Chapter 9. Non-Structural Flood Mitigation Plan

9.1 Overview of Eligible Measures

As described in Chapter 7, the non-structural flood mitigation plan is one of the important compositions of the comprehensive flood mitigation plan and play an important role for flood mitigation as good as the structural plan. The non-structural measures are broadly classified into three categories according to the functions required of them (see Table R 9.1).

Table R 9.1 Eligible Non-Structural Flood Mitigation Measures

Classification	Measures
(1) Measures for Securing of Flow of Waterways (To maintain the flow capacity of river/drainage channel and safely convey the flood discharge to the sea.)	▪ Cleanup of Waterway ▪ Prevention of encroachment to river area
(2) Measures for Retaining of Basin Runoff (To maintain the retention capacity of the river basin and stop the increment of basin peak flood runoff discharge.)	▪ Control of excessive land development ▪ Legal arrangement for introduction of on-site detention facility
(3) Measures for Flood Evacuation (To mitigate flood damage through capacity building for dealing with floods.)	▪ Establishment of flood warning/evacuation system and flood hazard map

The above non-structural measures could be attained only if the local governments and communities acknowledge the necessity of the measures and participate in the plan formulation, implementation and monitoring/evaluation of the measures. From this viewpoint, a variety of approaches to the local governments and communities are taken during the Master Plan Study such as opening of public consultation meetings/workshops, questionnaire surveys with the communities. As the result of these approaches, the plan for non-structural measures is proposed, as described below.

9.2 Plan for Cleanup of Waterways

9.2.1 Plan for Regular Maintenance of Critical Bottlenecks

The JICA Study Team had carried out field reconnaissance and interview surveys with the residents on the clogging of waterways by garbage and other drifting materials. As the result, it was clarified that most of the plastic and other garbage floating in the waterways tend to be flashed away during flood. However, there exist 14 critical bottleneck bridge sections and 6 drainage channels, which often cause river-overflow flood due to clogging by garbage, other drifting materials and sediment deposits (refer to Table R 9.2 and Fig. 9.1 attached).

Table R 9.2 Number of Bottlenecks Clogged with Garbage and other Drifting Materials

Classification of River and Drainage Channel	Name of River/Municipality	Number of Bridges and Drainage Channels
Bottleneck Bridge Sections	Imus River (Mainstream)	1
	San Juan River (Mainstream)	1
	Canas River (Mainstream)	1
	Bacoor River (Tributary of Imus)	2
	Julian River (Tributary of Imus)	2
	Malamok River (Tributary of San Juan)	4
	Tirona River ((Tributary of Canas)	1
	Others (Canal and Drainage Main)	2
	Sub-total	14
Drainage Channels Habitually Clogged	Bacoor	1
	Kawit	1
	Noveleta	1
	Rosario	2
	Tanza	1
	Sub-total	6
Total		20

As described in Subsection 6.4.2, the illegal garbage damping would be reduced by the operation of new provincial-wide solid waste disposal systems. Nevertheless, it is virtually difficult to eradicate such illegal garbage dumping due to the lax discipline and incomplete coverage of the public garbage collection system. Moreover, there is no sizable forest area in the Study Area, and driftwoods or plants could flow down from various bushes scattered therein. Due to such conditions, it is also virtually difficult to stamp out such driftwoods/plants by a certain measure for forest conservation and/or watershed management. Thus, it is indispensable to remove the garbage and drifting materials accumulated at the above bottlenecks before the occurrence of every flood. At the same time, the plan on reformation of the particular bottlenecks may be required to avoid the accumulation of garbage and drifting materials. From these points of view, the following works for the maintenance of waterways are proposed.

(1) Flood Mitigation Committee (FMC)

The Flood Mitigation Committee (FMC) as proposed in Section 11.4.2 should coordinate and supervise the entire programs prepared and the actual field works executions by the relevant members. The FMC should further coordinate and arrange the necessary annual budget for execution.

(2) DPWH District-Office in Trece Martires

The DPWH District-Office in Trece Martires as the member of FMC should undertake the monitoring and removal of garbage and driftwood at the bridge sections of the national road. At the same time, the DPWH is required to de-clog the drainage channels along the national road, which are habitually clogged up. The objective bridge sections and drainage channels are as enumerated in Tables R 9.3 and R 9.4.

Table R 9.3 Objective Bridge Sections for Regular Removal of Garbage and Drifting Materials

No.*	Name of Bridge	Name of Waterway	Municipality
1	Tejero Bridge	Canas River	General Trias
2	Ylang-Ylang Bridge	Sun Juan River	Noveleta
3	Imus Bridge	Imus River	Imus
5	Panapaan Bridge in Barangay Panapaan IV/VI	Bacoor River	Bacoor
9	Bridge in Barangay Marulas/Tramo Bantayan	Malamok River	Kawit
10	Bridge in Barangay Gahak/Medicion II-F	Malamok River	Kawit/Imus
11	Bridge in Barangay Gahak/Pag-AsaIII	Malamok River	Kawit/Imus
12	Bridge in Barangay Gahak & Tabon I	Tributary of Tirona	Kawit
13	Malimango Bridge in Barangay Salcedo II	Dr-8 Drainage Main	Noveleta

* The number. is the same as that indicated in the location map, Fig. 9.1 attached.

Table R 9.4 Objective Drainage Channels for De-clogging

No.*	Name of Drainage Channel	Municipality	Barangay
17	Road Drainage along Tirona Highway	Bacoor	Mabolo II/Dulong Bayan
18	Road Drainage along Kawit Loop Road	Kawit	Marulas
19	Road Drainage along Manila-Cavite Road	Noveleta	San Rafael
20	Road Drainage along Noveleta-Naic-Tagaytay Road	Rosario	Silangan I

* The number is the same as that indicated in the location map, Fig. 9.1 attached.

The principal work items of the above objectives are as enumerated below.

- Annual implementation programs should be prepared and submitted to the FMC at the beginning of every fiscal year for approval.
- Accumulation of garbage, driftwoods and sediment deposits should be checked after every flood. Regular monitoring also should be made once a week during the rainy

season from May to October and once a month during the dry season from November to April.

- Once piling of garbage and driftwoods at the bridge sections and/or sediment deposit at the objective drainage channels are detected, their immediate removal is required. The Provincial Engineer's Office (PEO) may support, through coordination with FMC, the removal works, when heavy equipment such as backhoe and truck are required for the removal.
- Certain infrastructure measures for bridge substructure should be planned and adopted to prevent garbage and driftwoods from being entangled in the bridge piers.

(3) Cities/Municipalities and Barangays

Offices of City/Municipal Engineers (CEO or MEO) in collaboration with the barangays and communities should undertake monitoring and removal of garbage, driftwood and sediment deposits at the bottleneck sections and/or drainage channels in their own jurisdiction areas, as listed in Tables R 9.5 and R 9.6.

Table R 9.5 Objective Culvert and Bridge Sections for Regular Removal of Garbage and Drifting Materials

No.*	Name of Bridge	Name of Waterway	Municipality
4	Culvert in Barangay Habay II/ I	Tributary of Bacoor	Bacoor
6	Culvert in Barangay Mambog I	Bacoor River	Bacoor
7	Bridge in Barangay Taclong II-B/II-A	Julian River	Imus
8	Bridge in Barangay Medicion II-A & II-B	Julian River	Imus
14	Ligtong Bridge in Barangay Ligtong III	NIA Irrigation Canal	Rosario

* The number is the same as that indicated in the location map, Fig. 9.1 attached.

Table R 9.6 Objective Drainage Channels for De-clogging

No.*	Name of Drainage Channel	Municipality	Barangay
15	Drainage Main in Barangay Sapa IV	Rosario	Sapa IV
16	Drainage Main in Barangay Julugan I	Tanza	Julugan I

* The number is the same as that indicted in the location map, Fig. 9.1 attached.

The principal work items of the above objectives are as enumerated below.

