DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
THE REPUBLIC OF THE PHILIPPINES

Japan International Cooperation Agency

PROVINCIAL GOVERNMENT OF CAVITE

THE STUDY
ON
COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA
IN
THE REPUBLIC OF THE PHILIPPINES

DRAFT FINAL REPORT

Volume 2: Feasibility Study

January 2009

CTI ENGINEERING INTERNATIONAL CO., LTD.
in association with
NIPPON KOEI CO., LTD

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PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a development study on Comprehensive Flood Mitigation for Cavite Lowland Area and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a study team headed by Mr. Makihiko Otogawa of CTI Engineering International Co., Ltd. in association with Nippon Koei Co., Ltd, between March 2007 and January 2009. In addition, JICA set up an Advisory Committee which examined the Study from specialist and technical point of view.

The Study Team held discussions with the officials concerned of the Government of the Philippines, and conducted field surveys at the study area. Upon returning to Japan, the Study Team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the project and promotion in the Philippines, and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the Study Team.

February, 2009
Ariyuki MATSUMOTO
Vice-President
Japan International Cooperation Agency

The Study on Comprehensive Flood Mitigation for Cavite Lowland Area in the Republic of the Philippines

February 2009

MR. ARIYUKI MATSUMOTO
Vice-President
Japan International Cooperation Agency
Tokyo, Japan

Ref.: **The Study on Comprehensive Flood Mitigation for Cavite Lowland Area in the Republic of the Philippines**

Subj.: **Final Report - Letter of Transmittal**

Dear Sir:

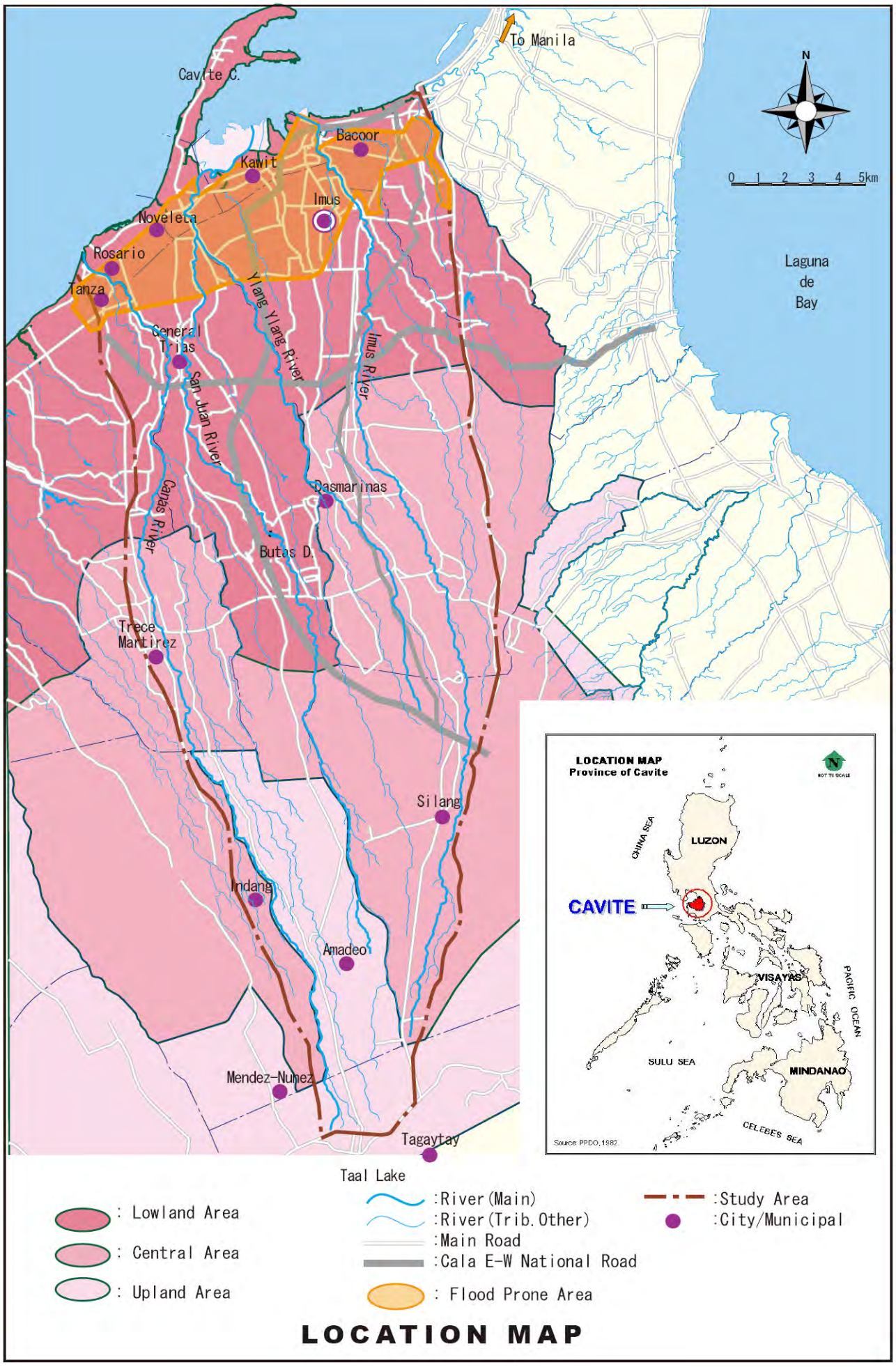
We are pleased to submit herewith the Final Report on "The Study on Comprehensive Flood Mitigation for Cavite Lowland Area" for your kind consideration. This report compiles the results of the Study in accordance with the contract between CTI Engineering International Co., Ltd. in association with Nippon Koei Co., Ltd. and the Japan International Cooperation Agency (JICA) during the period of March 2007 to February 2009.

During the Study, the Study Team formulated the master plan and conducted the feasibility study on comprehensive flood mitigation composed of applicable structural and non-structural measures for the Cavite Lowland Area based on the analysis of existing/future conditions and problems in the area. The report consists of Volume I: Master Plan Study, Volume II: Feasibility Study, Volume III: Adaptation to Climate Changes, and Volume IV: Appendix. The summaries of the master plan and feasibility studies are included in Volume I and Volume II respectively.

On this occasion the Study Team would like to express its sincere appreciation to JICA, the Ministry fo Foreign Affairs, and also to the officials concerned of the Government of the Republic of the Philippines, the Provincial Government of Cavite, and the Local Government Units (LGUs) concerned for the cooperation extended to the Team during the Study. We sincerely hope that the results of the Study will contribute to the solution and/or mitigation of flooding problems in the Cavite Lowland Area and that the amicable relationship between both our countries will further continue in the future.

Very truly yours,

MAKIHIKO OTOGAWA
Team Leader
The Study on Comprehensive Flood
Mitigation for Cavite Lowland Area



LOCATION MAP

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ABBREVIATIONS AND ACRONYMS

A&B	Alienable and Disposable
AAB	Authorized Agent Bank
AAGR	Average Annual Growth Rate
ADB	Asian Development Bank
AFMA	Agricultural and Fisheries Modernization Act
AKPF	Abot-Kamay Pabahay Fund
AO	Administrative Order
B/C	Benefit / Cost Ratio
BIR	Bureau of Internal Revenue
BDCC	Barangay Disaster Coordinating Council
BOD	Biological Oxygen Demand
BOT	Build – Operate – Transfer
BRS	Bureau Research and Standards
BSWM	Bureau of Soils and Water Management
BP	Batas Pambansa
C/T	Census Survey and Tagging
CALA EW	CALA East – West Highway (Project)
CALA	Cavite – Laguna
CALABARZON	Cavite. Laguna, Batangas, Rizal and Quezon
CARP	Comprehensive Agrarian Reform Program
CDCC	City Disaster Coordinating Council
CENRO	City Environmental and Natural Resources Office
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
CLUP	Comprehensive Land Use Plan
CMP	Community Mortgage Program
CO	Carbon Monoxide
DA	Department of Agriculture
DAO	Department Administrative Order
DAR	Department of Agrarian Reform
DBB	Dasmariñas Bagong Bayan
DBP	Development Bank of the Philippines
DECS	Department of Education, Culture and Sports
DENR	Department of Environment and Natural Resources
DENR-EMB	DENR – Environmental and Management Board
DENR-LMB	DENR – Land Management Bureau

DILG	Department of Interior and Local Government
DND	Department of National Defense
DO	Dissolved Oxygen
DOF	Department of Finance
DOH	Department of Health
DOJ	Department of Justice
DOST	Department of Science and Technology
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highways
DPWH – MTIDP	DPWH Medium – Term Infrastructure Development Program
DTI	Department of Trade and Industry
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EMMP	Environmental Management and Monitoring Plan
EO	Executive Order
EOHO-DOH	Environmental and Occupational Health Office
ESC	Environmental and Social Consideration
ESSO	Environmental and Social Service Office (in DPWH)
FCIE	First Cavite Industrial Estate
FMB	Forest Management Bureau
FMC	Flood Mitigation Committee
F/S	Feasibility Study
GDP	Gross Domestic Product
GEA	General Emilio Aguinaldo
GINI	Gini Coefficient
GIS	Geographic Information Systems
GMA	General Mariano Alvarez
GOCC	Government Owned and Controlled Corporation
GOP	Government of the Philippines
GSIS	Government Service Insurance System
ha(s)	Hectare (s)
HDMF	Home Development Mutual Fund
HGC	Home Guarantee Corporation
HLURB	Housing and Land Use Regulatory Board

Hr/hr	Hour
HUDCC	Housing and Urban Coordinating Council
I/A(I/P)	Implementing Arrangement (Implementing Program)
ICET	International Center for Environmental Technological Transfer, Japan
IEC	Information Education Campaign
IEE	Initial Environmental Examination
ILO	International Labor Organization
IRA	Internal Revenue Allotment
IRTAF	Inter-agency Resettlement Task Force
IUCN	International Union for the Conservation of Nature and Natural Resources
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KIIs	Key Informant Interview
Km	Kilometer
LAPRAP	Land Acquisition Policy and Resettlement Action Plan
LARC	Land Acquisition Resettlement Cost
LARR	Land Acquisition Resettlement and Rehabilitation
LBP	Land Bank of the Philippines
LGUs	Local Government Units
LRT	Light Rail Transit
LTFRB	Land Transportation Franchising and Regulatory Board
MCM	Million Cubic Meter
MDCC	Municipal Disaster Coordinating Council
MDG15	Mellenium Development Goal 2015
MFC	Municipal Financial Corporation
MGB	Mines and Geosciences Bureau
MFCP	Major Flood Control Project
MM	Metro Manila
MMDA	Metro Manila Development Bank
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPDC / MPDO	Municipal Planning and Development Coordinator / Municipal Planning and Development Office
MPN	Most Probable Number
MRF	Material Recovery Facility
MTPDP	Medium Term Philippine Development Plan
MTPIP of DPWH	Medium Term Public Investment
MWSS	Metropolitan Waterworks and Sewerage System

m^2	Square Meter
m^3	Cubic Meter
NAMRIA	National Mapping and Resources Information and Authority
NAPC	National Anti-Poverty Commission
NAPOCOR	National Power Corporation
NCR	National Capital Region
NDCC	National Disaster Coordinating Council
NEDA	National Economic Development Authority
NEDA – ICC	National Economic Development Authority – Investment and Coordination Committee
NFPP	National Framework for Physical Planning
NG	National Government
NGOs	Non – Government Organizations
NHA	National Housing Authority
NHMFC	National Home Mortgage Finance Corporation
NHRC-UPERDFI	National Hydraulic Research Center
NIA	National Irrigation Authority
NIPAS	National Integrated Protected Areas System
NOx	Nitrogen Oxide
NPCC	National Pollution Control Commission
NPV	Net Present Value
NSCB	National Statistical Coordination Board
NSO	National Statistic Office
NWRB - DENR	National Water Resources Board
O&M	Operation and Maintenance
OCD	Office of Civil Defense
ODA	Office Development Assistance
PAF / PAPs	Project Affected Families / People(s)
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PAG – IBIG	Pagtutulungan sa Kinabukasan: Ikaw, Bangko, Industriya at Gobyerno
PAWB	Protected Area and Wildlife Bureau
PCFC	People’s Credit and Finance Corporation
PCM	Public Consultation Meeting
PCUP	Presidential Commission for the Urban Poor
PD	Presidential Decree
PDCC	Provincial Disaster Coordinating Council
PDTF	People’s Development Trust Fund

PEA	Public Estate Authority
PEQR	Philippine Environmental and Quality Report
PEZA	Philippine Economic Zone Authority
PHDMO	Provincial Housing Development and Management Office
PHILSSA	Partnership of Philippine Support Service Agencies Inc
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PIF	Philippine Infrastructure Fund
PMO – FS	Project Management Office – Feasibility Studies
PNCC	Philippine National Construction Corporation
PNP	Philippine National Police
PO	People's Organization
PPDO	Provincial Planning and Development Office
PPFP	Provincial Physical Framework Plan
PPP	Public-Private Partnerships
PRA	Participatory Rapid Appraisal
PSP	Private Sector Participation
PTFAPSSS	Provincial Task Force Against Professional Squatters and Squatting Syndicates
R1	Radial Road (Number)
RA	Republic Act
RAP	Resettlement Action Plan
RBCO	River Basin Control Office
RDCC	Regional Disaster Coordinating Council
RIC	RAP Implementation Committees
RIS	Resident Interview Survey
RDC	Regional Development Council
ROW	Right of Way
RTAF	Resettlement Task Force
SAFP's	Strategic Agricultural & Fisheries Planning Zones
SCC	Sagip Ilog Cavite Council Inc.
SES	Socio – Economic Survey
SHF	Special Housing Fund
SHFC	Social Housing Finance Corporation
SIRP	Save Imus River Rehabilitation Project
SOx	Sulfur (Di) oxide Concentration
SRA	Social Reform Agenda
SSS	Social Security System
STM	Stakeholder Meeting

TESDA	Technical Education and Skills Development Authority
TMC	Trece Martirez City
TOR	Terms of Reference
TSP	Total Suspended Particulates
TWG	Technical Working Group
UDHA	Urban Development and Housing Act
µg	Microgram
UNESCO	United Nation Educational, Scientific and Cultural Organization
UPAO	Urban Poor Affairs Office
UPERDFI	UP Engineering Research and Development Foundation, Inc.
W/R	The ratio of employment at workplace / at residence
WB	World Bank

SUMMARY OF THE FEASIBILITY STUDY

1. Objectives of the Feasibility Study

The Feasibility Study has been conducted on the priority components of the Project selected in the Master Plan, which include those of the structural measures and the non-structural measures. The objective of the study on structural components was to clarify the technical and economic viability of the four (4) flood retarding basins proposed in the Master Plan for the Imus River Basin, while that on the non-structural components aims at the following:

(1) To conduct the Pilot Project for Information and Educational Campaign (IEC) on the cleanup of waterways in several municipalities;

(2) To develop the prototype of database of the river area as basis for management of the river areas;

(3) To support the legal arrangement on the enforcement of ordinances concerning zoning of the urban area, and the construction of the on-site flood regulation pond; and

(4) To conduct a pilot project to develop a prototype flood hazard map and transfer knowledge on flood warning and evacuation to the relevant stakeholders.

The aforesaid pilot project on information and educational campaign (IEC) on the cleanup of waterways and the development of a flood hazard map focused on the municipalities located in the lowland area in Cavite Province such as Bacoor, Kawit, Noveleta, Rosario and Tanza.

2. Feasibility Study on Priority Component of Structural Measures

2.1 Location of Sites for Priority Project

The four sites of off-site flood retarding basin for the Imus River Basin have been selected in the Master Plan as the priority components of the flood mitigation plan; namely, the retarding basins with code numbers “RB-I1” on the Imus River, “RB-B4 “on the Bacoor River, and “RB-J1” and “RB-J2” on the Julian River. Both the Bacoor and Julian rivers are tributaries of the Imus River. The locations of these sites were reviewed in this Feasibility Study Stage, and the following modifications were made: RB-I1 was shifted to the downstream from the site originally proposed, and RB-J2 was eliminated due to the updated status of land tenure of the proposed sites, in particular.

Table 1 Modification of Location and Extent of Off-Site Flood Retarding Basin

Code of Retarding Basin	River	Design Scale	Possible Maximum Extent (ha)*	Location
RB-I1	Imus River	10-year return period	58.0	The site is shifted to about 3.3km downstream from the original location proposed in the Master Plan.
RB-B4	Bacoor River	2-year return period	13.5	The site is placed at the location proposed in the Master Plan.
RB-J1	Julian River	5-year return period	38.0	The site is placed at the location proposed in the Master Plan, but expanded in order to compensate for the elimination RB-J2 as mentioned below. Moreover, the site is divided into RB-J1R for flood mitigation of Julian River and RB-J1L for the secondary tributary of Julian River.
RB-J2	Julian River	-	-	The site is not considered due to difficulty in acquiring the necessary land.

*: Estimated on the updated status of land tenure of the site.

