stations without flood gates incorporated with navigation gate: 1 ・Independent flood gates: 6 ・Pumping stations with ancillary flood gates: 4 (two were cancelled together with the cancellation of control gates) ・Rehabilitation of existing drainage channels: 5.6km ・Construction of drainage channels: 2.1km
Procurement of equipment	・Hydrological and meteorological observation instruments ・Dust removal equipment for pumping stations	As planned.
Consulting services	・Basic study of topography and soils and review of basic design of flood control facilities ・Detailed design of flood control facilities ・Assistance for bidding ・Environmental management including monitoring of observation of Environmental Compliance Certificate and supervision of contractors ・Assistance for development of report on resettlement and land acquisition and for livelihood of resettled persons	As planned.
External monitoring of resettlement and land acquisition	・Monitoring of resettlement and land acquisition processes by the executing agency ・Monitoring of social and economic conditions of the resettled persons and of related activities by the relevant governmental agencies ・Advice for the relevant governmental agencies	As planned.
2. Project Period	April 2000 – December 2006 (81 months)	April 2000 – January 2012 (142 months)
3. Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 7,163 million yen 4,623 million yen (1,541 million Philippine pesos) 11,786 million yen 8,929 million yen 1 Philippine pesos=3 yen (As of August 1999)	 5,795million yen 12,063 million yen (5,585 million Philippine pesos) 17,858 million yen 8,786 million yen 1 Philippine pesos=2.16yen (Average between April 2000 and January 2012)