- Annual implementation programs should be prepared and submitted to the FMC at the beginning of every fiscal year for approval.
- The progress of accumulation of garbage, driftwoods and sediment deposits should be monitored after every flood. Regular monitoring also should be made once a week during the rainy season from May to October and once a month during the dry season from November to April. Once piling of garbage and driftwoods and/or sediment deposits is detected, their immediate removal is required.
- Installation of signboards and barriers/grills (strainers) should be considered as one of the eligible measures at points of intensive garbage dumping.
- Each barangay should organize a regular patrol team to check the intensive garbage dumping.

9.2.2 Plan for Information and Education Campaign on Cleanup of Waterway

According to the results of the "Flood Damage and Social Survey" in the Study, about 6% of the residents answered that they dump their garbage into the waterway, as reflected in the table below.

Table R 9.7 Garbage Disposal Practices

Garbage Disposal Practices	Formal Residents		Informal Residents		Total	
	Persons	Share	Persons	Share	Persons	Share
Follow the garbage collection rule	69	63.3%	31	42.5%	100	54.9%
Drop garbage at designated place but not on designated date	22	20.2%	21	28.8%	43	23.6%
Dump the garbage into the nearby the waterway	**3**	**2.8%**	**8**	**11.0%**	**11**	**6.0%**
Burn the garbage	12	11.0%	10	13.7%	22	12.1%
Bury the garbage	1	0.9%	1	1.4%	2	1.1%
Ask somebody to take the garbage	2	1.8%	2	2.7%	4	2.2%
Total	109	100.0%	73	100.0%	182	100.0%

Source: Flood Damage and Social Survey made in the Study

Some reasons for the above garbage dumping into the waterways may be attributed to the inadequacy of public garbage collection system, while the others are due to the lax discipline of residents. In order to raise the awareness of residents on the necessity of cleanup of waterways, it is proposed to strengthen the Information and Education Campaign (IEC) based on the ongoing "Oplan Linis Cavite" and the other relevant programs undertaken by cities/municipalities and communities. The proposed programs should include the following contents:

(1) Themes of the IEC

The themes of the IEC should address the following items related to the cleanup of waterway and further reduction of household wastes:

- Introduction of evil instances caused by garbage dumping into waterway;
- Effects and necessity of cleanup of waterway;
- Methods of cleanup of waterway;
- Institutional setup required for cleanup of waterway;
- Present regulations and penalties on illegal garbage dumping; and
- Necessity and methods of segregation and recycling of household waste.

(2) Required Activities of the IEC

The Executive Committee and the Technical Working Groups of Oplan Linis Cavite have been organized at provincial and city/municipal levels. The City/Municipal Technical Working Group regularly executes several items of the IEC relevant to the cleanup drive through coordination and support from the Provincial Executive Committee.

The FMC should coordinate with the above Executive Committee of Oplan Linis Cavite in the planning of the annual programs of the IEC addressing particular issues on the cleanup of waterways. Based on the annual programs, the City/Municipal Technical Working Group of Oplan Linis Cavite in collaboration with FMC should undertake the following activities:

- Conduct of seminars and/or workshops
- Preparation and distribution of periodicals and publications
- Installation signs along the riverbanks; and
- Conduct of regular field practices on the cleaning of waterways, greening and planting along the riverbanks. (Involvement of academes, Rotary Clubs and other private resources should be attempted.)

In order to materialize the above activities and further strengthen the ongoing IEC, pilot projects will be undertaken in January to February 2008 as part of the scope of the Study in collaboration with the NGOs and the local government units. Details of the pilot project are as described in Subsection 9.2.5.

9.2.3 Plan for Capacity Development

One of the important issues on the cleanup of waterways and/or reduction of garbage dumping should be addressed to education of leaders and the spread of appropriate knowledge on the cleanup of waterways to the residents. From this point of view, the FMC in collaboration with the Executive Committee for Oplan Linis Cavite should undertake activities through support from the academes/research centers and/or external technical assistance, as follows:

- To organize seminars/workshops to disseminate appropriate knowledge on the cleanup of waterways;
- To prepare and distribute manuals on cleanup of waterways, which should contain procedures/methods and identification of relevant stakeholders on the cleanup of waterway; and
- To conduct pilot projects to initiate capacity development on the advanced technology of segregation and recycling of household wastes.

The De La Salle University-Dasmariñas has accumulated adequate knowledge on a variety of eco-environmental issues, and should be involved as trainer for the objective capacity development. The officials of Barangay Gahak in Kawit Municipality had already acquired basic knowledge through the transfer of technology on the segregation of biodegradable wastes from household wastes and refining them into organic fertilizer through the technical assistance from JICA, and such knowledge should be further spread in the whole province.

9.2.4 Issues and Recommendations on Strengthening of Provincial-wide Solid Waste Management System

The new solid waste disposal system described in Subsection 6.4.2 would bring about a dynamic improvement on the solid waste management system in Cavite Province, effectively reducing the practice of dumping garbage into the waterways.

The Provincial Government (PG-ENRO) estimated the provincial total of household wastes at about 1,420 tons, which is to be generated by the provincial population of about 2 million. On the other hand, the final disposal site to be completed in the new solid waste system has a capacity to dispose the inert solid waste of about 4.25 million m^3, which could accommodate the said provincial total of household waste for more than a half century as listed below. Thus, the new solid waste disposable system possesses the adequate capacity for the whole house waste, which could be the major parts of the garbage damped into the river channels and/or the drainage channels.

Table R 9.8 Estimated Term of Validity of Final Disposal Site under the New Solid Disposal System

Description	Estimated Volume	Remarks
(1) Provincial Total Weight of Household Waste	1,420 ton/day	Estimated by PG-ENRO
(2) Provincial Total Volume of Household Waste	947 m^3/day	(1) / 1.5 ton/m3
(3) Volume of Waste Transported to Final Disposal Site	189 m^3/day	(2) x 20%
(4) Disposal Capacity of Final Disposal Site	4,250,000 m^3	85ha （area）x10m（Depth) x 50%
(5) Term of Validity of Final Disposal Site	61 years	(4) / (3) /365 days

The above new solid waste disposal system is, however, planned on the premise that the end collection of garbage is to be made by the present haulers operated by the cities and municipalities.

The volume of household wastes in the Study Area is estimated at about 1,080 ton/day assuming the population of 1.54 million in the Study Area and the per-head garbage volume of 700g/day/person. On the other hand, the number of haulers currently operated in the Study Area is only 75 units, so that one hauler needs to collect the household wastes of 14 ton/day (=1,080 ton divided by 75 units), which is considered to be beyond the capacity of the hauler[1]. Moreover, some of the municipalities such as Bacoor, Indang and Silang possess fewer haulers as compared to the daily volume of household wastes. Accordingly, it would be difficult to fully collect all household wastes and eradicate the present illegal

[1] The utmost hauling capacity of a 4-ton track is assumed at about 8 tons (=2ton/cycletime multiplied 5 times).

garbage damping in to the river channel and/or drainage channels unless the cities and municipalities increase the number of their operating haulers. Under the circumstances, therefore, the cities and municipalities would need to cope with their inadequate capacity on garbage collection, although it may not be easily made due to budgetary constraint. Measures such as the collection of fees for the collection of garbage from the residents may be considered.

Table R 9.9 Present Capacity for Garbage Collection by Cities/Municipalities

City/ Municipality	(1) Population (Thousand)	(2)* Daily Volume of Household Wastes (ton/day)	(3) Number of Present Haulers of Garbage	(4) (2)/(3) (ton/day/unit)	(5) Frequency of Collection
Bacoor	306	214	6	36	Daily
Kawit	63	44	3	15	Daily
Noveleta	32	22	3	7	Daily
Rosario	74	52	3	17	Daily
Trece Martires	42	29	4	7	Daily
Dasmariñas	380	266	15	18	Once a week
Gen. Trias	108	76	9	8	Twice a week
Imus	195	137	14	10	Once a week
Tanza	111	78	15	5	Every other day
Amadeo	26	18	1	18	3 times a week
Indang	51	36	0	-	-
Silang	156	109	2	55	3 times a week
Total	1,543	1081	75	14	

* (2) = (1) multiplied with 700g/day/person
Source (for (1), (3) and (5)): Provincial Government of Cavite

9.2.5 Plan for the Implementation of Pilot Project

In order to materialize the afore-said IEC and other activities relevant to the cleanup of waterways, two pilot projects are to be implemented through the Study for the period from January to February 2008. The expansion program for the pilot project would be further proposed in the Feasibility Study Stage in 2008. The details of the pilot project as well as the expansion plan are as described below.