2.2 Hydraulic Estimation of Required Storage Volume of the Flood Retarding Basin

Hydraulic analysis based on the flood runoff and river flood routine simulation by "MIKE 11"was made to estimate the required storage volume of the three objective flood retarding basins mentioned in the preceding Section 2.1; namely, RB-I1, RB-B4 and RB-J1.

In this simulation model, the flood mitigation effect of the flood retarding basin was estimated in such manner that the overflow dike is set as the inlet point of the flood retarding basin and a certain volume of the river flow discharge is flowed over the overflow dike into the flood retarding basin, resulting in the reduction of river discharge at the downstream sections of the flood retarding basin.

The design scales of the flood mitigation plan have been set in the Master Plan at 10-year return period for the Imus River, 2-year return period for the Bacoor River, and 5-year return period for the Julian River. At the same time, on the premise of these design scales, the river design discharges at the downstream sections from the flood retarding basins were determined as the optimum values, taking the eligible scale of river improvement and the effect of the flood retarding basins into account, as shown below:

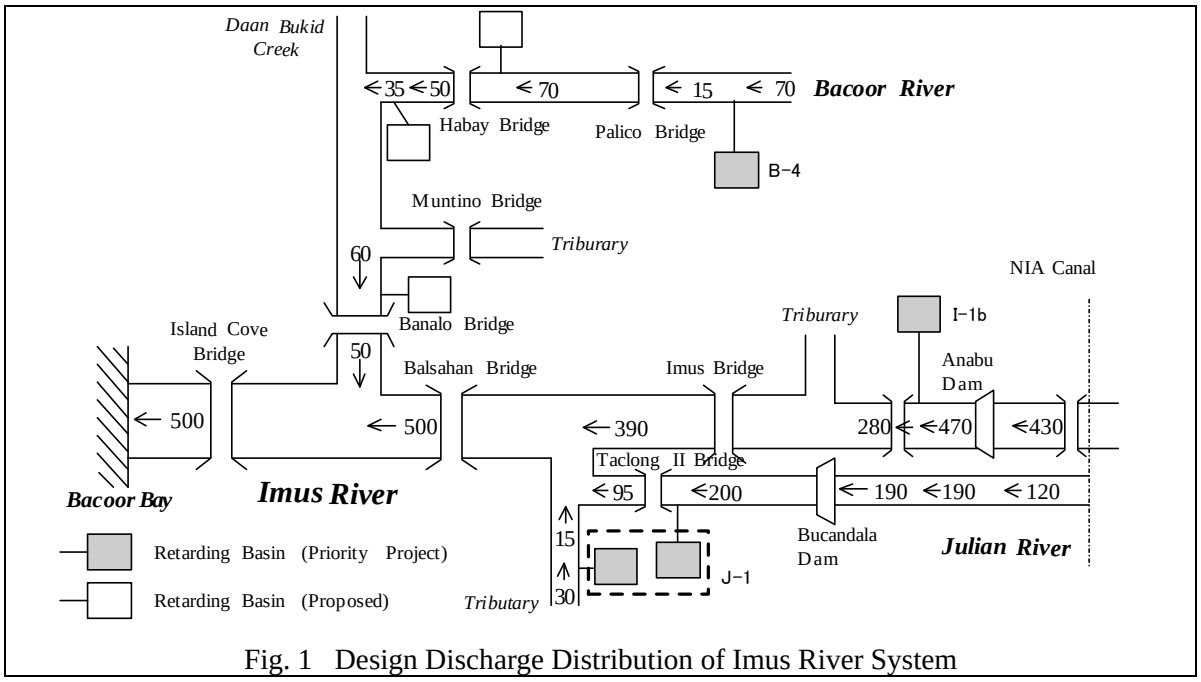


Fig. 1 Design Discharge Distribution of Imus River System

The storage volume of the flood retarding basin is required to ensure the above design discharges for the downstream stretches against the design flood. However, such storage volume is variable according to the crown level and the length of the overflow dike. That is, as the crown level of the overflow dike is made higher and the length of the dike longer, a lesser volume of the river discharge enters the flood retarding basin and, therefore, the storage volume which could contain the design discharge at the downstream stretches is reduced.

The construction costs of the flood retarding basins also become variable depending on the combination of dimensions of the overflow dike and the storage volume. As the crown elevation of the overflow dike is made higher, the cost of excavation for the flood retarding basin would decrease due to the smaller storage volume required. In this case, however, the cost of the overflow dike increases due to the longer dike length required.

In due consideration of the above, various combinations of dimension of the overflow dike and the corresponding storage volume of the flood retarding basins were provisionally estimated. As a result, the combination which takes the least cost has been finally selected as the optimum, as listed in the following table.

Table 2 Optimum Dimension of Overflow Dike Storage Volume for Priority Flood Retarding Basin

Code of Retarding Basin	Design Scale (Return Period)	Elevation of Overflow Dike	Width of Overflow Dike	Required Storage Volume	Ratio of Storage Volume Used against Variable Probable Flood (%)*		
					2-yr RP	5-yr RP	10-yr RP
RB-I1	10-yr. R.P.	EL.11.25m	45 m	1.48 MCM	32	81	100
RB-B4	2-yr. R.P	EL.8.35 m	25 m	0.45 MCM	100	100	100
RB-J1L	5-yr. R.P	EL.5.78 m	30 m	0.11 MCM	64	100	100
RB-J1R	5-yr. R.P	EL.6.60 m	50 m	0.44 MCM	59	100	100

Note *: Ratio = Storage Volume Used / Required Storage Volume

The optimum storage volumes for RB-I1, RB-J1L and RBJ1R are not in equivalent to the minimum volume among those required to ensure the design discharge. This could bring the following complementary advantages besides the least cost for construction:

(1) The crown elevation of the overflow dike for the optimum storage volume is set to be lower than that for the minimum storage volume. This means that the optimum storage volume could store and mitigate the river flow discharge for smaller floods below the design scales. Construction of the flood retarding basins selected as the priority project is implemented in advance of the river channel improvement. Accordingly, the said effect for smaller floods is preferable.

(2) The larger storage volume could make possible the zoning of the impounding area of the flood retarding basin. This zoning enables a certain extent of the impounding area to be less frequently inundated and the zoned area could be used as amenity space, farmland, and other multiple uses of land (refer to Fig. 2).

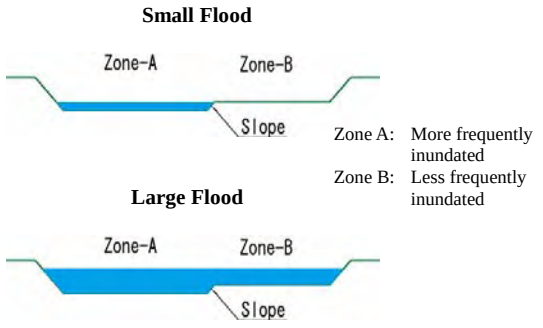


Fig. 2 Zoning of Impounding Area of Retarding Basin

2.3 Preliminary Design of Off-Site Flood Retarding Basin

2.3.1 Geological Condition at the Site of Retarding Basin

The whole Study Area is covered with Quaternary volcanic products of Taal Volcano; namely, Taal Tuff and sedimentary rocks of the Guadalupe Formation. Due to the volcanic products, the top of the soft rock stratum lies about 4.5~6m below the ground surface of the sites. Bulldozer with ripper (or equivalent attachment) is required to excavate the soft rock before the construction of the impounding area of the retarding basin.

2.3.2 Basic Topographic and Hydraulic Conditions in and around the Retarding Basin

The present flow condition in the river channels around the retarding basins is unsteady because of meanders and variable channel width/depth. Soft rocks in the riverbed of Imus and Julian rivers, in particular, are exposed, which could be the possible cause of riverbed degradation. This river channel condition may affect the overflow condition on the overflow dike. Further, the retarding basin may not be able to mitigate floods as originally designed. Hence, trimming of the river channel around the overflow dike together with the construction of groundsill is proposed.

I1 Retarding Basin (Imus River)

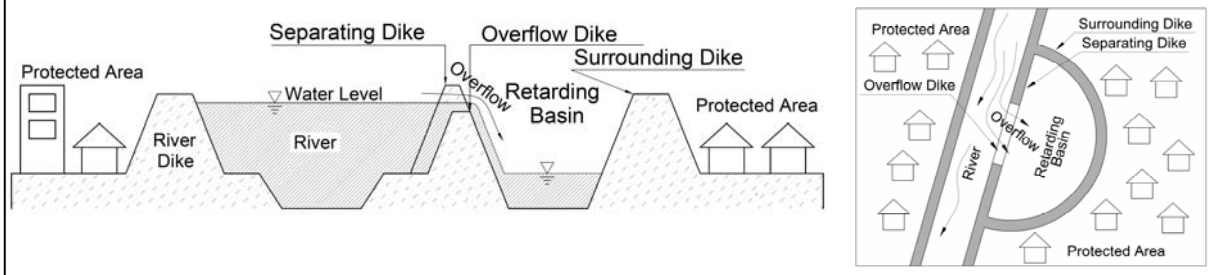
B4 Retarding Basin (Bacoor River)

J1 Retarding Basin (Julian River)

Fig. 3 View of River Channels around the Proposed Sites of Flood Retarding Basin

2.3.3 Design of Principal Structures Attached to the Flood Retarding Basin

The Off-Site Flood Retarding Basin (herein after referred to as the "Retarding Basin") consists of the Surrounding Dike, the Separating Dike, and the Overflow Dike. Each retarding basin is further provided with a Stilling Basin, an Outlet Sluice, and a Sedimentation Basin.



Structures	Target Functions
Surrounding Dike	To protect the residential area against spill-over of impounded water and, at the same time, used as operation and maintenance road as well as access to the recreational area in the retarding basin.
Separating Dike	To safely store excess floodwater in the retarding basin.
Overflow Dike (Fixed Weir)	To let floodwater flow over the dike crown and into the retarding basin.
Stilling basin	To be placed at the foot of the overflow dike in order to prevent the retarding basin from scoring by the inflow discharge.
Drainage sluice	To be placed at the downstream end of each retarding basin in order to drain the water stored in the flood retarding basin
Small Conduits	To be paced along both sides of the surrounding dike in order to prevent the polluted sewer water flowing into the retarding basin.

Fig. 4 Principal Structures of the Flood Retarding Basin

The design standards for the structural components were decided by referring to the design criteria/guidelines of the DPWH as well as the actual site conditions, as described below:

(1) Surrounding Dike

- Crown Level is set taking the possible highest flood water level (P.W.L.) and the freeboard into consideration. The P.W.L. is assumed as the highest existing ground level along the surrounding dike. Freeboard is further assumed at 0.8m for the river design discharge of more than 200m^3/s and 0.60m for less than 200m^3/s.
- Width of the dike crown is set at 6.0m.
- Side slope of the dike is sodded with grass and its gradient is set as V:H=1:3.0.

(2) Separating Dike

- Elevation and width of the dike crown are set in the same manner used in the surrounding dike.
- Side slope of the dike is sodded and its gradient is set as V:H=1:3.0. However, a certain part of riverside slope, where scouring and erosion could occur, is protected by revetment with wet stone masonry type or grouted riprap type. Gradient of V:H=1:2.0 is

adopted to the riverside slope when the existing riverside slope is steeper than V:H=1:2.0 and judged to be stable.

(3) Overflow Dike

- Crown elevation and length of overflow dike are set through the hydraulic simulation, as shown in the foregoing Table 2.
- The structure of the overflow dike is designed as the "Special Gabion-Facing Type" (refer to Section 2.3.1 and Table 2.2 in Chapter 2 for details).

(4) Stilling Basin

- Stilling Basin is provided with bed protection structures made of concrete blocks or gabion and end-sill structures.
- Actual length of basin and height of end-sill for each retarding basin is designed based on the hydraulic model test in the detailed design stage.

(5) Drainage Sluice

- This drainage sluice is designed to drain water impounded in the retarding basin within approximately 12~24 hours after flooding has subsided.
- The drainage sluice in each retarding basin is provided with flap gate, so that operation activities before and after flooding events are not necessary.
- Slope of the separating dike and riverbank around the outlet of drainage sluice is protected by revetment structures of up to 10m long on the upstream and downstream sides of the sluice (20m in total length) since turbulence of flow would occur around the outlet of sluice.

On the premise of the above design standards, the dimensions of the structures were determined, as listed below:

Table 3 Dimensions of the Principal Structures of the Retarding Basin

Structure	Description	Unit	Imus (RB-I1)	Bacoor (RB-B4)	Julian (RB-J1L)	Julian (RB-J1R)
Surrounding/ Separating Dike	Length	m	2,300	1,900	2,800	
	Crown Elevation	m	18.0	10.4	10.0	10.0
	Crown Width	m	6.0	6.0	6.0	6.0
	Slope Gradient (not along River Channel)	V:H	1: 3.0	1: 3.0	1: 3.0	1: 3.0
	Slope Gradient (along River Channel)	V:H	1:2.0	1: 0.5*	1:2.0	1:2.0
Overflow Dike	Location (Center of Dike)	Sta. No.	9+450	8+150	3+400	2+900
	Length (m)	m	28	25	30	50
	Crown Elevation	EL. m	11.25	8.35	5.78	6.60

* Subject to revetment works

2.3.4 Trim of River Channel

Trimming works of the river cross-sections, together with the revetment works and construction of groundsill, is proposed, as listed below.

Table 4 Trimming Works of River Channel

Item	Imus River	Bacoor River	Julian River
Length of trim of river cross-section	100m downstream from O.D.; 50m upstream from O.D.	100m downstream from O.D.; 70m upstream from O.D.	50m downstream from O.D.; 20m upstream from O.D.
Location of Groundsill	100m downstream from O.D.	100m downstream from O.D.	50m downstream from O.D.
Revetment Works at opposite sides of river banks	Slope Gradient: V:H=1:2.0 with berm	Slope Gradient: V:H=1:0.5 with revetment	Slope Gradient: V:H=1:0.5 with revetment

Note: O.D.: Overflow Dike

2.3.5 Dimensions of Impounding Area of Retarding Basin and the Required ROW

The impounding area of the retarding basin is designed for multiple uses as described above. In order to attain such multiple uses, the impounding area is divided into the following zones through the design of different bottom elevations for each of the zones:

(1) Zone A: Bottom ground level of this Zone is set 1m above the designed riverbed elevation adjacent to the drainage sluice. The storage volume of this Zone is designed to accommodate the flood inflow volume of 2-year return period.

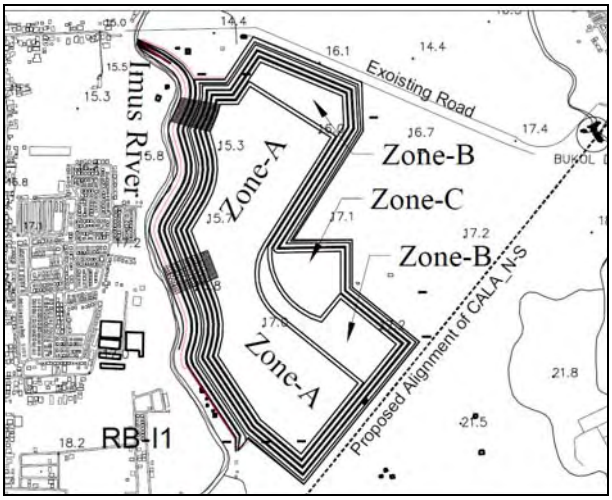
(2) Zone B: Bottom ground level of Zone B is set to correspond to the water level of 2-year return period in the impounding area of the retarding basin. The total storage volume for Zone A and Zone B is designed to accommodate the flood inflow volume of 5-year return period. Zone B is for the retarding basin with the design scale of 5-year return period or larger.

(3) Zone C: Bottom ground level of Zone C is set to correspond to the water level of 5-year return period in the impounding area of the retarding basin. The total storage volume for Zone A, Zone B and Zone C is designed to accommodate the flood inflow volume of 10-year return period. Zone C is for the retarding basin with the design scale of 10-year return period or larger.

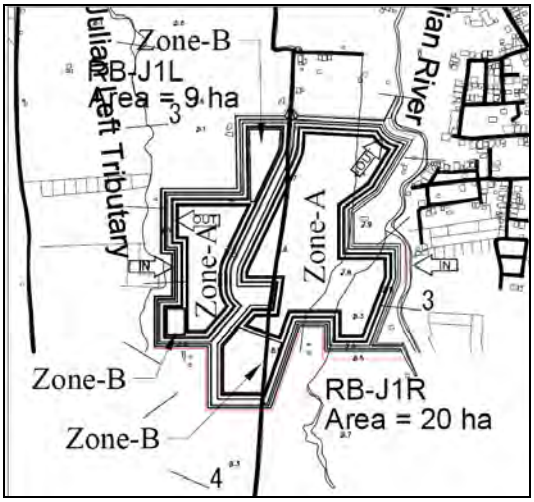
Based on the above concept, the impounding area of the flood retarding basin and the required ROW were estimated, as listed below.