(1) Proposed Plan of Pilot Project for the Municipality of Imus

As mentioned above, the Municipality of Imus had organized a team for the "Save Imus River Rehabilitation Project (SIRRP)" in 2005, and since then, various programs of IEC for the cleanup of Imus River have been carried out. The project team composed of the government and non-government members is headed by the Vice Mayor of Imus Municipality. The NGO named "Sagip-Ilog Cavite Council" acts as secretariat of the team.

In the Fist Phase of the SIRRP, the initial education campaign, socio-economic profiling, sedimentation and vegetation studies and water analysis have been accomplished. The Pilot Project supported by the JICA Study Team will form the second phase of SIRRP, which targets 29 barangays along the almost 20-km length of Imus River and include the following activities. The detailed schedule of the Pilot Project for Imus is as shown in Table 9.1 attached.

- The module materials on the river cleaning activities will be developed for future trainers. The materials aim at enhancing their capability to come up with more acceptable training materials, and they contain the knowledge on protection, conservation and preservation of the river.
- Indoor and field trainings on river cleaning will be undertaken for the above-mentioned 29 target barangays.
- Nursery planting will be undertaken along river banks based on the concept that it will serve as the buffer and natural riprap for the riverbank.

(2) Pilot Project for the Municipality of Kawit

The NGO named "The Kawit Sagip-Ilog & Anti Flood Group" is currently undertaking an IEC for the cleanup of waterways as well as actual field cleaning activities in the Municipality of Kawit. As the result of discussions between the NGO and the JICA Study Team, the execution of the following items is proposed as the programs of the Pilot Project. The detailed schedule of the Pilot Project for Kawit is as shown in Table 9.2 attached.

- Comic reading materials to promote the importance of river cleaning will be prepared and distributed to the residents of the 12 to 15 barangays along the river channel in Kawit.
- Seminars/workshops on river cleaning will be held about 10 times. Attendance in the seminars/workshops will involve both the formal and informal dwellers in the aforesaid barangays.

(3) Expansion of Community-Based Activities on Cleaning the Waterway

There are many municipalities in the Study Area where the cleaning of waterway is still not practiced. In this connection, an attempt will be made to expand the activities of the pilot projects. The target municipalities for the expansion of activities are preliminarily assumed as Rosario, Noveleta, General Trias, Tanza, Bacoor, Trece Martires, Dasmariñas and Silang.

9.3 Prevention of Encroachment to River Area

Presidential Decree No. 1067 prescribes that the water body of the river together with the river corridor within the distance of 3m in urban area, 20m in agricultural area and 40m in forest area from the edge of the water body should be designated as the river area, where nobody is allowed to reside. In spite of such prescription, there exist a large number of informal and formal settlers in the subject river areas. Moreover, the encroachment of houses on the riverside tends to be more intensive as the urban population increases. These houses are a great hindrance to flood flow in the river channel and at the same time, exposed to the high risk of floods, and no structural flood mitigation measure could be applied due to the topographic conditions as well as the legislative constraint. To cope with these issues, a plan for management of the river area, which would function to prevent further increment of illegal structures in the river area and create more appropriate environment of the river area, is proposed.

9.3.1 Proposed Boundary of River Area and Existing Houses in the Proposed River Area

There exist the arterial and/or secondary roads, which form the river dike along a part of the river sections of Imus, San Juan and Canas. Parapet walls of less than 1.5m in height were further constructed along a part of downstream stretch of the rivers. The riverine area confined by these roads and/or parapet wall could be defined as the river area.

However, a substantial part of the downstream sections of the rivers have no definite riverbank, and their flow widths largely change depending on the magnitude of discharge, which leads to the uncertainty on the river area's boundary. Accordingly, a clear definition of the river area and the delineation of boundaries of the river area would be essentially required for the no-riverbank sections in particular to cope with the encroachment of houses into the river area. From this viewpoint, the JICA Study Team preliminarily proposes that the river area should cover the water body and river corridor as defined by the following items (1) and (2) (refer to Figs. R 9.1):

(1) The Water Body: the riverine area confined by the river dike/bank, if they exist, should be defined as the water body. In case of difficulties in recognizing the clear river dike/bank, the water body should be assumed as the potential waterway of floods with the recurrence probability of 2-year return period.

(2) The River Corridor: In accordance with Presidential Decree No. 1067, the river corridor should have the widths of 3m in an urban area, 20m in an agricultural area and 40m in a forest area from the outward bound of the above water body.

The majority of houses in the river area as defined above concentrate along the downstream section of the river in the urban area shown in The majority of houses in the river area as defined above concentrate along the downstream section of the river in the urban area shown in attached Fig. 9.2 through the non-uniform calculation method assuming that the flood discharge is of 2-year return period.

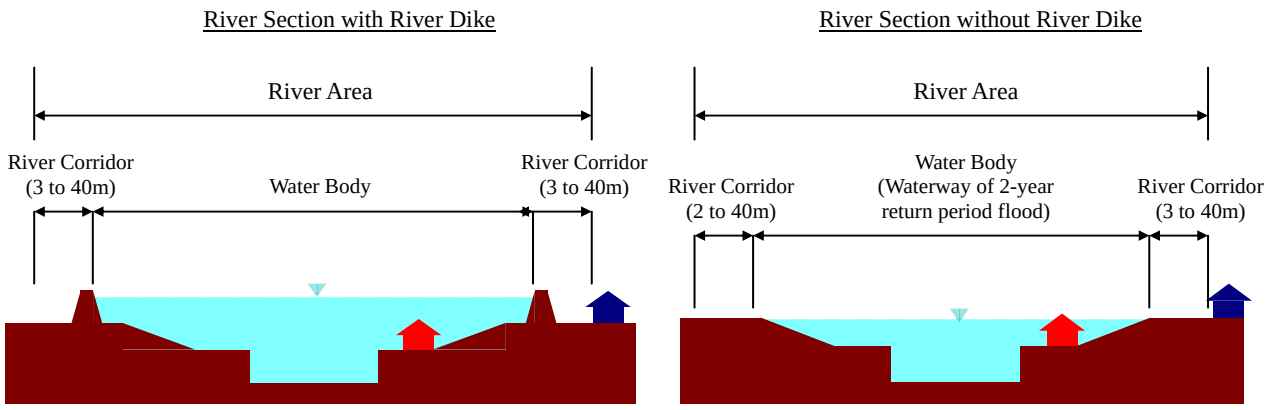


Fig. R 9.1 Concept of River Area

Photo: Encroachment of Houses in River Area

9.3.2 Existing Houses in the River Area

The water body, a part of the river area, is the flow section of the river and no structural measure could protect the houses in the water body against flood. The river corridor, another part of the river area, is also necessary as the buffer for maintenance of the river channel. Accordingly, prevention of further increment of houses in the river area is firstly raised as one of the important issues on flood mitigation with non-structural measures.

The cities and municipalities are required to inventory the houses in the river area and refrain the further increment of houses in accordance with the relevant acts and regulations such as (1) the Urban Development and Housing Act of 1992; (2) the Implementation Rules and Regulations (IRR) Governing Summary Eviction, 1993; and (3) Executive Order No. 93, Series of 2007, Office of the Governor, Province of Cavite.