Table 5 Dimensions of Impounding Area of Retarding Basin and ROW Requirements

Retarding Basin	Zone	Bottom of Zone		Accumulated Impounding Area and Volume			ROW (ha)
		Elevation (EL. m)	Area (ha)	Elevation (EL. m)	Area (ha)	Volume (MCM)	
Imus (RB-I1)	Zone A	6.00	15.5	9.00	17.6	0.5	40.0
	Zone B	9.00	5.1	12.00	25.1	1.2	
	Zone C	12.00	2.7	12.91	28.5	1.5	
Bacoor (RB-B4)	Zone A	2.50	4.8	9.36	8.5	0.46	12.2
Julian (RB-J1L)	Zone A	3.50	2.8	5.50	3.6	0.07	29.0
	Zone B	5.50	1.1	6.27	5.0	0.11	
Julian (RB-J1R)	Zone A	3.50	8.8	6.20	10.9	0.27	
	Zone B	6.20	1.6	7.48	14.0	0.44	



Imus Retarding Basin (RB-I1)



Julian Retarding Basin (RB-J1L and J1R)

Fig. 5 Zoning Plan of Imus and Julian Flood Retarding Basin

2.3.6 Plan for Multiple Uses of the Impounding Area of Retarding Basin

Zone C in particular would be submerged underwater only once in five years. Hence, the multipurpose use of land in the flood retarding basin is possible, and the idea on the multiple use of land is as provisionally proposed below (refer to Fig. 5).

Table 6 Provisionally Proposed Multiple Uses of Land in Impounding Area of Retarding Basin

Zone	Provisionally Proposed Multiple Uses of Impounding Area of the Retarding Basin
Zone A	Eco-Park and Community Pond; Community Farmland (during Dry Season)
Zone B	Basketball Court(s), Other Sports Facilities such as track and field
Zone C	Public Parking Lots, Area for Sunday Market and Barangay and Municipal Public Spaces

2.4 Project Cost Estimation

The initial cost of the project priority component has been estimated based on the updated price levels as of September 2008, with the currency exchange rates set at JPY105.90 and/or PHP46.98 in equivalent to USD1.00.

The project cost is composed of the construction base cost, the compensation cost, the administration/ consultancy service cost, the price/physical contingencies, and the duties/tax. Of these items, the compensation cost, the administration/consultancy service cost, and the price/physical contingencies were assumed, as stated below:

(1) Compensation cost includes the costs for house evacuation and land acquisition, and its unit value is assumed taking the latest valuation of the Provincial Government and the actual market prices into account.

(2) Administration cost is assumed at 1.0% of the sum of the construction cost and the compensation cost taking into consideration the minimum requirement for administration and practical budget disbursement conditions, while the engineering service cost is 6% for the detailed engineering design and 10% for the construction supervision services of the construction base cost.

(3) Physical contingency is assumed at 5% of the sum of construction base cost, compensation cost and engineering service cost, while price contingency is 6% for the local currency portion and 2% for the foreign currency portion.

(4) Twelve percent (12%) of the sum of construction base cost and engineering service cost is added to the project cost for Duties/Value-Added Tax.

Based on the above assumptions, the project cost has been estimated at 2,130 million pesos in total, as summarized below:

Table 7 Initial Project Cost for Priority Project Component

Item	Cost (in Million Peso)	Share
(1) Construction Base Cost	832	39.2%
(2) Compensation Cost	644	30.4%
(3) Engineering Service Cost	133	6.3%
(4) Physical Contingency	80	3.8%
(5) Price Contingency	278	13.1%
(6) Administration	15	0.7%
(7) Duty/Value Added Tax *1	138	6.5%
Grand Total	**2,120**	**100.0%**

Note : *1 : 12% of Items (1) & (3) and a part of (5) related to (1) & (3)

In addition to the above initial project cost, operation and maintenance costs are required including those for the patrol/inspection works, maintenance works and operation works. The annual operation and maintenance cost is estimated at 4.73 million pesos.

2.5 Construction Plan

The work items and quantities of the project are shown in Table 8. Of the work items, particular attention is given to the excavation works and the disposal of excavated materials. The total volume of excavated materials is estimated at about 3,700,000m^3. Of this volume, only 200,000m^3 is to be reused for constructing the dike and landscape facilities, etc., at the construction site. However, the remaining of 3,500,000m^3 has to be disposed out of the construction site.

Intensive public and private land developments are being implemented in Cavite Province. The PPDO, MPDO and MEO of Imus had informed that land developers would be willing to utilize the materials excavated from the site of the flood retarding basin for embankment/filling materials for the development sites should the excavated materials be offered to them without charge. Should that be the case, the cost for the preparation of an exclusive disposal site for the project would not be required, and the necessary cost for disposal would be limited to loading, hauling, unloading and spreading works.

The hauling distance for disposed materials is estimated to be about 2km, considering the location of the ongoing land development sites. However, some of the excavated materials may need to be used for the land development site proposed by the Provincial Government, which requires the hauling distance of about 5km.

Table 8 Work Items and Quantities for the Project

Work Item	Description of Work	Unit	Work Quantity
Retarding Basin	Excavation	10^6 m^3	3.7
	Embankment	10^3m^3	164
	Pavement of Access Road	m^2	27,140
	Concrete Pavement	m^3	2,280
	Concrete Ditch Installation	m^3	2,970
	Connecting Culvert	m^3	1,000
	Grass Sodding on Slope	10^3m^3	140
Overflow Dike/Stilling Basin	Installation of Gabion with filter cloth	m^2	7,072
Drainage Sluice	Box Culvert	m^3	1,330
	Flap Gate	set	3
River Improvement	Revetment (Wet Stone Masonry)*1	m^2	8,770
	Revetment (Rubble Stone Masonry)*2	m^3	5,500
	Renovation of NIA Canal	location	1
	Concrete for Ground Sill	location	3
Amenity Facilities	Basketball Court	court	4
	Eco-Park	location	3
	Open Space*3	ha	14.4
	Preparation of Community Farm incl. grading and fertilization	location	2
	Gazebo/Resting-Place/Kubo	location	3
	Tree Planting (Strip)	tree	350

Note *1: for Slope of 1:2.0 ~ 1:3.0 (V : H)
Note *2: for Slope of 1:0.5 (V : H)
Note *3: prepared for Playgrounds

The target completion year of the priority project component has been set at the year 2013, as proposed in the Master Plan. On the premise that the above works have to be completed by this target completion year, the construction schedule was formulated, taking the annual available working days and the eligible work productivity/efficiency into account.

In accordance with the above work quantities and the completion year of 2013, the proposed construction schedule is as shown below.

Table 9 Entire Construction Schedule for Three Retarding Basins

Work Item		2008	2009	2010	2011	2012	2013
Civil Works	Construction of Imus Retarding Basin				■	■	■
	Construction of Bacoor Retarding Basin				■	■	
	Construction of Julian Retarding Basin				■	■	■
Engineering Services	Detailed Design & Bidding Procedure			■	★		
	Supervision				■	■	■
Compensation	Land Acquisition and House Relocation			■	■	■	

Note ★: Bidding

In connection with the above schedule presented in the Draft Final Report, one of the officials of DPWH commented that the schedule is not doable and suggested that the year for commencement of the project should move to 2011 instead of 2010, the year proposed in the Study. It is, however, urgently required to secure the ROW for the proposed project site taking the present rapid expansion of the built-up area into account, and the LGUs are ready to start consultation meetings with PAPs for the sake of consensus building on land acquisition and/or house relocation. Moreover, there is a fair chance to secure the necessary budget for the engineering services taking the possibility of the external financial assistance into account. From these points of view, the commencement of the project is still set at 2010.

2.6 Economic Evaluation

2.6.1 Flood Mitigation Effects of the Priority Project Component

The design discharges for the river channel improvement of Imus River and its tributaries have been determined, as shown in Fig. 4.1. These design discharges are against the design flood of 10-year return period for Imus River, 2-year return period for Bacoor River, and 5-year return period of Julian River.

The above design discharges could not be guaranteed without the flood control effects of the off-site flood retarding basins selected as the priority project components. At the same, the off-site flood retarding basin alone without the river channel improvement could not fully prevent the design flood from overflowing river channel.

However, the off-site retarding basin alone could store a certain volume of flood runoff discharge, reducing the inundation depth and duration even when the flood exceeds the design scale. Thus, the off-site flood retarding basin would contribute a certain extent of flood mitigation regardless of the flood scale. This flood mitigation effect is further expected to increase in the future land use status, because the current intensive land development would cause expansion of the built-up areas and the increment of peak flood runoff discharge in the future.

Based on the above points of view, the effects of the off-site flood retarding basin were estimated through hydraulic simulation, and the area and number of houses with reduced flood inundation depth/duration due to the effect of the off-site flood retarding basin were also estimated as shown below:

Table 10 Potential Area and Number of Houses to be Relieved by the Off-Site Flood Retarding Basin in Imus River Basin

Return Period	Area Relieved by Priority Project (km^2)		Number of Houses Relieved by Priority Project (unit)	
	Present Land Use	Future Land Use in 2020	Present Land Use	Future Land Use in 2020
2-yr	8.39	9.40	6,911	15,652
5-yr	11.75	12.46	11,459	23,928
10-yr	13.78	14.35	14,534	28,520
20-yr	15.59	16.22	16,373	33,437
30-yr	16.43	18.46	17,013	37,943
50-yr	17.46	19.98	18,007	39,439
100-yr	19.64	20.93	19,464	41,782

2.6.2 Economic Benefit of the Project

The economic benefit of the Project has been computed as the difference between the annual average flood damage in case of the "With-Project" and "Without-Project" conditions. However, the annual average flood damage would increase year by year due to land development, as described above. Hence, the annual flood damage was estimated for both the present land use condition as of 2003 and the future land use in 2020, and then, the annual average flood damage for each year was assumed to linearly increase at the annual incremental rate from the present to the year 2020. The annual average flood damage and economic benefit were estimated, as follows:

Table 11 Economic Benefit of the Project

(Unit: million pesos/year)

Item	Present Land Use	Future Land Use
Annual Average of Flood Damage in case of Without-Project	1,623	3,726
Annual Average of Flood Damage in case of With-Project	1,349	3,060
Economic Benefit	**274**	**666**

2.6.3 Economic Cost

The financial cost for project implementation as estimated in Section 2.4 has been converted to economic cost assuming various conversion factors and the annual disbursement of the economic cost has been estimated, as listed below:

Table 12 Economic Cost of the Project

(Unit: million pesos/year)

Description	2008	2009	2010	2011	2012	2013	Total
Financial Cost	0	83	283	586	578	295	1,826
Economic Cost	0	71	229	479	492	254	1,526

Note: The above costs exclude price contingency. The annual maintenance cost of about 5 million/year is added in the computation.

2.6.4 Economic Evaluation of the Project

The economic evaluation of the Project is made in terms of Economic Internal Rate of Return (EIRR) assuming the aforesaid economic benefit and economic cost of the Project. As a result, the EIRR of the priority project component is estimated at 29.6%, which could adequately satisfy the required "Social Discount Rate (SDR)" of 15% prescribed in the guidelines of NEDA.

2.6.5 Sensitivity Analysis

The site of the priority project component is placed within the limits of the existing non-built-up area, and the Municipal Government of Imus is required to preserve the present land use of the site. However, private land developers had procured a part of the land in the proposed project site, and they may not sell their land at the officially appraised land price or even the prevailing market price. The land acquisition cost estimated in the Study is based on the prevailing market price of land, and the actual cost may increase depending on the results of negotiation with the land developers, resulting in the increment of project economic cost.

According to the results of the sensitivity analysis, the project cost incremental rate of 45% would barely satisfy the aforesaid SDR of 15%, and this would be a critical factor to the project's economic viability. Since the land acquisition cost would take about 40% of the whole project cost, the said project cost incremental rate of 45% almost corresponds to the incremental rate of 100% for land acquisition cost. In other words, the economic viability of the project could be verified when the land acquisition cost for the project site is made within the limit of 100% increment of the present market value. (Refer to Section 2.7.6 in Chapter 2 for details.)

2.7 Resettlement Program

2.7.1 Resettlement Policy

The implementation of the proposed flood retarding basin as priority flood mitigation projects will necessitate the acquisition of 81.2 hectares of agricultural land. This is likely to cause five categories of social and economic impacts on project-affected persons (PAPs); namely, (1) physical displacement of PAPs; (2) loss of assets and production base; (3) loss or diminution of livelihood and income-earning opportunities; (4) loss of basic social services and community structures; and (5) disintegration of social support networks and relationships. At the same time, the influx of new settlers is likely to induce adverse impacts on the host or receiving communities, including the following: (1) land speculation; (2) increased population and in-migration; (3) bigger administrative responsibilities for receiving LGUs; and (3) competition over limited natural, social and economic resources, livelihood opportunities and existing social services

To mitigate these potential impacts, resettlement is to be undertaken as an integral component of the proposed interventions as stipulated in JICA's Guidelines for Social and Environmental Consideration (2004). This report puts forward some recommendations that will facilitate the preparation and implementation of a full-scale Resettlement Action Plan (RAP) during the detailed design stage of the proposed projects. The RAP preparation shall consider the Land Acquisition, Resettlement and Indigenous Peoples Policy (LARRIPP) of the Department of Public Works and Highways (DPWH), which governs the payment of compensation and entitlement for PAPs affected by all types of DPWH projects.

2.7.2 Scope of Resettlement

A social survey was commissioned as part of the Environmental Impact Assessment (EIA) study in order to enumerate and characterize the PAPs and their affected assets. The potential PAPs include all the landowners, residents, business establishments and institutions that occupy, conduct business or operate in the area at the time of taking, regardless of their legal ownership status with respect to affected properties.

There are 14 structures likely to be demolished. These include 12 houses distributed in the proposed basin locations as follows: 5 in Calsadang Bago; 1 in Anabu I-G, and 6 in Tanzang Luma VI. Two other structures will likely be removed, namely a motor pool and a plant nursery, both belonging to the Municipal Government of Imus. There are 12 resident households (HH) that presently occupy the proposed project sites. Of these, 6 HH are formal settlers who claim to own the land and structure they occupy; 6 HH are tenants and tenant-farmers who live inside the project area and are at the same time engaged in farming activities. Thirty-four (34) PAPs do not reside in the area but own the land and/or derive incomes from their use, occupancy or economic activities on such lands by another party. This includes 15 landowners with relatively small landholdings, 15 tenant farmers, two land development companies, one candy factory and an LGU. The land developers, namely Earth and Style Corporation and ACM Land Holdings, Inc. respectively, own 26.0 ha and 17.0 ha, respectively, of the proposed retarding basin areas.

It is assumed that only 12 resident households will be subjected to resettlement, which translates to about 60 individuals, using the province's average household size of 4.78 (NSO, CY 2000). The potential re-settlers who may be displaced are five (5) resident families in Carsadang Bago, one (1) resident family in Anabu I-G, and six (6) resident families in Tanzang Luma VI.

2.7.3 Characteristics of Resettling Families

Seventy-seven (77) respondents were interviewed among potential PAPs and resident households around the proposed off-site flood retarding basin. The results of the survey provide an initial profile of the peculiar living conditions, needs and externalities surrounding the PAPs that should be considered during RAP formulation. In particular, measures and strategies must be in place to prevent the impoverishment of extremely vulnerable PAPs such as the poorest of the poor, the female-headed households and the senior citizens, who have more limited access to social services and economic opportunities.

(1) Social Conditions

(a) Demographic Characteristics

The average household size is 4.5; 88% of the household heads are male; only 12% are female. Male household heads and their spouses are generally younger than their female counterparts, with more than 62% still in their reproductive and economically active age. In contrast, more than 60% of female HH heads are past their childbearing age and 33% aged above 60 years old.

(b) Educational Attainment

The educational level is generally low, especially among female HH heads. Almost 80% off the PAPs obtained elementary and high school education only. Only a few were able to enter college or obtain vocational training. There is an obvious need to upgrade the income-earning capacity and skills level of the working population to enable PAPs to re-establish their economic base after relocation. A skills development program should be designed for them in consideration of their educational level.

(c) Tenurial and Housing Characteristics

With respect to land tenure and ownership of houses structures, the results of this interview survey are inconclusive. It is crucial after the conduct of census-tagging (C/T) activities and it should be verified from legal documents the actual tenurial status among PAPs, in order to determine their eligibility to receive compensation and other entitlements.

House structures are predominantly semi-concrete and concrete with rest are made of makeshift and salvaged materials. The implications are significant in terms of compensation for these structures at replacement cost at the time of project construction, which should be considered during RAP preparation. Semi-concrete and concrete units will definitely cost more than those made of makeshift materials.

(d) Access to Basic Utility Services

The PAPs generally have good access to domestic and potable water supply from deep wells, communal wells and communal faucets. On the other hand, 77% of the PAPs have their own household connections to power distribution lines through the Metropolitan Electric Company (Meralco). Water and power supply facilities should be available in the resettlement sites in much the same way as these are readily accessible to PAPs in their present locations.