According to the above acts and regulations, the objective houses to be inventoried are classified into the following groups: (1) informal and formal dwellers according to ownership of land titles; and (2) beneficiaries and non-beneficiaries of the Social Housing Program. The inventory-survey of each group is required as the basis for management of river area, and the results of the inventory survey should preferably be compiled in the form of a digitized cadastral map so as to facilitate updating and administrating the progress of relocation.

9.3.3 Plan for Management of the River Area

Presidential Decree No. 1067 designated DPWH as the responsible agency to manage all rivers in the country. On the other hand, Republic Act 7160 (the Local Government Code-1991) allows the local government units to take part in flood mitigation projects, which may include the management of the river area. Furthermore, NIA implements flood control works to protect farmlands as well as irrigation facilities.

Thus, various national and local government units are currently engaged in the management of the river area, but no definite role and demarcation have been setup regarding management. In this connection, proposed are the following plans for management of the river area:

(1) Development and Updating of Database of the River Area

The database of the river area should be developed as the base of maintenance and management of river area. The objective of the database would need to cover the information on updated number and location of houses in the river area as well as the major river structures such as the river dike/revetment, river bridges and dams/weirs for irrigation intake.

Of these objectives, the major river structures have been inventoried through the Study. The cities and municipalities in the Study Area are also currently developing the inventory on informal dwellers in their jurisdiction for the sake of relocation. Based on the presently available information, the roles and authorities of the government agencies on the development of the database of the river area are preliminarily proposed as below:

(a) The FMC should develop an integrated form for the development of database of the river area and further coordinate the works to be undertaken by the cities/municipalities as mentioned below.

(b) The cities and municipalities should complete the objective database for each of their jurisdictions in accordance with the above integrated form of database. The objective database should be based on the presently available information and the results of the additional inventory survey on houses and landownership in the river area. The cities/municipalities are also required to update the database whenever a new river structure is constructed or relocation of houses from the river area has progressed.

(c) The provincial offices of DPWH as well as NIA should provide the necessary information on their own river structures to the FMC to facilitate compilation of the objective database by the cities/municipalities.

(2) Relocation of Informal Dwellers in River Area

The task force named “Provincial Drive against Professional Squatting and Squatting Syndicates” headed by the Provincial Housing & Urban Development Office and the Provincial Legal Service Office shall prepare and execute the annual program for control of further encroachment of houses into the river area in collaboration with FMC.

(3) Land Zoning

The land zoning aims at establishing the proper land readjustment of the river area, which could promote public interest on the environment of the river area, ensuring the safe flow of river floods and preventing the re-occupancy of the river area after the relocation of houses. The land uses applicable as the objectives of the zoning plan shall be such as river parks, sports ground, river walk lanes, and biotope providing a living place for a specific assemblage of vegetations and animals. To achieve such land readjustment, the City/Municipal Planning and Development Office (CPDO/MPDO) shall undertake the following works:

- Integrate and appraise all land zoning plans prepared by the cities/municipalities for the river area cleanup; and
- Coordinate and arrange the necessary annual budget for implementation of the land-zoning plan for the river area.

(4) Maintenance of River Area

The works required of the relevant government and non-government entities are as described below.

(a) The FMC shall undertake the following works through coordination with the city/municipal government, the provincial offices of DPWH and NIA, and other relevant government agencies, as follows:

- Prepare the annual program of maintenance of river area for the entire Study Area based on those prepared by the city/municipal governments and the District Engineering Offices of DPWH and NIA;
- Coordinate and arrange the necessary budget for undertakings scheduled in the above annual program; and
- Supervise and coordinate the maintenance and management works undertaken by the cities/municipalities.

(b) The cities and municipalities should undertake the following works through coordination with the barangays:

- Prepare annual programs for maintenance and management of river area within the administrative boundary of each city/municipality including those for relocation of houses from the river area, land zoning of the river area and routine maintenance of the river area;
- Supervise, administer and coordinate the routine maintenance of the river area to be undertaken barangays as mentioned in item (d) below;
- Execute information and education campaign (IEC) to promote the proper maintenance of river area and the prohibition of illegal activities in the river area such as occupancy of land and garbage dumping; and
- Organize working groups at the barangay level to execute maintenance works for the river area, as mentioned in item (d) below.

(d) Each of the barangays shall organize a team for the maintenance of the river area with the following duties and responsibilities:

- To execute river patrols to check and prevent re-occupancy of the river area by squatters, the illegal garbage dumping and other illegal activities made in the river area;
- To report illegal activities detected through river patrol to the city or municipality concerned;
- To remove weeds and/or trees in the river area once a year at the end of the dry season in April; and
- To remove garbage and driftwood detected through the river patrols.

(e) The provincial office of DPWH shall undertake the following works:

- Conduct river longitudinal and cross sectional channel surveys along the downstream reaches of the Imus, San Juan and Canas rivers, as shown in the following table, which should preferably be made along the estuary once a year after every rainy season to monitor erosion and/or sedimentation of the river channel.

Table R 9.10 Target Stretch for Periodical River Channel Survey

Name of Rivers	Length	Section
Imus	13km	Stating from the river mouth
Bacoor	8km	Stating from the confluence with Imus River
San Juan (Downstream)	8km	Stating from the river mouth of diversion channel
Ylang-Ylang (Middle)	4km	Starting from the confluence with San Juan River
Canas	9km	Stating from the river mouth
Total	42km	

- Monitor and rehabilitate damaged river structures such as river dike and revetment.

(f) The provincial office of NIA shall undertake monitoring and rehabilitation of dams and weirs for irrigation.

9.4 Plan for Control of Land Development

9.4.1 Control of Excessive Land Development

As described in Chapter 4, the comprehensive land use plans (CLUPs) prepared by the cities/municipalities suggest that the future built-up area in the Study Area will increase from 24.5% to 65.2%. Such remarkably high built-up ratio projected in CLUP is, however, hardly possible in the Study Area due to the limited area of farmlands that could be converted to built-up areas in accordance with the HLURN regulations. Moreover, the projected built-up area could accommodate the population of about 3.5 million, while the future population in the Study Area in 2020 is estimated at only 2.4 million. Thus, the built-up area projected in CLUPs is deemed to be not realistic.

A higher ratio of built-up area would possibly cause more significant degradation of the living environment including the increment of peak flood runoff discharge. Accordingly, the expansion of built-up area should be properly controlled in due consideration of the reasonable projection of the trend of socio-economic conditions. From these points of view, the future increment of population was re-examined and the built-up ratio of 42.7% is newly proposed by the Study (refer to the foregoing Subsections 4.3 and 4.4). The principal issues and necessary measures to attain the proposed built-up ratio of 42.7% are as described below.

(1) Establishment of Provincial-wide Strategic Land Use Plan

The cities and municipalities could have developed their CLUPs independently with less coordination from the provincial government and/or other cities/municipalities. As the result, the CLUPs hardly reflect the socio-economic development of the entire province and, at the same time, the provincial policy on socio-economic development hardly reflects the CLUPs.

The development of residential subdivisions has been speculatively made concentrating on the municipalities adjacent to Metro Manila such as Bacoor, Imus and Dasmariñas. Such market-oriented land development has brought out the uneven provincial-wide distribution of population/population densities. Should the present excessive development of residential subdivisions be continued, serious overpopulation in urban centers and environmental deterioration would possibly occur in the Study Area. To cope with the issues, it is indispensable to build up a more coordinative capacity of the Provincial Government with the cities/ municipalities so as to attain the following approach and adjustment:

- More detailed approach to population projection based on more realistic socio-economic projections;
- Adjustment of population growth among the cities and municipalities taking necessary arrangements for provincial-wide migration, which aims at achieving a well-balanced population distribution; and
- Adjustment for the well-balanced distribution of the built-up area.

(2) Conversion of Farmland to Built-up Area

The present dynamic expansion of built-up areas causes the serious reduction of existing farmlands leading to the decline of agricultural production and the deterioration of natural environments. Accordingly, the Provincial Government as well as the city/municipalities will be required to conserve farmlands at the allowable level as guided by HLURN.

On the other hand, a part of the existing irrigation areas along Aguinaldo Highway and Governor's Drive in particular are currently designated as the Agrarian Reform Area that should not be converted to built-up area. Most of this area is, however, currently abandoned and remain as vacant land, while the potential for urban development of the farmlands is believed to be quite high. In due consideration of the over-incremental population, it is provisionally proposed in the Study that such abandoned farmlands should be converted to built-up areas so to accommodate the excessive future population increment of the municipalities in the Study. However, this issue requires further discussions with the municipalities concerned.

(3) Remarkable Increment of Built-up Area/Mixed Land Use

The CLUPs indicate a remarkable increase in the built-up/mixed-land use area (the area for mixed industrial, commercial, residential and institutional land use) from the present coverage rate of 0.1% to the projected ratio of 41.5%. This mixed-land use would conform to the conventional or historical lifestyles (live and work at same place) and flexibly deal with any type of land use; however, it contains the following potential problems, which will wipe out the said advantages and cause more serious adverse effects:

- Efficient public investment will hardly takes place.
- The existing farmlands would be fragmented, which would lead to difficulty in developing large-scale subdivisions in the remaining farmlands. At the same time, it also causes difficulty in effectively using the farmlands and attaining a high agricultural production.
- The natural landscape would be marred.
- Serious traffic congestion would occur.

From the above viewpoints, zoning of the mixed-land use is not recommended and instead, the concept of area division to separate urban growth centers and residential areas is provisionally proposed in the Study.

The urban zoning of areas needs autonomous review by the cities/municipalities. To share a common future urbanization image of Cavite, the effort to build consensus among stakeholders is important especially among the key coordinators and decision makers - MPDC, mayors, the Governor and other elected officials. Some municipalities, such as Indang, have developed a detailed zoning for the urban core. In other city/municipalities, urban areas shall be designated for detailed zoning.

(4) Development of Human Resources and Tools for Processing of Land Use Plan

The CLUPs are hardly integrated into a provincial-wide land use plan, which causes difficulty in grasping the provincial-wide future land use situation and in reflecting the policy/strategy on the provincial-wide land development in the CLUP. The principal cause of this problem could be the inadequate organizational set-up or the inadequate human resources and tools for processing the land use plan. From this point of view, the programs for developing the organizational setup, human resources and tools are proposed, and the initial relevant trainings were made through the Study as described in Appendix-2.

(5) Exclusion of Environmentally Critical Areas from Projected Built-up Area

For spatial distribution of the built-up area, exclusion of the following environmentally critical areas from the built-up area is proposed:

- Steep sloped areas (more than 15%);
- The area specified as the Strategic Agricultural and Fishery Development Zone (SAFDZ);
- The area specified in the Comprehensive Agrarian Reform Program (CARP);
- The NIA irrigated area; and
- Habitual flood inundation areas (the probable flood inundation area of 2-year return period with the probable inundation depth of more than 25cm).

9.4.2 Legal Arrangements for the Introduction of On-site Flood Regulation Pond

Preliminarily proposed in the Study is an ordinance that would make the installation of an on-site flood regulation pond mandatory for new subdivision development projects in Cavite. Details of the ordinance are as enumerated below:

(1) Title of Ordinance: The title of the Draft Ordinance is "On-Site Flood Regulation Pond Requirement in a New Subdivision Project."

(2) Effect of Ordinance: The ordinance is to take effect within the administrative boundary of Cavite Province. Accordingly, the ordinance will be promulgated by the Provincial Governor with the approval of the Sangguniang Panalawigan (the Legislative Council) of Cavite Province.

(3) Objective Area for Application of the Ordinance: The on-site flood regulation pond is to be constructed at the downstream end of new subdivisions of more than 5ha, which shall be a tract or parcel of land registered under Act No. 496 and division partitioned primarily for residential purposes into individual lots with or without improvements thereon, and offered to the public for sale, in cash or in installment term. The requirement for on-site flood regulation pond shall include all residential, commercial, industrial and recreational areas as well as open spaces and other community and public areas in the project.

(4) Procedure for Approval of Construction of On-site Regulation Pond: The design of the on-site regulation pond is to be reviewed by a licensed engineer and approved within the procedure of subdivision permit. The approval procedure shall be in accordance with the Revised Implementing Rules and Regulations of Presidential Decree No. 957 or the Revised Implementing Rules and Regulations of Batas Pambansa No. P220 (Republic Act No. P220).

(5) Entity Responsible for the Maintenance of Regulation Pond: The owner or the owners' association shall conduct the maintenance work regularly to ensure the functions of the pond.

(6) Minimum Space of On-site Flood Regulation Pond: On-site regulation ponds shall have an area equal to or larger than three (3) percent of the total area of subdivision. Allocation of land may be inclusive of the required minimum open space of 30%, which is as stipulated in PD957. When a part or all functions of basic utilities and other community facilities/services do not satisfy the standards because of the allocation of the on-site regulation pond, the developer shall provide an additional area in addition to the 30% open space requirement within the area of subdivision project.

The draft of the ordinance is still being discussed with the stakeholders, since the additional cost of the on-site regulation pond to the development of the subdivision may deteriorate the initial intent of providing economic housing. The way to deal with the development of small-scale subdivisions of less than 5ha needs further discussion. Another issue is how to deal with the on-site regulation pond requirement within the legal frame of the National Building Code and environmental regulation at the time of building construction. These issues will be discussed and clarified in the next stage of the Study.

9.5 Plan for Flood Warning and Evacuation System

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, as described in Subsection 2.3.3. On the other hand, since

flood is a natural phenomenon, any structure for flood mitigation could hardly stamp out the flood damage. Hence, flood warning and evacuation is highlighted as one of the eligible non-structural measures against floods that exceed the design capacity of the flood mitigation structure. As described above, however, there is no consistent flood warning and evacuation system in the Study Area.

An accident occurred during Typhoon Milenyo in 2006 where a dozen of residents at the riverbank watching the overflow on the dam crest died due to the collapse of footing of the riverbank. Such a tragic accident could have been avoided if the residents were well guided through a flood warning and evacuation system. Unless certain measures are taken, casualties by flood would further increase due to complex factors such as the expansion of urban population, the progress of encroachment to the flood hazard area, and the increment of peak discharge with the expansion of built-up area in the river basin. From this point of view, the plan for flood warning and evacuation system for the Study Area is proposed in consideration of the existing activities and resources of the disaster coordinating councils in the province, as well as the cities/municipalities and barangays in the Study Area.

9.5.1 Flood Risk Area

The extent and depth of potential flood risk have been simulated in the Study (refer to Chapter 5). As a result, it was clarified that the extent of flood risk area largely changes depending on the magnitude of flood. The recent Typhoon Milenyo in 2006 caused the flood area of about 60km^2, which covers a substantial part of the low-lying area of the Study Area. The recurrence probability of the flood caused by the typhoon is almost equivalent to a 100-year return period, while even the provable flood of 2-year return period could submerge the area of about 30km^2. It was further clarified that a part of the flood risk area would have the flood depth of more than 50cm, which could cause damage to household assets and/or injury to the residents.

Based on the above clarification, the flood risk areas are preliminarily assumed as those which may be submerged to a depth of more than 50cm by a probable flood of 100-year return period. The depth of 50 cm is adopted as the critical level to do the injury to a person and the probable flood of 100-year return period is also adopted as the recoded maximum flood in the Study Area (recoded in the Typhoon Milenyo in 2006). In accordance with this assumption, the flood risk area of 1,283 ha is delineated, as shown in Fig. 9.3. The flood risk area is further divided according to the administrative boundaries of the city and municipality as listed in Tables R 9.10 and R 9.11 (refer to Table 9.3). The CDCC/MDCC and BDCC are required to undertake the necessary activities of flood warning and evacuation for each of the flood risk areas located within their respective jurisdictions.