(2) Economic Conditions

(a) Livelihood and Income Sources

The male HH heads generally have better and more varied jobs than female HH heads. The male household heads are predominantly farmers, the rest are employed as vehicle drivers, office workers, construction workers, and auto-mechanics while a few others have odd jobs such as mowing lawns, pruning trees, cleaning and repairing appliances, etc. (1.5%). Most of the spouses are stay-at-home wives. Similarly, most female HH heads have no means of livelihood. The few who are earning do odd jobs such as laundry, house cleaning, manicure/pedicure services for neighbors and the like, work as farm laborers, make sales or rely on monthly pension. On the other hand more than 56% of other income-earning members are gainfully employed as office workers.

(b) Income Levels

Almost 34% of the PAPs are poor and 21% of them could hardly earn enough to meet their food threshold level. Nearly 36% of the resident settlers live below poverty level and about 21% can barely eat three decent meals a day. Similarly, 32% of the farm tenant families live below poverty and 21% live below the food threshold level. These

families are considered among the poorest of the poor and would need access to a sound livelihood development and income restoration program to preclude impoverishment after relocation.

2.7.4 Potential Resettlement Sites for the PAPs

At most, only 1.0 ha of land will be needed to provide a suitable resettlement site to accommodate all the 12 identified potential resident PAPs. The resettlement site will include with basic support infrastructures such as roads, drainage, water supply, power lines and, as necessary, public schools, wet market, chapel, health center, day care, basketball court, multi-purpose hall, materials recovery facility (MRF), and the like.

In order to preclude the costly acquisition of residential land for resettlement site, the DPWH may develop existing or potential resettlement sites by virtue of special institutional arrangement with the provincial government of Cavite and/or the municipal government of Imus, which will be defined in a Memorandum of Understanding (MOU). Resettlement site development including land upgrading and basic support infrastructures and social amenities may be financed out of the loan package, subject to negotiations with the funding agency (former Japan Bank for International Cooperation or JBIC).

Three sites, with an aggregate area of 18.6 hectares, are potential relocation sites that could readily accommodate the influx of PAPs, if developed in time prior to project construction. Of these sites, the remaining 1.5 ha of idle lot in Pamayanang GK ng Imus, located in Barangay Alapan II, is deemed as the most viable option. It will provide within-town resettlement for the PAPs, who live only within a distance of 4.1 km, 4.7 km and 3.2 km from the retarding basins I1, B4 and J1, respectively. It is now under the Gawad-Kalinga program and hosts less than 100 family-relocatees from blighted areas of Imus.

Two other sites are equally acceptable alternatives. One is a portion of the 53-ha lot in Barangay Pasong Kawayan II, Gen. Trias that was recently acquired and developed by the Provincial Government of Cavite. This resettlement site would be advantageous to PAPs in terms of proximity to government centers, hospitals, schools, markets and other social support infrastructures. It offers the advantage of proximity to possible places of employment in nearby industrial estates and business parks located in the municipality, where more than 40 companies presently operate. The only possible disadvantage is that the site is almost 11 km and 13 km away from the point of origin of resettling PAPs from Imus. The other is a 1.3 ha land in Toclong, Kawit, which the provincial government is negotiating to purchase. Owing to its proximity, it may be a more acceptable resettlement option to PAPs than the one in Barangay Pasong Kawayan II since it is only 3.0 km from Anabu I-G and Carsadang Bago and 4.5 km from Barangay Tanzang Luma VI.

2.7.5 Recommended Procedures, Strategies and Measures for Resettlement

During the detailed design stage, a full-scale resettlement action plan (RAP) shall be formulated to address the identified impacts of displacement on affected families. The overarching goal of the RAP is to ensure that the social and economic base of PAPs is restored to pre-project levels, if not improved. A local consulting firm may be commissioned to prepare the RAP and to provide technical assistance during its implementation.

Resettlement is a process consisting of three stages: the pre-relocation stage, the relocation stage and the post-relocation stage. The following are recommended specific activities, strategies and measures that would be involved in each stage

(1) Pre-Relocation Stage

(a) Social Preparation

Resettlement calls for an intensive and reiterative consultation meetings with PAPs and concerned barangay and municipal officials to clarify misconceptions and level off expectations particularly on matters of demolition, resettlement, and compensation, among others. It will allow room for PAPs to meaningfully participate in consensus building and decision-making about the options available to them.

(b) ROW Acquisition

Right of way acquisition will involve the following activities: (i) Parcellary survey and mapping to delineate the limits of the ROW and segregate the project area from adjacent real property; (ii) Census survey-cum-structure tagging (C/T) operation to identify legitimate PAPs; (iii) Verification of legal ownership of land and tenurial status of PAPs and preparation of master list of eligible PAPs; (iv) Socio-economic survey to obtain the socio-economic profile of a representative sample of PAPs; (v) Inventory and assessment of extent to which PAPs' assets (land and improvements thereon including structures, trees, perennials and crops) are affected; (vi) Appraisal of the current fair market value or replacement cost of affected assets; and (vii) Negotiation and payment of compensation and entitlement to eligible PAPs.

(c) Compensation and Entitlement

The Compensation and Entitlement Matrix defined in the DPWH LARRIP policy shall govern the payment of entitlement to PAPs according to degree of impact on economic assets. Only those PAPs residing, doing business, cultivating land or having rights over resources within the project area as of C/T survey date will be eligible for compensation and/or other entitlement, regardless of their tenurial status.

(d) Resettlement Site Development

The location of resettlement site should be acceptable to PAPs. As explained in the previous section, the remaining undeveloped portion of the GK relocation site in Barangay Alapan II may be the most ideal site, if the DPWH can agree on institutional arrangements by virtue of a Memorandum of Agreement (MOA) with the municipal government and the GK partners. The land improvement and provision of support infrastructure shall conform to the requirements of Batas Pambansa 220 for socialized housing.

(e) Shelter Development

Shelter development can be made more affordable to PAPs if the experience of Gawad Kalinga and Habitat for Humanity can be replicated in the proposed resettlement sites, through effective linkage and partnerships with relevant agencies. Both programs subscribe to the holistic approach in shelter development, where communities are organized, assisted in building houses and neighborhood facilities through sweat equity and empowered to re-build their lives with dignity around self-help initiatives and community-based undertakings.

(2) Relocation Stage

The RAP should prescribe guidelines and procedures governing humane conduct of demolition, eviction and movement of PAPs to the relocation site, consistent with the UDHA's intents. As far as possible, PAPs should be allowed to voluntarily dismantle their structures to ensure minimum damage and reuse of salvageable materials. The RAP should incorporate measures to preclude future encroachment and re-occupation of cleared areas.

(3) Post-Relocation Stage

(a) Social Rehabilitation and Re-integration

A sound community organization/community development and social integration program will hasten the re-establishment of PAPs' sense of belonging and hasten the process of integrating them into the life of the community. Again, the holistic programs of the GK and Habitat provide a model worthy of replicating in the potential resettlement sites. At the same time, the receiving LGUs and host communities will play a major role by way of extending the social services to meet the added burden for health care, schools, sport/recreational activities as well as maintenance of peace and order, harmony and livability in the resettlement sites.

(b) Livelihood and Income Restoration Program

The poorest of the poor could benefit from the flagship livelihood programs of the province under the auspices of the Provincial Cooperative, Entrepreneurial and Livelihood Development Office (PCLEDO) in partnership with government support agencies (TESDA, DECS, DTI, etc.), the academe, financial institutions, industries and NGOs. One such program is sustainable agri-aqua production which introduces various fisheries production technologies and provides micro-lending to fisherfolks. Some LGUs and NGOs conduct sewing classes, computer literacy, automotive mechanics and adult education programs for mothers and out-of-school youths.

The PCLEDO also regularly holds the Techno-Livelihood Caravan among poor communities, in coordination with the concerned municipal LGUs. The caravan showcases income-earning options for backyard production, such as food items and handicrafts or novelties.

There is still a need to conduct a more focused socio-economic survey and skills inventory among the identified PAPs to tailor-suit the livelihood options to their present occupations and skills, training and preference. At the same time windows of economic opportunities would need improved access to credit for re-capitalization of disrupted business and livelihood, establishment of new ventures, and micro-financing for extremely vulnerable PAPs.

(c) Estate Management

The RAP should outline the manner and procedure by which the LGU will dispose or award the lots and/or housing structures to qualified beneficiaries. The LGU's responsibility will also include delivery of titles and legal documents to secure the renurial status of PAPs. The RAP should define the schemes and mechanisms by which the LGU expects to recover cost of investments for resettlement land and/or housing development will be recovered. It should clarify agency responsibility for conservancy and maintenance of physical structures.

2.7.6 Implementation Arrangement

(1) Organization of Resettlement Task Force

An inter-agency resettlement task force (IRTAF) will be organized to oversee the preparation and implementation of the RAP. The Provincial Housing Development and Management Office (PHDMO) or the Municipal Planning and Development Coordinator (MPDC) of Imus, as the case may be, shall be the lead agency of the IRTAF, while the DPWH shall serve as co-chair. The RAP Implementation Committee (RIC) shall be the implementing arm of the IRTAF. Membership will include private and government agencies, among them the National Housing Authority (NHA), Department of Social Welfare and Development (DSWD), Department of Trade and Industry (DTI), Technical Education and Skills Development Authority (TESDA), Philippine National Police (PNP), Philippine Commission for the Urban Poor (PCUP), Urban Poor Affairs Office (UPAO), concerned municipal and barangay LGUs, non-government organizations (NGOs) and People's organizations (POs).

The PAPs should be adequately represented in the RIC and accorded the right to be heard and to decide on resettlement issues affecting them. In particular, the PAPs' right to equal protection of the law shall be guaranteed through a Grievance Redress and Arbitration Sub-Committee under the RIC, where legitimate complaints could be heard and conflicts could be resolved. The PAPs shall be represented with full voting powers in such committee.

(2) Budget and Time Frame

The RAP shall include a realistic estimate of the costs entailed by resettlement planning and implementation from cradle to grave, including post-relocation restoration programs. Loan proceeds and GOP counterpart funds for these purposes shall be earmarked and made available in a timely manner so that resettlement activities may proceed in parallel with

construction activities. This is especially needful for land acquisition and payment of compensation and entitlement. PAPs should be given sufficient time to harvest their crops and re-establish their dwellings prior to demolition and transfer to their new location.

(3) Monitoring and Evaluation

A Monitoring and Evaluation (M&E) plan will ensure regular and periodic collection, analysis and reporting on the progress throughout the resettlement cycle. In-house monitoring shall be done to assess the extent to which resettlement objectives as set out in the RAP are achieved. A Monitoring Sub-committee shall be organized under the RIC for the purpose of in-house monitoring. Monitoring will take place against the activities, entitlements, time frames, budget and target benefits of the resettlement program throughout the project cycle and beyond. An external monitoring agency may be necessary to evaluate the benefits that accrue to the PAPs as a result of the project in general and the resettlement implementation in particular. A local NGO, an academic institution or a local consulting firm may be commissioned for this purpose.

2.8 Environmental Impact Assessment

The environmental elements for the EIA study were identified by the scoping works and agreed in principle in the stakeholder meeting. The impacts on the above elements were predicted and necessary mitigation measures were proposed. Among them, the major impacts and mitigation measures are described below.

(1) Land Acquisition and Resettlement

The project land (81.2 ha) is predominantly grassland mixed with farmland for rice, corn, vegetable and other crops. The land is owned by a comparatively few owners. About 78% of the I-1 project area (40 ha) is owned by a land developer (Earth and Style Corporation) and the remaining area is owned by seven resident farmers and one non-resident owner. All the B-4 project area (12.2 ha) is owned by three resident farmers and three non-resident owners including one public institution and one private firm. About 58% of J-1 project area (29 ha) is owned by a land developer (ACM Land Holdings, Inc.) and the remaining area is owned by five resident farmers and three non-resident owners.

Totally, 14 structures (12 house buildings and 2 public structures) are affected in which 12 families reside. Twenty-seven farmers will be affected of which 6 are owner-operated farmers and 21 are tenant farmers.

The affected lands, house buildings, resident households and farmers are shown in the below table.

Table 13 Affected Land, House/Buildings, Resident Households and Farmers

Item	I-1	B-4	J-1	Total
Affected Farm/Grass Land (ha)	40.0 (25.8)	12.2 (0.0)	29.0 (17.1)	81.2 (42.9)
Rice Field	6.6 (0.0)	0.0 (0.0)	18.8 (10.3)	25.4 (10.3)
Upland (corn, vegetable, etc.)	1.4 (1.0)	0.8 (0.0)	1.7 (1.2)	3.9 (2.2)
Grassland	27.8 (22.1)	7.1 (0.0)	3.3 (2.9)	38.2 (25.0)
Others (housing lot, bush, etc.)	4.3 (2.6)	4.3 (0.0)	5.2 (2.7)	13.8 (5.3)
Affected House Building (No.)	1	8	5	14
Affected Resident Household (No.)	1	6	5	12
Formal Settler	0	4	2	6
Tenant Resident	1	2	3	6
Informal Settler	0	0	0	0
Number of Affected Farmer (No.)	9	6	12	27
Owner-operated Farmer	0	4	2	6
Tenant Farmer	9	2	10	21

Note: 1) Figures within parentheses .are lands acquired by land developers.
2) Formal settler: owns land and house building, and engaged in farming or other jobs.
3) Tenant resident: owns house building but not land, and engaged in farming or other jobs.
4) Informal settler: owns neither land nor house building, residing as sub-tenant or rent-free occupant, and tills land without consent of landowner or engaged in other jobs.

As shown in the above table, some part of the land, which the developers had already acquired, is temporarily being cultivated by farmers with or without expressed consent of the developers.

For preliminary land acquisition and resettlement program, see Section 2.7 in this summary.

(2) Clearance of Riverbank Trees

Trees of 24 species are growing on the riverbanks of the three project sites. Among them, Kamagong (one tree) and Is-is (one tree) designated as endangered or vulnerable species are identified on the riverbank of the J-1 project site. However, these endangered/vulnerable species can be maintained as present by properly designing the layout of the J-1 retarding basin.

The projects will clear the growing trees on some river sections, resulting in loss of the habitats of birds/small animals. On the other hand, all the retarding basins are designed to plant trees on their surrounding banks for the enhancement of landscape and recreation. This tree planting will compensate for the loss of the habitats.

(3) Noise by Operation of Construction Equipment

The present noise level in the surrounding residential areas of the projects is 60 dB during daytime. The equipment for the excavation works will increase the noise level when it is operated in the fringe area of the retarding basins (distance is less than 100 m from residential area). Such fringe area is estimated at about 30% of the total retarding basin area (81.2 ha).

The excavation works in the fringe area shall be conducted according to a proper work plan, regulating the working time schedule.

(4) Traffic Disturbance due to Excavated Soil Transportation

All the excavated soils of the three projects can be appropriated for the land reclamation of subdivision developments in each neighboring areas. Among them, some portion of the soils shall be transported to 1-2km distant reclamation areas by using the public roads. The transportation road, existing traffic volume, additional traffic volume (dump truck), maximum road distance to be used and existing road conditions are shown in the below table.

Table 14 Traffic Conditions of Soil Transportation Roads

Item	I-1 R. Basin	B-4 R. Basin	J-1 R. Basin
Transportation Public Road	Anabu I-A road	Buhay na Tubig road	NIA road
Existing Peak Hourly Traffic Volume (one way vol.)	77 (130) vehicles/hr	386 (655) vehicles/hr	68 (221) vehicles/hr
Additional Traffic Volume of Dump Truck (one way vol.)	26 vehicles/hr	17 vehicles/hr	12 vehicles/hr
Operation Period	240 days/yr for 2.5 year	240 days/yr for 1.5 year	240 days/yr for 2.5 year
Max. Road Section to be Used for Soil Transportation	From project site to crossing with Buhay na Tubig road: 1.5 km	From project site toward southeast: 2.0 km	From project site toward south: 2.0 km
Existing Road Conditions	2 lanes road of 5 m width , asphalt/concrete pavement with partially gravel	2 lanes road of 6 m width, asphalt/concrete pavement	2 lanes road of 6 m width, concrete pavement

Note: Figures outside parentheses are four-wheel vehicle volume excluding tricycle/pedicab and motorbike, while figures within parentheses are total volume including tricycle/pedicab and motorbike.

The existing traffic volumes of Anabu I-A road and NIA road are comparatively small. Hence, the additional traffic for soil transportation will cause no significant traffic disturbance for these roads if a necessary traffic control is performed. On the other hand, the dump trucks for soil transportation passing through Buhay na Tubig road will worsen the present situation to some extent since the existing traffic volume is comparatively large. In this connection, the following measures shall be taken to mitigate this adverse effect for Buhay na Tubig road.

- Arrangement of sufficient traffic controllers at the key sites of the road section,
- Construction of a simple pavement of the road shoulders so that tricycles and motorbikes can drive on the shoulder as required, and
- Arrangement of limited operation time for soil transportation to avoid the peak traffic time in the morning and evening.