Table R 9.11 Proposed Flood Risk Area

Municipality	Flood Risk Area in Each River Basin (Unit: ha)				
	Imus River	San Juan River	Canas River	Residual Rivers	Total
Bacoor	272	32	0	0	305
Imus	0	62	32	121	215
Kawit	99	30	0	29	158
Noveleta	58	154	0	64	276
Rosario	0	104	0	132	236
Tanza	0	58	13	0	71
G. Trias	0	0	23	0	23
Total	430	440	67	346	1,283

Table R 9.12 Number of Barangays located in the Flood Risk Area

Municipality	Number of Barangays in Flood Risk Area and in Each River Basin				
	Imus River	San Juan River	Canas River	Residual Rivers	Total
Bacoor	31	10	0	0	41
Imus	0	3	4	14	21
Kawit	31	10	0	4	45
Noveleta	5	21	0	9	35
Rosario	0	9	0	11	20
Tanza	0	13	4	0	17
G. Trias	0	0	5	0	5
Total	67	66	13	38	184

9.5.2 Step-wise Flood Warning and Evacuation Procedures

The information on flood warning and evacuation should be made based on evaluation of weather and hydrological conditions such as river water level and rainfall intensity. Earlier information may facilitate more effective flood evacuation for residents, but the early information may be more misleading in the determination of issuance of flood warning and evacuation. Frequent misleading information would decline the concern of residents on flood warning and evacuation. In order to release the earlier information for flood warning and evacuation and at the same time minimize the issuance of such misleading information, the stepwise flood warning and evacuation is proposed. The basic concept of stepwise flood warning and evacuation is as summarized below:

(1) Step-1 (Standby): The members of PDCC, CDCC/MDCC and BDCC are convened for the execution of their respective assignments when PAGASA issues the Public Storm Warning Signal No. 1 over the entire province of Cavite.

(2) Step-2 (Alert Stage): The available human resources, equipment and materials for flood warning and evacuation are checked, and the necessary river patrol would start.

(3) Step-3 (Warning Stage): The flood warning is issued to the residents to prepare for flood evacuation.

(4) Step-4 (Evacuation Stage): The order of flood evacuation is issued to the residents.

Further detailed activities required for each of the steps are proposed, as listed below:

Table R 9.13 Activities Required to Each of Steps for Flood Warning and Evacuation

Step	Required Actions
Step-1 (Standby)	• The head of PDCC convenes all members of PDCC, MDCCs and BDCCs to enter standby status. • The PDCC orders the MDCCs in charge to start measurement of river water level and rainfall intensity in the Study Area and report to PDCC. • The PDCC starts to communicate with PAGASA Synoptic Station at Sanglay Point to collect the weather conditions over the Cavite Province.
Step-2 (Alert Stage)	• All members of DCCs start to check available human resources, equipment and materials for flood evacuation. • BDCC in collaboration with the communities start river patrol in accordance with the order from MDCC.
Step-3 (Warning Stage)	• The head of PDCC issues warning to the heads of MDCCs, whose jurisdiction is to be in danger of river overflow. • BDCC in collaboration with the communities start dissemination of flood warning in accordance with the order from MDCC. • The PDCC, MDCC and BDCC position the necessary equipment, material and personnel for flood evacuation.
Step-4 (Evacuation Stage)	• The head of PDCC issues order of flood evacuation to the heads of MDCCs, whose jurisdiction is to be in danger of river overflow • The head of MDCC informs the BDCC to disseminate the order of evacuation among the residents and undertake the necessary guides/supports for residents to evacuate.

9.5.3 Hydrometeorological Conditions for Initiation of Step-wise Flood Warning and Evacuation

The principal rivers of Imus, San Juan and Canas in the Study Area have the channel length of about 40 to 50km. Their middle and upstream channels have the rather steep channel slope of more than 1/200, while the downstream below the crossing with the existing NIA irrigation channel has the gentle channel slope of less than 1/500. The areas along the downstream channels are highly populated and subject to river-overflow flood. Thus, the major target of the flood warning and evacuation will be oriented to such low land areas.

According to the hydrological simulation of flood travel time on the above river channels, the target areas for flood warning and evacuation will receive the peak runoff discharge within about 30 to 100 minutes after the peak rainfall is observed in the river basin, as listed below.

Table R 9.14 Lag Time between Peak Rainfall in the River Basin and Peak Runoff Discharge in the Lower Reaches

River Basin	Point of Simulated Peak Discharge	Lag Time (Minutes)
Imus	Crossing of NIA Irrigation Canal (Sta. 12+850)	30
	River Mouth (Sta. 0+000)	40
San Juan	Crossing of NIA Irrigation Canal (Sta. 14+400)	50
	Diversion Point (Sta. 2+960)	100
Canas	Confluence with NIA Irrigation Canal (Sta. 10+450)	60
	River Mouth (Sta. 0+00)	100

Note: The simulation is made based on the probable flood of 2-year return period

In addition to the above flood travel time, a certain extent of spare time to predict flood risk will be availed through the public storm warning information given by PAGASA and the observation of incremental rate of river water level and/or the rainfall intensity in the river basin, as described below.

(1) Hydrometeorological Conditions for Actions of Step-1 (Stand-by)

Step-1 or the standby for flood warning and evacuation shall be put into effect once PAGASA releases "Public Storm Warning Signal No. 1," which indicates that a tropical cyclone with a wide velocity of 30 to 60km/hr would prevail over the Study Area within 36 hours.

(2) Hydrometeorological Conditions for Actions of Step-2 (Alert Stage)

Step-2 or the alert stage shall be put into effect when the weather conditions and/or river conditions reach any of the following critical levels:

- PAGASA releases "Public Storm Warning Signal No. 2", which indicates that a tropical cyclone with the wide velocity of 60 to 100km/hr would prevail over the Study Area within 24 hours.
- The accumulated rainfall for 5 minutes gauged in the Study Area reaches the probable rainfall intensity of 2-year return period.

This Step will start based on the accumulated rainfall for 5 minutes, while the next Step-3 (Warning Stage) is based on the accumulated rainfall for 30 minutes. Accordingly, the minimum time duration allowed for this Warning Stage is 25 minutes, which is ruled by such accumulated rainfalls. The detailed clarifications on the accumulated rainfall are as described in Subsection 9.4.4

(3) Hydrometeorological Conditions for Actions of Step-3 (Warning Stage)

Step-3 or the warning stage shall be put into effect when the weather conditions and/or river conditions reach any of the following critical levels:

- PAGASA releases "Public Storm Warning Signal No. 3," which indicates that a tropical cyclone with the wide velocity of 100 to 185km/hr would prevail over the Study Area within 18 hours.
- The river water levels at the designated locations reach the predetermined critical level, which indicates that the river channel would take the bank-full discharge within one hour.
- The accumulated rainfall within 30 minutes gauged in the Study Area reaches the probable rainfall intensity of 2-year return period.

The minimum time duration allowed for this Warning Stage is 30 minutes, which is ruled by the difference in gauging time for the accumulated rainfalls and river water levels in this stage and the next stage. The detailed clarifications on the accumulated rainfall and river water levels are as described in Subsection 9.4.4.

(4) Hydrometeorological Conditions for Actions of Step-4 (Evacuation Stage)

Step-4 or the evacuation stage shall be put into effect when the weather conditions and/or river conditions reach any of the following critical levels:

- PAGASA releases "Public Storm Warning Signal No. 4," which indicates that a tropical cyclone with the wide velocity of more than 185km/hr would prevail over the Study Area within 12 hours.
- The river water levels at the designated locations reach the predetermined critical level, which indicates that the river channel would take the bank-full discharge within 30 minutes.
- The accumulated rainfall within 60 minutes gauged in the Study Area reaches the probable rainfall intensity of 2-year return period.