3. Promotion of Community-Based Flood Mitigation Activities

3.1 Cleanup Drive of Waterways

3.1.1 Activities Undertaken

The JICA Study Team has undertaken information and education campaign (IEC) for the pilot projects on cleanup of waterways in collaboration with the relevant government agencies and NGOs to raise awareness on the necessity of clearing the river and drainage channels, which is indispensable to keep the flow capacity for flood mitigation.

The pilot project was undertaken for seven municipalities in the coastal lowland area through two phases, namely: (a) the first phase for two municipalities of Imus and Kawit undertaken from October 2007 to February 2008, and (b) the second phase for five municipalities of Tanza, Rosario, Bacoor, Noveleta and General Trias for a period from April to June 2008. The "Manual on Community-based Cleanup Drives of Waterway" has been finally prepared based on the lessons given from the pilot projects and compiled as a part of this Report.

The outline of the pilot projects are described hereinafter:

(1) First Phase Project

The first phase of the project was undertaken for 45 barangays along the riverbanks in the municipalities of Imus and Kawit. The activities for the pilot project include training of trainers, opening of community workshops, distribution of materials for IEC and the actual field practices such tree planting and removal garbage in the waterways. Among others, a comic book was prepared as the material of IEC to facilitate the easy understandings of the residents on necessity of cleanup of the waterways.

These activities were made in collaboration with the Provincial Government, the relevant municipality/barangay offices, the NGOs and the residents. Two NGOs, namely, the "Sagip Ilog Cavite Council" and the "Kawit Sagip-Ilog (KSI)" in particular greatly contributed to the execution of these activities.

(2) Second Pilot Projects

Based on the experiences obtained from the first phase of the project mentioned above, the extension programs to share the experiences obtained were conducted for the other low-lying municipalities of Cavite, i.e., in Tanza, Rosario, Noveleta, Bacoor and General Trias.

This extension programs were led by the Provincial Government's Project called "OPLAN LINIS CAVITE" which is organized by Cavite Provincial Government – Environment and Natural Resources Office (PG-ENRO). For the Extension Program, Trainer's Training was conducted prior to the individual community workshop at each municipality. Thereafter, community workshop at each municipality was implemented.

3.1.2 Evaluation of Pilot Projects on the Cleanup Drive on Waterways

The results of the pilot projects are as evaluated below:

(1) Relevance

A large volume of the garbage is being dumped into the rivers and the drainage channels in the lowland area in particular, which is densely packed with houses. The dumping of garbage remarkably reduces the flow capacity of the river and drainage channels causing serious flood

overflow. Hence, the information and education campaign (IEC) for cleanup of the waterways undertaken in the pilot projects accord with the needs of the Study Area. The Medium-Term Philippine Development Plan 2004-2005 also highlights proper maintenance of the river/drainage channels, including the removal of garbage therein as one of the important tasks of flood mitigation. Thus, the pilot projects were consistent with the national development policy.

(2) Effectiveness

Before commencement of the pilot projects, it was provisionally planned that the objective area of each pilot project should include several communities, and the boundary of one unit of the objective community should be set at the administrative boundary of the barangay (the smallest administrative unit in the Philippines). In accordance with the results of discussions with the Provincial Government of Cavite, however, the pilot project areas were expanded from the said barangay level to the municipality level covering several barangays. As a result, various municipality officials, core members of the NGOs, and barangay captains attended the training. Thus, the necessary knowledge on IEC was disseminated to more groups of leaders.

(3) Efficiency

The pilot projects required about 1 million pesos (about 3 million yen) for their implementation, while the Provincial Government had allocated about 35 million pesos as the annual budget for maintenance of public utilities in the whole province. Hence, the cost of 1 million pesos for implementation of the pilot projects is not a small amount compared to the annual budget of the Provincial Government for maintenance of public facilities. However, the cost required for the pilot projects was used for the (i) training of the leaders for the IEC, and (ii) the preparation of materials such as leaflets and pamphlets for enlightenment of the residents on the cleanup drive on waterways. Accordingly, the necessary cost required for the other activities of the IEC was limited to the holding of workshop/seminars for the enlightenment of residents and the printing of additional IEC materials. The expenditure for the pilot projects, therefore, counterbalanced the output of the said projects.

(4) Impact

The provincial government (the PG-ENRO in particular), the municipality (MENRO), the NGOs and the residents had jointly undertaken the IEC for cleanup of river/drainage channels starting from the preparatory works. Such cooperative activities were never made before, and the lessons learned through implementation greatly contributed to the promotion of the cleanup of waterways, which could lead to the proper preservation of channel flow capacity and the reduction of flood channel overflow.

(5) Sustainability

The Provincial Government of Cavite had decided to continue the IEC for the cleanup of waterways, and appointed the PG-ENRO and the MENROs as the implementation agencies. The necessary cost for the IEC is to be taken from the budget for “Oplan Linis,” which is now in progress as the cleanup drive for roads, parks and other public open spaces. Moreover, the Provincial Government will soon establish the Flood Mitigation Committee (FMC) and expected to complete the necessary budgetary arrangements for its establishment by March 2009. The FMC is to lead, coordinate and monitor the activities of the IEC.

The sustainability of the IEC for the cleanup of rivers and drainage channels would be ensured by the above organizational setup which would ensure maintenance of the necessary flow capacity of rivers and drainage channels, and protection against channel flood overflow.

3.2 Flood Warning and Evacuation

3.2.1 Objectives

A substantial part of the study area is currently exposed to the risk of river overflow even in the event of a probable flood of 2-year return period. Under such condition, the plan for the flood warning and

evacuation system was preliminarily formulated in the foregoing Master Plan Study (refer to Section 9.5 in Vol. 1). Succeeding to the Master Plan, a pilot project was carried out for 3 months, from August to October 2009, to further materialize the plan highlighting the following issues in particular:

(1) Development of a prototypical flood hazard map;

(2) Diffusion of knowledge on flood hazard map through seminar/workshop and evacuation drills in the field; and

(3) Preparation of the "Flood Disaster Preparedness Manual", which describes the necessary procedures of flood warning and evacuations.

The objective areas of the pilot project were determined through the discussions among the JICA Study Team and the relevant officials in the three barangays in the Municipality of Kawit, namely "Potol-Magdalo," "Gahak" and "Manggahan-Lawin," which often received damaged due to flood overflow of the river and/or the drainage channel.

3.2.2 Map Exercise

The map exercise for the residents was firstly carried out as preparatory works for the preparation of the flood hazard map. The residents know, based on their own experience, where the serious floods in the past occurred and/or which route should be selected for the evacuation from floods. However, a considerable number of the residents hardly expressed their knowledge on the maps and/or hardly recognized the locations indicated in the maps.

Therefore, three half-day workshops for the map exercise were carried out in September 2008, which were participated by 107 residents and 29 government officials. In the map exercises, the residents were trained on how to read the map and to indicate their knowledge about the flood hazard areas and evacuation routes on the map. The map exercises enabled the residents to understand the information given on the flood hazard map. At the same time, useful information on the flood hazard area and/or eligible evacuation route were obtained from the residents and incorporated in the development of the flood hazard map.

3.2.3 Development of Flood Hazard Map

The JICA Study Team developed the flood hazard map based on the information given by the residents and the relevant government officials through the above map exercise and the hydraulic simulation work. The information presented in the hazard map contains the following items:

(1) The possible flood inundation area and inundation depth in the recurrence probability of 5-year return period;

(2) The location of evacuation centers and evacuation routes;

(3) The contact telephone numbers in emergency including those of the police station, the fire station, the "Cavite Rescue 161," the office of the Disaster Coordinating Council, the Disaster Operation Center, and the Office of MERALCO;

(4) The location and photograph of landmarks such as the schools, the municipal hall, the barangay halls and the chapel;

(5) "What to do in the event of the Flood" (written in Pilipino), and

(6) The purposes and usage of the flood hazard map (written in Pilipino).

3.2.4 Seminar on Flood Hazard Map and Evacuation Drill for the Residents

The provincial government and the municipality office with support from the JICA Study Team organized the half-day seminars including the conduct of evacuation drills to facilitate adequate understanding of the residents on the contents of the flood hazard map. The seminars and drills were held three times in September 2008, and a total of 118 residents and 32 government officials participated. The seminars/evacuation drills contained the following items:

(1) Explanation and discussions on the flood mechanism;

(2) Explanation about the purposes, contents of the flood hazard map, and how to use the map;

(3) Explanation about the activities to be taken in map exercises;

(4) Confirmation and suggestion on results of map exercise; and

(5) Evaluation of the evacuation drills.

3.2.5 Training on Flood Hazard Map for the Government Officials

The Provincial Government held a one-day seminar on November 26, 2008 with support of the JICA Study Team in order to impart the technical expertise and skills of the government officials on development of the flood hazard map. The number of participants for this seminar is 45 government officials in total including those from the provincial government, seven municipalities in the Cavite lowland area, the district office of DPWH, and the JICA Study Team.

The participants from municipality offices had selected the target barangays within their jurisdiction areas in advance and they conducted the aforesaid map exercise for the said target barangays. They further learned the methods of preparing the flood hazard map by overlaying it with the flood inundation area simulated by JICA Study Team. To facilitate the future work of developing the hazard map of the municipalities, the JICA Study Team furnished the necessary data in the GIS, Auto-CAD and JPEG formats.

3.2.6 Development of Flood Disaster Preparedness Manual

The "Flood Disaster Preparedness Manual" was prepared to provide guidance on the objective, procedure and required activities of flood warning and evacuation. The contents of the Manual are shown below:

Table 15 Contents of Flood Disaster Preparedness Manual

Title	Contents
Chap. 1 Introduction:	Background, objective, flood history in Cavite, and hydro-meteorological conditions in Cavite.
Chap. 2 Disaster Preparedness in Cavite:	Related laws and regulations, flood risk area, procedure of flood warning and evacuation, flood warning code, communication network among DCCs,
Chap. 3 Community-Based Flood Warning and Evacuation	Barangay, Organizational Setup and Tasks of BDCC,
Chap. 4 Evacuation:	The required activities in the non-flood time and in the event of flood,
Chap. 5 Flood Hazard Map:	Importance, objective, contents of the flood hazard map, and
Chap. 6 Public Awareness:	Objective, Map Exercise, Seminar and Evacuation Drill, Others

3.2.7 Evaluation on the Results of Pilot Projects for Flood Warning and Evacuation

The results of the pilot project are evaluated as described herein:

(1) Relevance

A substantial part of the study area is currently exposed to the risk of frequent and disastrous river overflow, and the flood calamities would be further aggravated due to complex factors such as the progress of encroachment to the flood hazard area and the increment of peak discharge due to the increase of urban population and the expansion of built-up area. In spite of the risk of floods, the residents have not been adequately provided with the information for flood evacuation such as the extent of the flood hazard area and location of the eligible flood evacuation routs/evacuation centers. Under these conditions, the pilot project, which aims at the establishment of flood warning and evacuation system, is judged to be consistent with the needs of the residents, and urgently required.

The national development plans in the Philippines such as the Medium-Term Philippine Development Plan for 2004-2010 as well as the Medium-Term DPWH Infrastructure Development Plan for 2005-2010 also take up the development and diffusion of the flood hazard map and the establishment of flood warning and evacuation systems as one of the national important policies. Thus, the pilot project is in line with the national development policy.

(2) Effectiveness

The disaster information that residents obtain through the TV, radio and newspapers is deemed to be rather fragmentary and not always useful during the actual flood. The Provincial Government and the municipalities have established the disaster coordinating committees (the PDCC and MDCCs) in order to safely guide the residents during evacuation from floods. However, the committees have neither developed the flood hazard map nor established the definite process for flood warning and evacuation.

Taking the above current status into account, the pilot project aimed at developing the flood hazard map and establishing the definite processes for flood warning and evacuation for the selected three (3) barangays as the pilot communities. At the same time, the transfer of relevant knowledge to the officials of the LGUs as well as the residents was made as a part of the scope of the pilot project. These activities undertaken in the pilot project would solve the above issues for flood warning and evacuation and bring the benefits to the residents.

(3) Efficiency

The pilot project was executed by one Japanese expert in collaboration with various officials of LGUs for 3-month period. The cost required to execution of the project was about 360, 000 pesos (about 1 million yen) in total. The manpower committed and the cost invested in the pilot project is judged to be extremely small as compared with other similar projects.

The objective areas of the pilot project were limited to three (3) barangays, which could be the principal reason for the above small manpower and cost required for the project. In spite of the limited manpower and project cost, however, the project was efficiently performed completing all works as per the original schedule. The works performed in the project include the workshops/seminars, the map exercise and the field drill for flood evacuation as described above.

(4) Impact

With implementation of the pilot project, the flood warning and evacuation system, together with the flood hazard mapm is expected to gradually spread over all municipalities in the study area. As a result, the awareness of residents as well as the officials of the LGUs on the risk of flood would increase, and the consciousness not to reside in the flood hazard area would lead to proper land use in the study area.

The development of the hydrological gauging network for flood warning and evacuation is now in progress through the financial assistance from the United Nations Development Programme (UNDP). The flood hazard maps, the “Flood Disaster Preparedness Manual” and other outputs of the pilot project are expected to contribute to the successful implementation of the said development of the hydrological gauging network.

(5) Sustainability

The Provincial Government plans to continue the activities taken in the pilot project after completion of the Study, and appointed the PDCC, the MDCCs and the BDCCs as the execution bodies for the project. Moreover, the Provincial Government has scheduled to establish the Flood Mitigation Committee (FMC) and complete the necessary budgetary arrangement for its establishment by March 2009. The FMC will lead, coordinate and monitor the activities for the development of the flood hazard map and the establishment of the flood warning and evacuation system.

The sustainability of the activities taken in the pilot project would be ensured by the above organizational setup, which would promise continuation of development/updating of the flood hazard map, as well as the information and educational campaign including the transfer of knowledge on flood warning and evacuation.

3.2.8 Problems and Recommendations

The results of the aforesaid pilot project are evaluated as listed below:

(1) Some of the existing disaster evacuation centers are deemed to be not safe from the flood inundation. Some centers are also likely to not adequately accommodate the evacuees. From these points of view, review on the location and accommodation capacity of the evacuation is required for improvement.

(2) The potential flood risk area simulated in the pilot project is still the trial product not adequately taking the micro-topographies into account. The officials of the municipal offices concerned are required to conduct the field inspection on the actual inundation area for every flood and revise the simulated flood risk area accordingly.

(3) In the future workshop/seminar for IEC on the flood warning and evacuation, it is important to ensure the common understandings of all concerned people on the purpose of flood warning and evacuation. Discussions should be well guided by the facilitators.

(4) The positive utilization of the mass media is recommended to widely diffuse the importance of the flood information, and the real time information of the flood.

(5) The execution of the activities as guided in the “Flood Disaster Preparedness Manual” is indispensable to improve the capacity of community-based flood mitigation.

4. Plan for Land Use Control

4.1 Proposed Urban Growth Management Concept

The cities/municipalities had projected the future land use plans as delineated in their land use plan called the “Comprehensive Land Use Plan (CLUP)”. However, these existing land use plans are evaluated to contain the three principal issues. The contents of the issues and the countermeasures against them proposed in this Study are further described as follows:

4.1.1 Urban Development in the Designated Zone

The CLUP constitute quite a large part of the urban growth area showing the mix land uses for residential and commercial use in order to receive the high demand of land development of the private sectors. However, such scattered-type of urban development tends to cause the excessive land development, and deteriorates the accumulative effect of urban function and efficiency of public investment leading to aggravation of the city landscape and traffic congestion. Moreover, the productivity of the agriculture falls due to loss of massive agricultural lands by commercial and residential land development.

In due consideration of the unfavorable effects of the mix land use, the JICA Study Team proposed the urban development within a designated zone, which could contribute to the formation of urbanization area with the accumulation effect and effective public works investments (refer to Fig. 6).

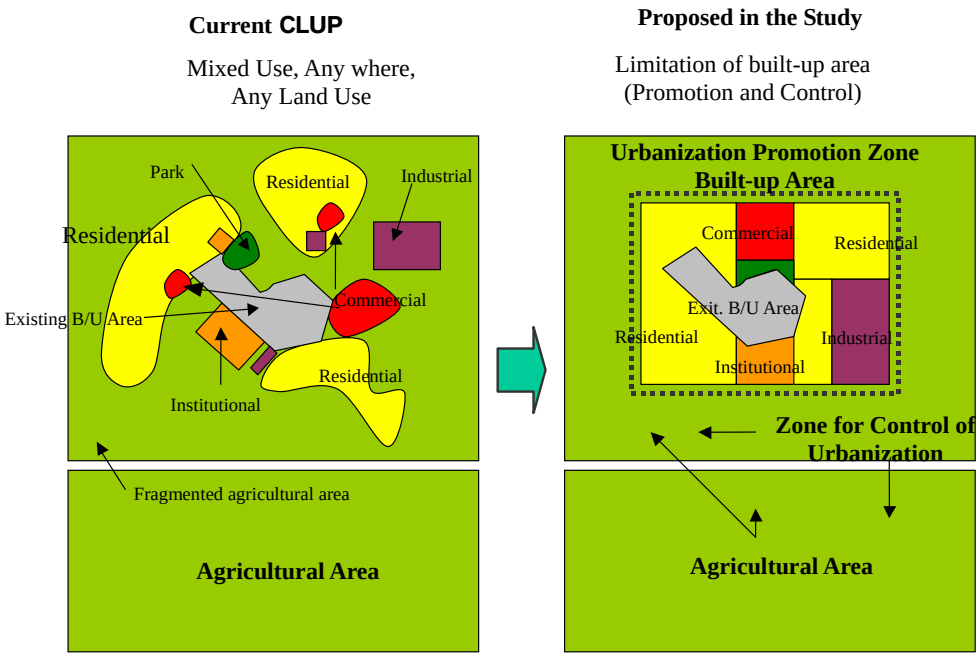


Fig. 6 Differences in the Policy between the current CLUP and JICA Proposal

4.1.2 Consistent Land Use Plans Prepared by the Cities/Municipalities and the Provincial Government

There are discrepancies in the acreages and the locations of the future urban growth areas projected by the cities/municipalities and the provincial physical framework plan (PPFP). In order to adjust the discrepancies, executions of the following works are proposed:

(1) To apply the common legend to the land use plan with referring to the guideline of HLURB.

(2) To re-clarify the acreages and the locations of each land use area based on the GIS method and the eligible aerial photo and/or satellite image data.

(3) To review the PPFP for the whole province with referring to the guideline of NEDA.

(4) To strengthen the role and authority of Provincial Land Use Committee (PLUC) in approval process of the land use plans of the PPFP and CLUP.

(5) To step in a process of the examination by PLUC for development permission against the application of the land use plan in the urbanization control zone.

(6) To strengthen the capacity of PPDO for collection, processing and management of the accurate and updated spatial information.

4.1.3 Delineation of Urban Growth Boundary

The CLUP projected about 65.2% of the Study Area to be the urbanized area in 2020. The projection is, however, based on the assumption such that the past intensive population growth would continue in the future. However, the JICA Study Team as well as other relevant study report estimated that the future population growth tends to decrease because of the land development policy in the Cavite Province, the decrease of the natural birth rate and other several factors. Moreover, the urbanized area projected in the CLUP includes the areas legally prohibited and/or not suitable for urban growth such as: (a) the protective farmland specified by the agricultural reform programs; and (b) the steep-sloped area, the flood hazard area and the other environmental critical areas.

In view of the above, the future urbanized area for the Study Area in the year of 2020 was re-clarified in the Master Plan Study, and the future urbanized area in the Study is projected to take about 42.7%

of the entire Study Area, which is far smaller than the said urbanized ratio of 65.2% as projected in the CLUPs.

In order to control the excessive expansion of the urbanized area, the "Urban Growth Boundary" is proposed dividing the urbanize area projected in the CLUPs into Zone A as the "Urban Promotion Zone (UPZ)" and Zone B as the "Urban Control Zone (UCZ)" as shown in Fig. 7. The Zone C as the "Production and Promotion Zone (PPZ)" is further proposed as the remaining farmland in the Study Area.

The Zone-A (UPZ) includes the existing built-up area and the area, where the urbanization should be positively made. On the other hand, the Zone B is the area, where the urbanization is conditionally allowed only to the area of more than 10ha and the EIA is obliged for urban development. The Zone C is the agricultural and fishery production area, where any urbanization is not allowed.

The Zone B covers the flood hazard area of 109ha, which may cause the inundation depth of more than 25cm in case of 2-year return period. This flood hazard area is designated as the Zone B2. The lowest floor elevation of the houses/building newly constructed in this Zone B2 is required to be more than 50 centimeters above the ground level or equipped with flood-proofing structures.

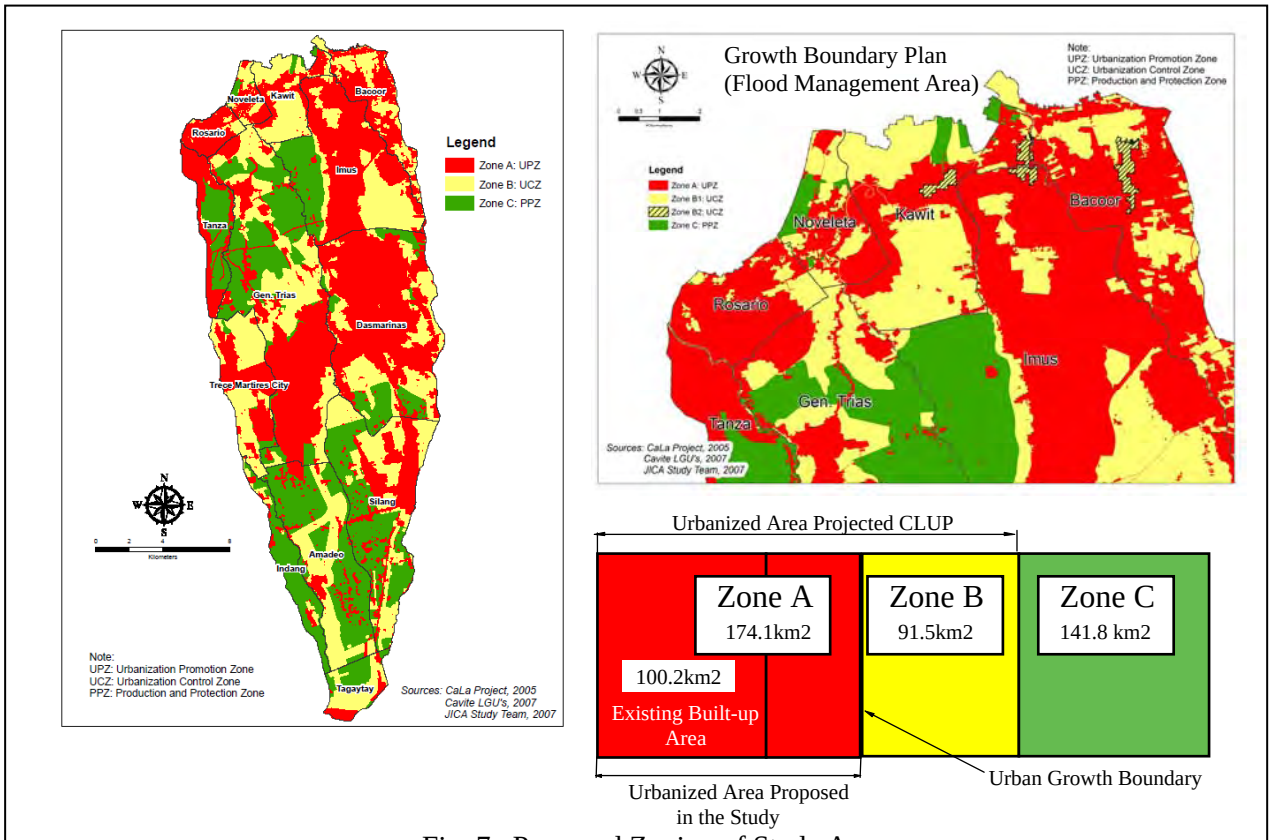


Fig. 7 Proposed Zoning of Study Area

4.2 Proposed Ordinances

The JICA Study Team had proposed two ordinances regarding the "On-Site Flood Regulation Pond Requirement on New Development" and "Urban Growth Management." Both of these ordinances aim at minimizing the increment of the peak flood runoff discharge inflicted by the basin land development in the Study Area.

4.2.1 Ordinance for On-Site Flood Regulation Pond

An ordinance "On-Site Flood Regulation Pond Requirement in a Development Project" was proposed for the sake of reducing the peak flood run-off discharges from the new subdivisions. The ordinance obliges the developer of the subdivision to construct an on-site flood regulation pond at the downstream end of the subdivision, when the extent of the subdivision is more than five hectares. The

construction cost of the pond to be borne by the developers differs as shown in Table 15 depending on the subdivisions for the medium/high cost housing under PD 957 and for the low cost housing under BP 220.

Table 16 Cost Requirements for Construction of On-site Flood Regulation Pond

Extent of Land Development Area	Development of Subdivision for Medium/ High Cost Housing under PD957/Others	Development of Subdivision for Low Cost Housing under BP220
≥5	The construction cost of the on-site regulation pond is required on the premises that the whole cost is borne by the developer of subdivision.	The Provincial Gov. would subsidies one million pesos/hectare of subdivision for construction of the on-site flood regulation pond. The remaining construction cost of the pond is born by the developer.
< 5 ha	The construction cost of the on-site regulation pond is not required. However, one million pesos/hectare of subdivision is collected from the developer as the Flood Impact Fee.	Both of construction cost of the on-site regulation pond and the Flood Impact Fee is exempted.

The extent to be allocated for construction of the on-site flood regulation pond is set with the limit of 3% of the entire area of the subdivision. The developer has been also legally requested to provide 30% of the entire extent of the subdivision as the public utility such as road and amenity space, and the area for the on-site regulation pond could be included into the open-space as long as the pond does not aggravate the functions of the public utility.

4.2.2 Ordinance for Urban Growth Management

The Ordinance on "Urban Growth Management" should be enforced to realize the aforesaid urban growth in province-wide level so as to orderly control and promote the urban development. The Ordinance requires the Provincial Planning and Development Officer (PPDO) to designate the aforesaid Urbanization Control Zone (UCZ) and Urbanization Promotion Zone (UPZ). The PPDO is further required to update the Provincial Physical Planning Framework Plan (PPFP) to express UCZ and UPZ in the PPFP with consideration of existing CLUPs prepared by the cities/municipalities.

The current procedure of development application for permit shall be applied in UPZ, while the minimum area of development in UPC shall be set as ten hectares with consideration of conformity to PPFP, development impacts, and availability of infrastructure.

4.3 Consensus Building on the Proposed Ordinances

A series of meetings were held during the Study Period to promote the understanding and consensus on the aforesaid proposed two ordinances (refer to Table 16). The participants of the meetings include the officials of the HLURB as the representative agency of the central government, the members of the Cavite Provincial Assembly, the members of PLUC, the administrators of the LGUs for land use planning and development and other government officials concerned. In accordance with the comments and suggestions made in the meeting, the contents of the proposed ordinances were revised and finally agreed, in general, with PPCC and CPDCs/MPDCs through the Dialog on August 20, 2008.

Table 17 Meetings Held for Consensus Building on the Proposed Ordinances

Date	Purpose of Meeting	Target Participants to the Meeting
Mar. 04, 2007	Explanatory meeting on the proposed on-site flood regulation pond.	• Provincial Governor • Members of the Provincial Assembly
Sep. 12 to 28, 2007; Oct. 02 to 22, 2007	Consultation meeting on the present issues on excessive land use control in Cavite Province.	• HLURB • CPDCs/MPDCs
Feb. 10 to 27, 2008; July 07 to 18, 2008	Consultation meeting on the concept of the proposed ordinances for "On-site Flood Regulation Pond" and "Urban Growth management."	• HLURB • MPDCs • Mayors
July 16, 2008	Explanatory meeting on the concept of the proposed ordinances regarding "On-site Flood Regulation Pond" and "Urban Growth management.	• Members of PLUC
July 21, 2008	Explanatory meeting on the Draft of the above two ordinances.	• Members of the Provincial Assembly
July 24, 2008	Explanatory meeting on the Draft of the above two ordinances.	• Members of PLUC
Aug. 20, 2008	Dialog on the Draft of the above two ordinances.	• PPDC • CPDCs/MPDCs

The public hearing was scheduled to promote understanding and consensus among subdivision developers on the proposed ordinances about few weeks after the Dialog on August 20, 2008. To date, however, no public hearing has been held some reasons. The final dialog with all stakeholders including the officials of the relevant central/local government agencies and the land developers has to be held before the resolution of the proposed ordinances by the Provincial Assembly (refer to Table 17).

Under the above conditions, it is expected that the proposed ordinances will be enacted by March 2009 and enforced by July 2009.

Table 18 Meetings Required in the Future for Resolution of the Proposed Ordinances

Purpose of Meeting	Target Participants to the Meeting
Public hearing on the Draft of the above two ordinances	• HLURB • Developers of subdivisions
Dialog on the Draft of the above two ordinances	• HLURB • Developers of subdivisions • CPDCs/MPDCs • City/Municipal Engineers
Resolution on the above two ordinances	• Members of the Provincial Assembly

4.4 Organizational and Human Resource Development

4.4.1 Organizational Development

The objective organizations of the proposed development are oriented to the Provincial Land Use Committee (PLUC), the Provincial Planning and the Development Office (PPDO) and the City/Municipality Planning and Development Office (CPDO/MPDO). The following items are proposed with the main objective of strengthening the functions of these organizations:

(1) Functions of Provincial Land Use Committee (PLUC)

(a) To appraise the Provincial Physical Planning Framework (PPFP) prepared by the PPDO with a particular attention to the consistency with the "Guidelines on Provincial/Local Planning and Expenditure Management" prepared by NEDA.

(b) To appraise the CLUPs prepared by CPDCs/MPDCs from the point of consistency with the PPFP, the validity of the socio-economic data applied to the CLUP and the consistency between the land use items and the land zoning in the CLUP.

(c) To appraise the application of land development in the Urbanization Control Zone (UCZ) including the consistency with PPFP, the development impacts, availability of infrastructure and public services.

(2) Functions of Provincial Planning and Development Office (PPDO)

(a) To revise the PPFP with higher spatial accuracy on the 1/50,000 topographic maps with using the GIS digital format and the available aerial photos/satellite images.

(b) To prepare the plan for the aforesaid "Urban Growth Boundary" on the 1/50,000 topographic maps with using the GIS digital format and the available aerial photos/satellite images.

(c) To monitor the updated activities for urban development through acquiring the copies of development plans from C/MPDC.

(d) To supporting the aforesaid appraisal works by PLUC.

(e) To establish the GIS Unit under the existing IT Division of PPDO to undertake the necessary mapping works and spatial analyses.

(3) City/Municipal Planning and Development Offices

(a) To revise the CLUP in order to keep consistency with the updated PPFP, this would be also revised according to the new concept on the aforesaid urban growth boundary.

(b) To amend the procedures and the formats of applications for land development, so that the land development in the Urban Control Zone (UCZ) is subject to undertake appraisal and get the approval/certificate by the PPDO.

(c) To delineate the aforesaid flood hazard area designated as Zone B2 based on the results of the flood simulation by the JICA Study Team.

(d) To administrate the maintenance of the on-site flood regulation pond including preparation of the guideline for maintenance and execution of the periodical inspection for the pond.

4.4.2 Human Resource Development

The technology transfer was conducted through several dialogs and workshops in order to promote the understandings on: (1) the present excessive urban growth and the aggravation of flood in the lowland areas; (2) the concept on the proposed plan for control of the excessive urban development, and (3) the contents of the proposed ordinances for the "On-Site Flood Regulation Pond Requirement in a Development Project" and the "Urban Growth Management".

As the results of the above dialogs and workshops, the JICA Study Team had received the positive feedback. Trece Martires City and Bacoor Municipality had determined to incorporate the urban growth management proposed in the Study in their revised CLUPs. All the participants for the dialogs and workshops had also well understood the necessity and mechanism of on-site flood regulation pond.

5. Development of Database for River Area Management

5.1 Purpose of Development of Database for Management of River Area

The management of the river area is required to restrain the intensive encroachment into the river area and keep the appropriate river flow conditions, the river structures, the river morphologies and all other river environments. To facilitate the management of the river area, development of the database for the river area is proposed as the basis for management of the river area.

5.2 Establishment of Boundaries of River Area

5.2.1 Cross-sectional Boundaries

The Presidential Decree No. 1067 prescribes that the river area covers the water body of the river and a certain width of the river corridor along the channel. The Decree further defines the width of the river corridor to be 3m from the boundary of the water body, when the river corridor is located in the urban area.

However, the width of the water body largely changes depending on the magnitude of the river flow discharge, which leads to uncertainties of the boundary of the river area. From this point of view, the water body was provisionally assumed in the Master Plan as the flow area of the flood discharge of 2-year return period.

The above definition of the water body was re-clarified in the Feasibility Study. As a result, it is concluded that difficulties are still foreseeable in defining the flow area of the flood discharge of 2-year return period for every river cross section, and the river area is reclassified as below:

- The river section confined by the river dikes and the inland with a width of 3m from the foot of the dike are defined as the river area.
- In case of the river channel without a river dike, the water body should be assumed as the width of the water flow section measured in the dry season, and the river corridor, which should be included as the river area, is assumed to have the width of 3m from the edge of the water body.

5.2.2 Longitudinal Boundaries

The intensive encroachment into the river area is made along the downstream of Imus, San Juan and Canas River, with a length of about 29km in total, and the approximate upstream ends of such the intensive encroachment area are as shown in the table below. These river stretches area are proposed as the initial target for development of the database for management of the river area.