The minimum time duration allowed for this Evacuation Stage is estimated at 30 minutes taking the aforesaid flood travel time into account. The details of the above river water levels and accumulated rainfall are as described in Subsection 9.4.4

9.5.4 Technical Specification for Gauging Accumulated Rainfall and River Water Level

As described above the accumulated rainfalls and the river water levels are proposed as the boundaries to initiate each of the steps for flood warning and evacuation. The details of these accumulated rainfall and river water levels are as described below.

(1) River Water Level

The river water level would be the most definite and simple indicator to judge the possibility of river overflow. Should the lower river water level be set as the boundary to initiate the actions for each step of flood warning and evacuation, the earlier actions could be made. However, the lower river water level would cause more frequent failures in prediction of river overflow. In order to compromise such dilemma, the following assumptions are made:

- The actions to be taken in Step 3 (the Warning Stage) and Step-4 (the Evacuation Stage) would require 30 minutes at least to spare. Based on this concept, the river water level, which would emerge one hour before the river channel reaches the bank-full state, is assumed as the critically necessary indicator to initiate Step 3 (the Warning Stage). The river water level, which would emerge 30 minutes before the bank-full state, is likewise assumed as the indicator for Step-4.
- The river overflow firstly emerges out at the bottleneck section, which possesses the smallest flow capacity along the river channel. Hence, the critical water levels are set as those that cause the river flow at the said bottleneck section.
- The river overflow could initially occur in the event of the probable flood of 2-year return period in the Study Area. Taking such river channel flow capacity, the above river water levels are set based on the design hydrograph of 2-year return period.

Photo-1 Example of River Water Level Indicator for Flood Warning and Evacuation

The monitoring points for river water level shall be located in the target areas for flood warning and evacuation and at the same time, they should have easy accessibility during flood. From this point of view, several bridge sections are selected as monitoring points, and their critical water levels to initiate Steps-3 and 4 were estimated based on the aforesaid

assumptions. As the result, the following locations and their critical river water levels are proposed for the objective flood warning and evacuation.

Table R 9.15 Proposed Monitoring Locations for River Water Level and Critical Water Levels for Initiation of Steps 3 and 4 of Flood Warning and Evacuation

Location			Critical Water Level*	
River	Name of Bridge & Sta. No.	Barangay/Municipality	Step 3 (Warning)	Step 4 (Evacuation)
Imus	Binakayan (Sta. 1+950)	Balsahan-Bisita, Kawit	3.5	3.4
	Isabel II (St. 4+940)	Palico I, Imus	2.2	0.8
	Imus (Sta. 6+000)	Imus	1.0	0.7
San Juan	San Juan (Sta. 2+350)	San Juan I, Noveleta	4.0	3.2
	Noveleta (Sta. 3+280)	Polacion, Noveleta	3.7**	2.9**
	Ylang-Ylang (Sta. 4+480)	San Jose I, Noveleta	4.4**	3.3**
Canas	Tejero (Sra. 2+700)	Tejero, General Trias	8.8	8.3

* Height below bridge road surface
** Height below the top of dike

(2) Short-Term Rainfall Intensity

As described above, rainfall intensities (i.e., the cumulative rainfall of short time durations of 5 to 60 minutes) are proposed in order to secure the time duration of 25 to 30 minutes to take the necessary actions for Step-2 to 4 for flood warning and evacuation. The recurrence probability of the objective rainfall intensities is assumed at 2-year return period, which almost corresponds to the minimum river channel flow capacity of the existing river channel. Taking this recurrence probability and the aforesaid durations of cumulative rainfall for each Step of flood warning and evacuation into account, the critical level of the rainfall intensities were estimated, as listed below.

Table R 9.16 Critical Cumulative Rainfall Initiation of Steps 2, 3 and 4 of Flood Warning and Evacuation

Step	Objectives of Rainfall Gauge	Critical Level to Initiate the Step
Step 2 (Alert Stage)	Cumulative Rainfall in 5 min.	12.3 mm
Step 3 (Warning Stage)	Cumulative Rainfall in 30 min.	38.8 mm
Step 4 (Evacuation Stage)	Cumulative Rainfall in 60 min.	54.3 mm

The rainfall gauging equipment needs to be the tipping bucket type in order to catch the above short-term rainfall intensities for 5 to 60-minute duration, but all of the existing rainfall gauging equipment in and around the Study Area are the storage indicator type. Due to the present condition of gauging, the installation of three new tipping bucket type rainfall gauging equipment is proposed at the locations listed in the table below. Steps 2 to 3 shall start when any of these three gauging stations reach the critical levels shown above.

Table R 9.17 Proposed Tipping Bucket Type of Rainfall Gauging Equipment

Location	Agency to be Maintained and Operated
PAGASA Climate Station in Amadeo	PAGASA
Provincial Office of Cavite in Trece Martires City	PDCC
Municipal Office of Dasmarinas	MDCC of Dasmarinas

9.5.5 Establishment of Disaster Operation Center

Disaster Operation Centers for PDCC, CDCC/MDCC and BDCC shall be established as proposed below:

The PDCC is required to newly set up its own operation center otherwise called the “Provincial Area Coordinating Center” as prescribed in Executive Order No. 97, 2007. It is indispensable to place the Center at or adjacent to the Provincial Office in Trece Martires City so as to facilitate effective communication among the members of PDCC.

The MDCC Operation Center has been established only for the three municipalities of Imus, Kawit and Tanza, and needs to be established for the other municipalities covered by the proposed flood risk

area which include Bacoor, Noveleta, Tanza and General Trias. The Operation Center should be preferably placed at the Municipal Hall because of easier communication with the members of MDCC, but an alternative building would be required should the Municipal Hall is situated in a habitual flood inundation area.

The existing barangay hall would be in general used as the BDCC Operation Center. However, should the barangay hall be located in the habitual flood inundation area, another building shall be selected as the alternative Operation Center.

9.5.6 Establishment of Evacuation Center

As described in the preceding subsection, the Provincial Government of Cavite had preliminarily identified the existing eight public places in and around the entire Study Area as definite evacuation centers and further conceived the public elementary/secondary schools as potential centers. However, details of these candidate evacuation centers have not yet been clarified. Moreover, most of the barangays as well as the municipalities other than Imus and Kawit in the Study Area have not yet designated any definite flood evacuation center in their respective jurisdictions.

Under the above current situations, each of the municipalities and the barangays are encourages to decide on their definite evacuation centers and disseminate the information among the residents taking the flood risk map proposed in the above Subsection 9.4.1 into account. The criteria for the selection of eligible evacuation centers are as enumerated below:

(1) The evacuation center shall be located out of the flood risk area and preferably in an elevated place.

(2) It shall be equipped with power and water supply systems and adequate toilet facilities together with the related waste disposal system.

(3) It shall be preferably accessible by vehicle, which would facilitate easy evacuation for handicapped persons and/or effective conveyance of materials/equipment for evacuation.

(4) It shall be preferably equipped with health facilities and communal kitchen.

9.5.7 Communication Network for Execution of Flood Warning and Evacuation

The eligible communication route among the government and non-government organizations relevant to flood waning and evacuation as well as the residents is proposed, as shown in Fig. R 9.2 taking the present disaster communication system as well as the necessary flow of information to achieve the aforesaid step-wise flood warning and evacuation into account. The principal points on the proposed communication flow are as described below.

(1) Communication for DCC Operation Centers

The PDCC, MDCC and Barangay Operation Centers shall take the following communications:

- The PDCC Operation Center shall receive all necessary hydrometeorological information including weather information from PAGASA, as well as the aforesaid river water level and cumulated rainfall observed in the Study Area.
- The above hydrometeorological information is step-wisely transmitted from PDCC to MDCC and from MDCC to BDCC.
- The river conditions in each jurisdiction area of BDCC are step-wisely transmitted from BDCC to MDCC and from MDCC to PDCC.
- Each of the operation centers shall advise their Chairman of DCC to release the orders on necessary actions for flood warning and evacuation.