Table 19 Target River Stretches for Management of River Area

Name of River	Upstream End of Objective River Stretch			
	Length	Bridge at Stretch End	Name of Barangay	Name of Municipality
Imus	6,000 m *1)	Tomas Mas Cardo Bridge	Tanzang Luma I/Palico III	Imus
Bacoor	4,920 m *2)	Aguinaldo Highway Bridge	Panapaan VI	Bacoor
Julian	4,840 m *2)	Julian Bridge	Bayan Luma IX	Imus
San Juan	4,480 m *1)	Ilang-Ilang Bridge I	San Antonio II	Noveleta
Canas	9,150 m *1)	NIA Maintenance Bridge	Bunga	Tanza
Total	29,390 m	-	-	-

Note: *1): Length from the river mouth
*2): Length from the confluence with Imus River

5.2.3 Division of River Area and Establishment of Boundary Markers of River Area

The river area has the longitudinal length of several kilometers as listed in the table above and it is virtually difficult to recognize the location of issues/problems detected in the management of the river area. To cope with this issue, the river area is longitudinally divided by “cross-sectional boundary lines” into numerous small blocks with intervals of about 100m.

Moreover, the outward boundary markers of the river area should be established at the end of the above cross-sectional lines so as to easily recognize the extent of the river area. The boundary marker shall be made preferably of concrete pegs along the river channel. Signboards, which notify the residents about the boundary of the river area, should be placed also at intervals of about 1,000m.

5.3 Information to be recorded in the Database

The items to be recorded in the database were selected as described hereinafter in due consideration of the necessary information for the proper management of the river area.

Table 20 Proposed Information to be recorded into Database

Sheet	Heading	Classification	Information Recorded
Sheet A	Identification of Divided Block of River Area	Identity code of cross-sectional boundary line	ID number presenting the distances in kilometers from the river mouth or from the confluence with the mainstream.
		Location of cross-sectional boundary line	The latitudes and longitudes, and name of Municipality and barangay
		Width of River Area	The width of water body, width of river corridor at the both banks and the entire width of the river area
Sheet B	Land Use of River Corridor	Extent of River Corridor	Extent in square meters of river corridor at both banks
		Number of Houses	The number of the houses in the river corridor at both banks.
		Type of Land Use	Classification of land use in the river corridor by residential area, commercial area, vacant land and others
		Obstruction of River Flow	Results of evaluation on whether or not the land use in the river corridor hampers the safe flow of the flood discharge
Sheet C	River Structures	River Dike	Structural type and conditions of structural damages
		River Protection Works	Structural type and conditions of structural damages
		Bridge	Name of bridge, structural type, and conditions of the structural damage
		Weir/Dam	Name of weir/dam, structural type, and conditions of the structural damage
		Others	Structural type of them and other particular features
Sheet D	Particularities of River Area	Particular conditions of river dike	Noteworthy annotation on river dikes and river channel
		Particular land uses conditions	Noteworthy annotation on land uses in the river area and hinterland

5.4 Development of Database for Imus River

The database for management of Imus River, which consists of the information as described in the above subsection 5.3, was provisionally developed in order to work out the concrete example during the study period. The details of the database are as described hereinafter:

(1) Division of River Area

Encroachment into the river area of Imus River is intensive especially along the river stretch of about 6km in length from the river mouth up to the intersection of the Gen. E. Aguinaldo Highway. This river area is set as the priority extent for management, and in accordance with the aforesaid points for development of database, the river area is divided into 58 blocks by the cross-sectional boundary lines with longitudinal intervals of about 100m. The Database for the above "Sheet-A" is further developed to record the detailed information on each of the blocks.

The river area lies over eight Barangays in Bacoor Municipality and ten Barangays in Imus Municipality. The average width of the cross-sectional boundary line (i.e., the width of river area) is about 72 m, which is divided into 46m of water body, 9m of the river corridor at the left bank and 16m of the river corridor at the left bank. The width of the cross-sectional boundary line changes from 26m at minimum to 249m at maximum.

(2) Database on Land Use in River Area

The Database for "Sheet B" on the present land use in the river area of Imus River is developed. As the results of development of the database, it is clarified that the river corridor defined as a part of the river area has an extent of about 5.4ha (53,756m^2) in total, and a considerable part of it is currently used as residential area. That is, of the total 58 blocks of the river area, 11 blocks are encroached by the houses at the right bank and 32 blocks at the left bank.

The number of houses located in the river area is 323 units, which is composed of 37 units at the left bank and 286 units at the right bank. The house encroachment to the river corridor is intensive especially along the right bank river stretch of 3.4 to 5.7km upstream from the river mouth, where 234 houses exist and, among them, 110 houses are evaluated to cause significant effect on the river flow discharge, and are exposed to serious damage by the flood discharge.

(3) Database on Structures of Imus River

The Database for "Sheet-C" on the existing principal river structures placed in the river area of Imus River has been developed. The principal river structures recorded in the Database are the earth dike, the parapet wall, the revetment of stone masonry and/or concrete, and the four bridges (concrete T-Girder bridges); namely, (a) the Island Cove Bridge; (b) the bridge under construction, which has not been named yet; (c) the Binakayan Bridge; and (d) the Palico Imus Bridge.

(4) Database on Particularities of River Area

Regular river patrol would be required to grasp the updated condition of the river area. The data/information gathered by the patrol would be accumulated and, those for a certain time length need to be summarized into the database. From this point of view, the JICA Study Team, in collaboration with the government counterpart personnel, experimentally carried out the river patrol and made noteworthy annotations such as damages to river structures, houses in danger of flood. River areas intensively encroached by houses were encoded into the Database for "Sheet D."

5.5 Entities in Charge and Activities Required for Database Development

5.5.1 Entities in Charge of Development of the Database

The District Engineering Office of DPWH (DEO-DPWH in Trece Martires City) under the direction of the Flood Mitigation Committee (FMC) is proposed as the implementing body for the development and updating of the database from the following points of view:

- The DEO-DPWH has the knowledge on the river engineering, such as those for river structures, river morphology and river hydrology. Moreover, the office is now in charge of inspection and maintenance of river channel as well as river structures. The knowledge of the office on river maintenance works could be useful for collecting relevant information and for developing the database.
- The DEO-DPWH is the core member of the Flood Mitigation Committee (FMC) and could collect the information on the registration of houses in the river area and/or informal dwellers through members of FMC.

5.5.2 Activities Required for Development of Database

The database format together with the data input for Imus River was prepared during the study period. The DEO-DPWH is required to review the format and make the necessary revisions immediately after completion of the Study. The office is further requested to expand data collection for the Bacoor, Julian, San Juan and Canas rivers and compile them into the database.

The database needs to be updated once a year, and the time of updating works would be preferably after the flood season so as to clarify the updated flood damage potentials that could be used as basic information on the necessary river maintenance works in future floods.

6. Capacity Development

6.1 Overview

The capacity development for the counterpart personnel aims at transferring of knowledge on analysis, designing and plan formulation related to the structural and nonstructural flood mitigation schemes.

The capacity development was further extended to the residents and other stakeholders to disseminate knowledge on the proposed flood mitigation projects.

6.2 Capacity Development for Counterpart Personnel

The following six items of activities were undertaken for capacity development for the government counterpart personnel.

(1) Day-to-Day On-the-Job Training

The counterpart personnel participated in most opportunities of data collection, field reconnaissance, indoor analysis, plan formulation and other activities of the Study. The OJT on hydrological/hydraulic analysis in particular was intensively made for two counterpart personnel of DPWH from April to October 2007.

(2) Overseas Training in Japan

The overseas training was made for four counterpart personnel to promote the understanding on comprehensive flood mitigation projects through observation and lectures about the relevant practices in Japan. The training was made for a two-week period in July 2008.

(3) Study Tour in Philippines

The Ormoc Flood Control Project, which was completed in 2000, is now well operated, maintained and managed by the Flood Mitigation Committee (FMC) jointly organized by Ormoc City and DPWH. In order to learn the points of success and issues/problems encountered in the Project, ten counterpart personnel made a study tour to the site in September 2007.

(4) Workshop on Technical Transfer to Counterpart Personnel

The workshops were held fifteen times in order to achieve the transfer of knowledge related to the proposed schemes in the Study. The principal topics in the workshop included, among others, (a) technical skills for a variety of analysis and planning; and (b) basic policies/concepts on the proposed flood mitigation plans.

(5) Technical Transfer Seminar

The technical transfer seminar was held three times during the study period in order to share experience and knowledge with regard to the comprehensive flood mitigation practiced in the Study and other references in the Philippines as well as Japan.

(6) Meetings with Steering Committee and Technical Working Group

The meetings among the members of the Steering Committee (SC), the Technical Working Group (TWG) and the JICA Study Team were held eight times to explain and discuss the results of the studies carried out and, at the same time, to provide guidance to the smooth implementation of the Study.

6.3 Capacity Development for Stakeholders

The following three items of activities were undertaken for capacity development of stakeholders other than the government counterpart personnel:

(1) Stakeholder Meetings

The Provincial Government of Cavite with support from the JICA Study Team held six stakeholder meetings to explain and discuss the social and environmental impacts to be caused by the resettlement and land acquisition due to project implementation. The objectives of the first three meetings were oriented to the entire flood mitigation plan proposed in the Master Plan Study, while those of the remaining three meetings aimed at promoting the understanding and consensus on the contents of the priority project components examined in the Feasibility Study.

(2) Public Consultation Meeting

The JICA Study Team held eight Public Consultation Meetings to deliberate on the requests and suggestions of formal and informal residents on the flood mitigation plan proposed in the Study. The total number of attendants was 240.

(3) Pilot Project

As described above, the promotion of community-based flood mitigation activities was undertaken through the pilot projects in the Study. The pilot projects have two different themes; namely, (a) the clean-up drive on the waterways; and (b) the effective flood warning and evacuation activities. The knowledge on these themes was transferred to the counterpart personnel as well as the communities and the other relevant government officials through the workshops, the field training, the indoor practices and the distribution of campaign materials.

7. Plan for Activation of Flood Mitigation Committee (FMC)

7.1 Members of and Activities made by FMC

To promote the community-based flood mitigation and other activities relevant to flood mitigation by the LGUs, the FMC, which consists of the members shown in Table 20 was provisionally organized at the end of the Master Plan Study. The selected members of the FMC were the leading personnel for the community-based flood mitigation and other related flood mitigation works in the Study Area and all activities required of FMC were achieved through coordination among them.

Table 21 Members of FMC Revised in Feasibility Study

Designation	Personnel and Organization
Chairperson	Provincial Planning and Development Coordinator (PPDC)
Vice-Chairperson	District Engineer of DPWH in Trece Martires City
Member	Provincial Director of Philippine National Police (PNP)
Member	Head of PG-Environmental and natural Resources Office (PG-ENRO)
Member	Head of Provincial Housing and Urban Development Office
Member	Head of Provincial Engineering Office (POE)
Member	Representative from District Office of DENR in Trece Martires City
Member	Representative from District Office of NIA in Naic, Cavite
Member	Provincial Action Officer of the Government Service Office

Note: The secretariat was placed at the Provincial Planning and Development Office (PPDO)

The FMC started a part of its activities in collaboration with the local communities and NGOs during the Feasibility Study stage. The activities undertaken by the FMC included: (a) execution of the pilot projects for cleanup drive of the waterway and the flood warning/evacuation; (b) consensus building for the proposed ordinances on “On-site Flood Regulation Pond” and “Urban Growth Management;” and (c) holding of stakeholder meetings to promote understanding on the flood mitigation project proposed in the Study.

7.2 Plan for Activation of FMC

7.2.1 Organizational Setup

As described above, the FMC had started a part of the community-based flood mitigation during the Feasibility Study stage. The organizational setup of FMC is, however, based on the initiatives of the JICA Study Team and has not been adequately deliberated by the LGUs themselves. Due to such immature state of the FMC, only a few members of FMC had participated in the activities, and many members are still to be nominated.

To improve the immature status of the organizational setup, the PPDO as the chairperson of FMC as well as the other members who were initially assigned to FMC, should deliberate on the necessary revision of the organizational setup. The Executive Order on the permanent establishment of FMC has to be issued by the Provincial Governor at the earliest opportunity.

7.2.2 Tasks of FMC

The flood mitigation works by the LGUs shall be classified broadly into (a) promotion of community-based flood mitigation: (b) enactment of ordinance related to land use control: (c) support on the resettlement on project-affected persons; and (c) enhancement of the sustainable operation and maintenance of the project facilities, as shown in Table 21 below. A considerable part of these programs are actually executed as extension of the other existing entities and/or assumed as a part of the ongoing activities at the local level, as described above.

Under the above situations, the principal roles of the FMC would be oriented to inter-agency coordination. However, the FMC may also need to take a direct initiative on the flood mitigation works at the local level including the holding of stakeholder meetings, preparation of materials for IEC and other relevant works depending on the situation. To achieve the roles, the FMC is required to prepare annual coordination programs for the following items and execute them:

Table 22 Tasks to be Coordinated and Promoted by FMC

Classification of Tasks	Detailed Tasks	Relevant Agencies
Community-Based Flood Mitigation Works	IEC on cleanup of waterways	PG-ENRO, CENROs and MENROs
	Development of flood hazard map and flood warning and evacuation system in collaboration with each other	PDCC, CDCC/s, MDCCs and BDCCs
	Management against encroachment on the river area	PHDMO, PNP
Control of Excessive Land Development	Consensus building and enactment of the two ordinances proposed in the Study; namely: the “urban development management” and the “on-site flood regulation pond to be constructed in new subdivisions”	PPDC, CPDCs and MPDCs
	Revision of the Provincial Physical Framework Plan and the land use plan of each city/municipality in accordance with the concept of urban growth management proposed in the Study	PLUC, CPDCs and MPDCs
Project Implementation of Flood Mitigation Structures	Consensus building of project–affected-persons (PAPs) on resettlement	PHDMO, IRTF, DPWH,
	Census/survey and tagging of the PAPs	PHDMO, IRTF, DPWH
	Preparation of resettlement site	PHDMO
	Support on social rehabilitation and income restoration of PAPs	IRTF
O&M of Project Structures	O&M of off-site flood retarding basins	DPWH
	O&M of on-site flood regulation pond	HLURB
	O&M of river dikes	DPWH
	O&M of inland drainage facilities and coastal dike	City and Municipal Offices

7.2.3 Budgetary Arrangement

The budgetary arrangement for the activities of FMC is urgently required but it has not been established yet. The necessary expenditures for the activities of FMC would include those for: (1) holding of coordination meetings, public consultation meetings and other relevant meetings; and (2) preparation of materials for the IEC. Aside from these direct expenditures, personal expenditures may be potentially incurred but it could be substantially covered by the annual budget allocated in the existing office operating cost.

The necessary amount of annual expenditure for the activities of FMC is provisionally estimated at about 760,000 pesos based on the actual expenditure incurred for the implementation of the pilot project. FMC would need to seek for available financial sources to cover such amount of annual expenditure.

7.2.4 Coordinative Activities with Relevant Agencies

As described above, the FMC would need to coordinate with a variety of agencies as well as the ongoing projects. To keep close contact with those relevant entities, it is required to set up an annual schedule for regular meetings and to assign liaison personnel in the FMC as well as the relevant entity.

8. Evaluation and Recommendations on the Overall Study Results

8.1 Overview

The Study Area is vulnerable to floods, which could be attributed to the extremely low ground elevation and the insufficient flow capacity of the river and drainage channels. In spite of the vulnerability to floods, intensive urbanization is in progress, which leads to increment of the basin peak flood runoff discharge and expansion of the damageable assets in the flood hazard area. Moreover, the area along the downstream river stretch is densely packed with houses, and therefore, a large-scale river channel improvement as the conventional flood mitigation measure in the Philippines could hardly be executed.

To cope with the complex factors of flood damage, it is important to minimize the scale of river channel improvement and maximize the basin flood detention facility. From this point of view, implementation of the following three project components in particular is important: (a) partial river channel improvement; (b) construction of flood retarding basin; and (c) introduction of urban development plan. The components of items (a) and (b) are the structural measures. These are evaluated to contain high viability and urgently required to secure the ROW under the current intensive urbanization in the Study Area.

The component of the above item (c) is the non-structural project component measure and should be implemented at the earliest opportunity. The LGUs are required to establish the "Implementation Rules and Regulations" for the component and develop the institutional setup for screening/approval on applications for land development.

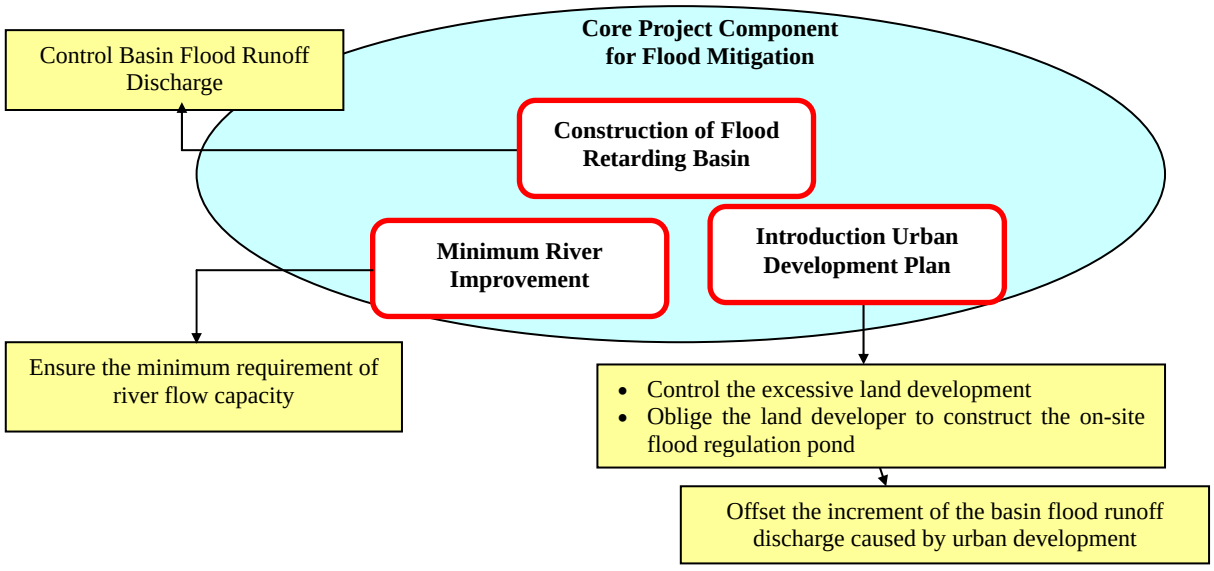


Fig. 8 Core Project Component of Flood Mitigation

8.2 Evaluation and Recommendation on the Structural Measures

The structural component as a whole is evaluated to be economically variable, and no fatal negative impact on social and natural environments is expected due to its implementation. The EIRR, the project construction cost and the target completion year are as summarized below:

Table 23 Principal Features of the Proposed Structural Flood Mitigation Component

Description	Unit	Entire Project	Priority Project
Project Cost (Initial Investment Cost)/1	Mi. Php.	6,858	1,845
Project Cost (O&M cost)/1	Mi. Pesos/year	34.7	4.7
Target Completion Year	A.D.	2020	2013
Number of Households benefited by Flood Mitigation Project	House	24,700/2	12,800/3
Number of Households affected by the Project/4	House	470	12
EIRR	%	22.2	26.0

Note: /1: Price contingency is excluded.
/2: The figure includes 17,700 households benefited by the project component for river overflow flood and 7,000 benefited by the component for inland flood in the entire Study Area.
/3 The figure is the number of households benefited solely by the priority project component for the river overflow of Imus River only.
/4 The figure is the number of houses that shall be relocated or resettled by the entire/priority project.

8.2.1 Off-Site Flood Retarding Basin Flood Retarding Basin

The downstream stretch of Imus and San Juan in the Study Area has an extremely small flow capacity, which could hardly cope with even the probable flood of 2-year return period. However, the area along the downstream stretches is densely packed with houses, and full-scale river channel improvement without any basin flood detention facility would require large house relocations of more than 2,000 houses. To minimize the number of house relocations and achieve the early effect of flood mitigation, construction of the off-site flood retarding basins is strongly recommended as the basin flood detention facility.

The proposed flood retarding basins will be constructed at ten (10) sites, requiring ROW of about 200 ha. This extent for ROW is apparently large. However, the off-site flood retarding basins are not designed exclusively for flood mitigation, but with multiple purposes such as farmland and amenity spaces during a non-flood time. Moreover, a part of the retarding basins would be seldom impounded (say once in five years) so that more constant land use could be made.

The proposed sites of the flood retarding basin could be placed at the current non-built up area. However, the present rapid expansion of the built-up area would possibly encroach into the eligible sites for off-site flood retarding basin when project implementation is delayed. The off-site flood retarding basins would bring about the early flood mitigation effect; hence, project implementation for the off-site flood retarding basins shall be urgently implemented in accordance with the proposed schedule.

8.2.2 Partial River Channel Improvement

The aforesaid off-site flood retarding basins could hardly protect the estuary of Imus and San Juan rivers against tidal floods. Moreover, there exits several bottleneck sections along the Bacoor and San Juan rivers which could not get rid of the river overflow solely by the off-site flood retarding basin. Due to these reasons, partial river improvement is required for the estuary section of about 5.4km in total and the bottleneck sections, which exist along the middle river stretch of 15.5km in total along the Bacoor and Julian rivers.

The structural scale for the partial river improvement could be minimized by the construction of an off-site flood retarding basin in the upper reaches. However, unless the off-site flood retarding basin reduces the peak flow discharge, river overflow will often occur along the river improvement section, which leads to the destruction of the river dike. From these viewpoints, the off-site flood retarding basin has to be a precondition for the execution of partial river channel improvement works.

8.2.3 On-Site Flood Retarding Basin

As long as urbanization makes progress in the upper reaches, the basin peak flood runoff discharge would continue to increase. It is, however, virtually difficult to gradually increase the structural size of the off-site flood retarding basin to meet the said continuous increment of basin peak runoff discharge. Over or under-structural size of the off-site flood retarding would be made when the structure is designed in consideration of the future increment of peak runoff discharge.

Under the above circumstance, construction of the on-site flood regulation pond is proposed. The on-site flood regulation pond could be progressively constructed in accordance with the expansion of urbanization to properly offset the increment of peak runoff discharge inflicted by the urbanization.

8.2.4 Inland Drainage Improvement

Inland drainage improvement works have to be made in the existing densely populated area, and this would require an enormous project investment cost of more than 6,300 million pesos and a large number of house relocations of more than 300 houses. Under the circumstances, the works would require a longer project implementation period and the EIRR of less than 6%. Taking the huge project cost, large number of house relocations and low value of EIRR, the design scale for drainage improvement is set at 2-year return period as the minimum requirement, and the proposed improvement works are limited to construction of the priority structures for the critical areas.

8.3 Evaluation and Recommendation on the Nonstructural Project Component

The nonstructural project component could bring about the early effect of flood mitigation with less cost of implementation as compared with the structural project components and, at the same time, it could contribute to a certain range of flood mitigation effect for every scale of flood. From these points of view, the execution of non-structural project components is recommended. A part of the non-structural components has been preliminarily implemented as the pilot project in the Study.

8.3.1 Control of Excessive Land Development

The plan of land use control possesses two main themes; namely, the urban growth management and the adaptation of on-site flood regulation pond for each of the new subdivisions. Urban growth management is recommended to prevent the increment of basin flood runoff discharge and preserve the necessary farmlands. The ordinances for both the urban growth management and the aforesaid on-site flood regulation pond were prepared through the Study. However, activities for their legislation are still in progress. Besides, consensus building among the stakeholders is further required for the early enforcement of the ordinances. Moreover, the LGUs are required to prepare the “Implementation Rules and Regulations” for the ordinances and establish the institutional setup for screening/approval of applications for land development. To achieve this requirement from the LGUs, further technical assistance from JICA is deemed necessary as proposed by the Provincial Government of Cavite.

8.3.2 Community-based Flood Mitigation

The community-based flood mitigation is directed towards two themes; namely, (1) Information and Educational Campaign (IEC) for cleanup of the waterways; and (2) promotion of a community-based flood warning and evacuation system. The pilot projects for these two themes had been executed in collaboration with the relevant local government agencies, the NGOs, the residents and the JICA Study Team. The practices examined in the pilot projects have to be made repeatedly and expanded to a wider range of residents. From this point of view, it is recommended that the LGUs should continue the practices learned even after completion of the Study. The initiative of the FMC, in particular, would be essential to sustain the practices for the community-based flood mitigation system. Moreover, further technical assistance would be preferable for developing the hazard map, in particular, as proposed by the Provincial Government of Cavite.

8.3.3 Management of River Area

The boundary of the river area has not yet been clearly defined and this will cause difficulties in executing the river area management. Since the boundary has not been clearly defined, intensive encroachment into the river corridor has progressed. To control the encroachment, the proper river area management shall be made based on the clear definition of the river area boundary and development of the database on the updated status of the river area. The format of the database together with data input for Imus River had been provisionally made in the Study. The FMC is required to appoint the implementing agency to undertake further development of the database.

8.3.4 Activation of Flood Mitigation Committee

The FMC had been preliminarily established to take initiatives for the community-based flood mitigation and other activities which should be under the jurisdiction of the LGUs. The organizational setup of the FMC is, however, based on the recommendations by the Study Team and has not been adequately deliberated by the LGUs themselves. Due to such immature status of the FMC, only a few members of FMC had participated in the activities and many of the members are still to be nominated. The LGUs shall review the existing organizational setup of the FMC and work for the early issuance of an Execution Order including the budgetary arrangement to sustain the activities of FMC.

8.4 Recommendation on the Project Execution Body

Implementation of the proposed structural project components other than the on-site flood regulation pond would require an enormous project cost of several billion pesos, and the eligible project implementation body for them has to be solely the DPWH judging from budget affordability. However, the LGUs shall take the supportive works on land acquisition including identification of the project affected persons (PAPS), consensus building of the PAPs for relocation, preparation of the relocation site, and support of the social rehabilitation/income rehabilitation for the PAPS. The LGUs are also required to undertake the aforesaid non-structural flood mitigation works, which include the control of excessive land development, the IEC for cleanup of waterways, the community-based flood warning and evacuation system, and all other community-based flood mitigation works.

8.5 Recommendation on Environmental and Social Consideration

The overall flood mitigation plan proposed in the Master Plan Study would require the house relocation of 470 families based on the target project completion year of 2020. To achieve such large-scale resettlement, the relocation action plan (RAP) has to be formulated and implemented without delay in accordance with “the Land Acquisition, Resettlement and Indigenous Peoples Policy of the Department of Public Works and Highways (DPWH),” In the execution of RAP, the operation for “Census survey-cum-structure Tagging (C/T)” shall be performed to identify the PAPs and restrain the illegal settlers from encroaching into the project site.

The overall flood mitigation plan also requires cleanup of the existing mangrove forest of about 4.1 hectares due to river channel improvement around the estuary and construction of the coastal dike. To mitigate the impact to the mangrove forest, it is required to formulate and implement a plan to transplant and/or regenerate the mangrove forest.

Of the project components in the overall flood mitigation plan, construction of the three off-site flood retarding basins is selected as the priority project component which is targeted for completion in 2013. The number of families to be relocated by the project is limited to twelve (12) families. LGUs in collaboration with the NGOs shall properly formulate and implement the RAP even for such small number of the families to be relocated. It is herein noted that the priority project would not affect any mangrove forest and other rare fauna/flora.

8.6 Implementation Program

The execution period as well as the necessity of foreign technical/financial assistance for each of the proposed programs is proposed, taking the project cost required and the validity of foreign technical/financial assistance into account, as shown below:

Table 24 Overall Project Implementation Program

Scheme	Execution Period	Foreign Assistance*	Present States
I. Program for Flood Mitigation before 2020			
1. Structural Project Componenst			
1.1 Priority Project (Short Term Project)			
(1) Imus Flood Retarding Basin (RB-I1)	2010-2013	Required	Proposed
(2) Bacoor Flood Retarding Basin (RB-B4))	2010-2012	Required	Proposed
(3) Julian Flood Retarding Basin (RB-J1)	2010-2013	Required	Proposed
(4) Compensation	2010-2012	-	Proposed
1.2 Long Term Project			
(1) Partial River Improvement for Imus, Bacoor and Julian	2014-2018	Required	Proposed
(2) Imus Flood Retarding Basins (RB-B1, B2, B3)	2013-2016	Required	Proposed
(3) Partial River Improvement for San Juan and Ylang-Ylang	2015-2019	Required	Proposed
(4) San Juan Flood Retarding Basins (RB-S1, Y1, Y2)	2017-2020	Required	Proposed
(5) Inland Drainage Improvement	2011-2019	Required	Proposed
(6) Compensation	2011-2018	-	Proposed
2. Non-structural Project Components			
2.1 IEC on Cleanup of Waterways			
(1) Pilot Project	2007-2008	Required	Completed
(2) Expansion Program	2009-Onward	-	Projected
2.2 Land Use Control			
(1) Legislation of Ordinances for Urban Growth Management	2007-2009	-	On-going
(2) Legislation of Ordinance for On-site Flood Regulation Pond	2007-2009	-	On-going
(3) Review of CLUP	2007-2010	-	On-going
(4) Review of PPFP	2009-2010	-	Proposed
(6) Organizational and Human Resource Development by Study Team	2007-2008	Required	Completed
(7) Organizational and Human Resource Development by the LGUs	2009-Onward	-	Proposed
2.3 Management of River Area			
(1) Establishment of Boundary for River Area	2008-2009	-	Proposed
(2) Development of Database of River Area	2008-2010	-	Proposed
(3) Formulation and Execution of the Management Plan	2009-Onward	-	Proposed
2.4 Community-based Flood Warning and Evacuation			
(1) Setup of Local Disaster Coordinating Council	2007-2009	-	On-going
(2) Formulation of Calamities and Disaster Preparedness Plan	2007-2009	-	On-going
(3) Establishment of Disaster Operation /Evacuation Centers	2008-2009	-	On-going
(4) Development of Flood Hazard Map	2008-Onward	Required	On-going
(5) Development of Hydrological Gauging Network	2008-2010	Required	On-going
(6) Training for Flood Warning and Evacuation	2007-Onward	Required	On-going
II. Program of Adaptation for Climate Changes after 2020			
1. Structural Measure			
1.1 Expansion of the off-site food retarding basins	Indefinite	Required	Conception
1.2 Expansion of the drainage network for eastern drainage area	Indefinite	Required	Conception
1.3 Construction of drainage pump in Kawit Municipality	Indefinite	Required	Conception
1.4 Expansion of the coastal dike along Noveleta、Rosario、Tanza	Indefinite	Required	Conception
2. Non-structural Measure			
2.1 Establishment of a monitoring and execution body for climate changes	2021		Conception
2.2 Revision of the ordinances for Urban Growth Management (Review on the zoning for urban development)	Indefinite	Required	Conception
2.3 Redefinition of the river area boundary and readjustment of the land use in the river area	Indefinite	Required	Conception
2.4 Strengthening of the flood warning and evacuation system	Indefinite	Required	Conception

*: Include the technical and financial assistance

Chapter 1. Introduction

1.1 Objectives of the Feasibility Study

The main themes to be discussed in this Volume are the Feasibility Study on the priority components of the Project selected in the Master Plan, and the capacity development for Philippine counterpart as the continuation activities of the Master Plan Study.

The above priority components of the Projected selected in the Master Plan include those by the structural measures and the non-structural measures, and the Feasibility Study are made on these structural and non-structural components. The detailed objectives of the Feasibility Study on these structural and non-structural components are as enumerated below:

(1) Objectives of the study on the structural components are addressed to clarify the technical and economical viability of the off-site flood retarding basins in Imus river basin, which are selected as the priority project component,

(2) Objectives of the study on the non-structural components covers the following items:

- To conduct the pilot project for Information and Education Campaign (IEC) on the cleanup of the waterway in the several municipalities,
- To develop the prototype of the database for the river area the base for management of the river area,
- To support the legal arrangement for execution of the ordinances on the zoning of the urban area and construction of offsite flood regulation pond, and
- To conduct the pilot project for development the prototype of the flood hazard map and transfer the knowledge on the flood warning and evacuation to the relevant stakeholders.

1.2 Location of the Priority Components Examined in the Feasibility Study

The target area of the Master Plan Study covered three river basins; namely, Imus, San Juan and Canas, which encompass a total area of about 407.4km^2. Of the three river basins, Imus river basin is selected as the target area of the priority components of the Project by the structural measures. On the other hand, the priority components for the non-structural measures cover the entire target area of the Master Plan in principal. However, the pilot project for IEC on the clean up of waterways and development of flood hazard map are focused to the municipalities located in the low land area in Cavite Province such as Bacoor, Kawit, Noveleta, Rosario and Tanza.

1.3 Study Schedule

The Feasibility Study was made for 12-month period from January to December 2008. The Draft Final Report is to be submitted in January 2009 compiling all of the results of Feasibility Study as well as the Master Plan Study and the submission of the Final Report is scheduled on February 2009, after reflecting the comments on the contents of the Draft Final Report.

1.4 Composition of the Final Report

The Final Report is to be submitted as the final product of the Study containing (i) the proposed optimum flood mitigation measures proposed in the Master Plan, (ii) the proposed priority project examined in the Feasibility Study and (iii) the results of the capacity buildings undertaken throughout the study period. The Final Report consists of the following four volumes:

Table R 1.1 Composition of the Final Report

Volume No.	Title	Contents
Volume 1	Master Plan Study	The executive summary on the results of the entire study and the results of the Master Plan Study
Volume 2	Feasibility Study (This Report)	The results of the Feasibility Study and the capacity development for the counterpart personnel as well as other stakeholders undertaken throughout the entire study period.
Volume 3	Adaptation to Climate Changes	The results on the study on the future possible climate changes in the Study Area and the eligible structural and non-structural flood measures to be adapted to them.
Volume 4	Appendix	The inventories of existing infrastructures, the guidelines/manuals, the basic data sheets related to the Study