(2) Communication for Chairman of DCC

The Chairmen of PDCC, MDCC and BDCC shall take the following communications:

- The Chairman of PDCC shall determine the provincial-wide actions necessary for flood warning and evacuation and transmits them to the chairman of MDCC. The Chairman of MDCC shall likewise determine the municipality-wide actions necessary for flood warning and evacuation and transmits them to the Barangay Captain. The Barangay Captain shall determine the necessary actions within his jurisdiction based on the information from the MDCC.
- The Chairmen of PDCC, MDCC and BDCC shall order their respective operation groups to execute the necessary actions for flood warning and evacuation.
- The Chairman of PDCC may communicate with the Chairman of NDCC and/or the RDCC to take the nationwide/ the regional-wide disaster management as required.

(3) Operating Group of DCC

The Operating Group of PDCC, MDCC and BDCC shall take the following communications:

- The Operating Groups shall take the necessary actions for residents including dissemination of flood warning/orders of flood evacuation, guidance to residents to the evacuation centers and all other necessary relief activities.
- The Operating Groups shall communicate with each other on the utmost utilization of human resources, equipment and materials necessary for flood warning and evacuation.

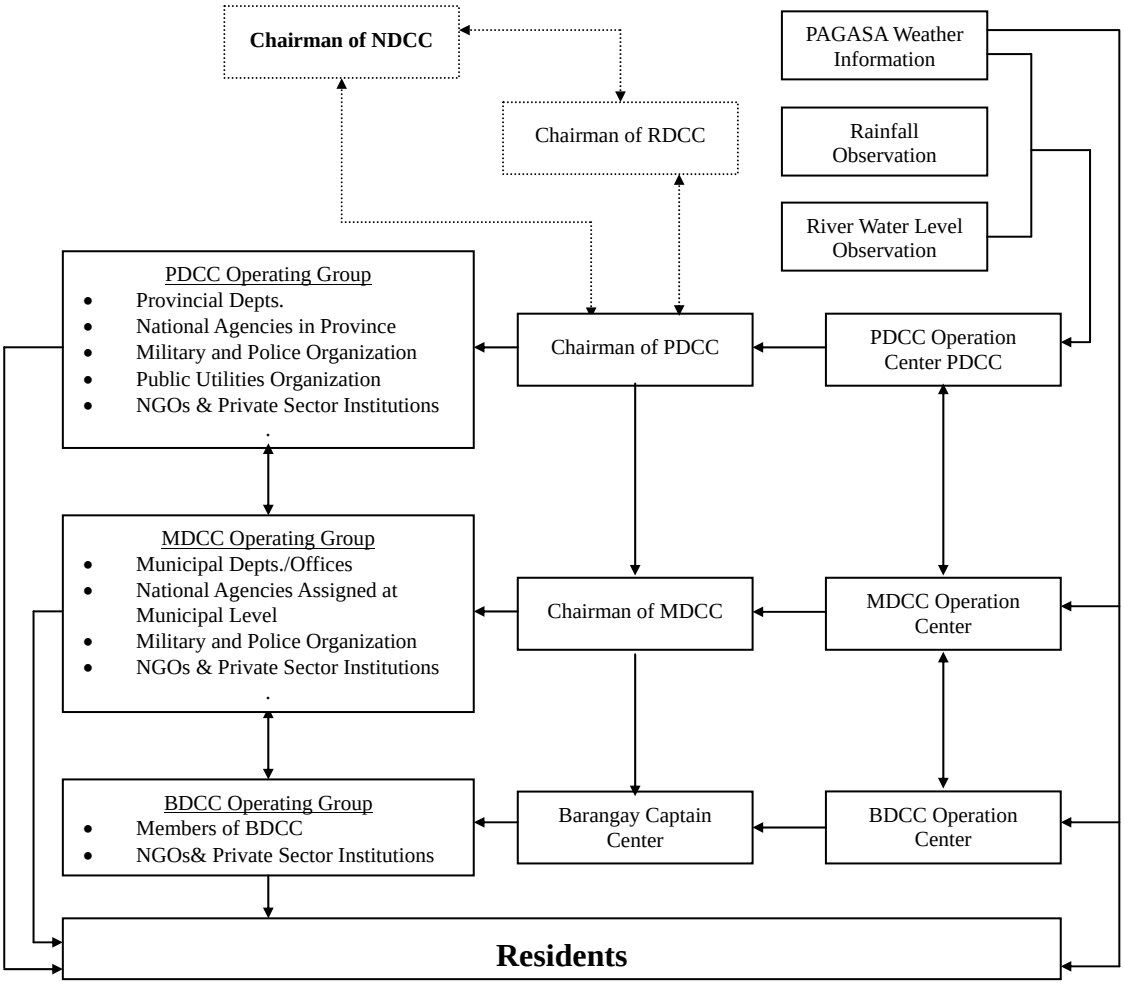


Fig. R 9.2 Communication Flow of the Flood Warning and Evacuation System

9.5.8 Equipment for Flood Warning and Evacuation

Equipment such vehicles and heavy construction equipment currently owned by the members of PDCC, MDCC and BDCC are in principle to be utilized in the flood warning and evacuation. Nevertheless, it is indispensable to newly procure the rainfall gauging equipment (tipping bucket type) mentioned above and the equipment for communication among PDCC, MDCC, and BDCC. The items to be procured are as described below.

(1) Rainfall Gauging Equipment

The tipping bucket type rainfall gauging equipment could be simply and easily installed and its procurement cost would be around 80,000 pesos/unit. The three rainfall gauging points mentioned above are preliminarily assumed as the minimum requirement to estimate the rainfall intensity influential to the flood runoff discharge in the lower reaches of the Study Area. It is recommended to initially operate these three gauging equipment and gradually add gauging points through the actual operation of the flood warning and evacuation system.

(2) Communication Equipment

The disaster coordinating councils from the province down to the Barangay level shall be provided with the necessary communication equipment such as VHF base radio sets, VHF hand-held radio sets and megaphone. The required number of communication equipment is as proposed below.

Table R 9.18 Number of Communication Equipment Required for Flood Warning and Evacuation

DCC	Office	VHF Base Radio Set	VHF Hand-Held Radio Set	Megaphone
PDCC	Operation Center	1	1	0
	Operating Group	0	30	0
MDCC	Operation Center	9	9	0
	Operating Group	0	45	0
BDCC	Operation Center	0	60	0
	Operating Group	0	0	180
Total		10	145	180

9.5.9 Community-Based Flood Warning and Evacuation

Of the local government units from the provincial level to the barangay level, the barangay has the following particular characteristics:

- All members of the Barangay Assembly, which governs the barangay, are composed of the residents.
- The Barangay Captain, who is the head of the barangay, has to be a resident who has continued to reside in the barangay for more than six months.
- All members of the BDCC are composed of residents, and no government agency is involved in the BDCC.

The Barangay is defined as the smallest government administrative unit in the Philippines as mandated in Republic Act (RA) 7160 of 1991, and it is also regarded as the resident's self-governing body because of the above particular characteristics. Therefore, the strengthening of BDCCs could lead to the promotion of community-based flood warning and evacuation.

The reorganization of PDCCs and CDCCs/MDCCs together with the preparation of the disaster preparedness plan has been completed or is now in progress in the Study Area as described in the foregoing subsection. On the other hand, the institutional setup of BDCCs in the Study Area is left behind. As the result, the residents currently evacuate from floods based on their own experience/judgment and means of transportation.

The ultimate purpose of the proposed flood warning and evacuation system is to support the voluntary evacuation of residents from the risk of floods. However, the objective flood warning and evacuation would be hardly achieved unless the BDCC in particular could function based on its definite disaster preparedness plan. From this point of view, the following actions are preliminarily proposed:

(1) Organizational Setup and Tasks of BDCC

The organization structure of BDCCs shall be set with reference to the mandate in PD 1566 and in due consideration of the eligible human resources in each barangay. The major points on the organization setup are as described below:

- The Barangay Captain shall be the chairman of BDCC, and a vice-chairman may be selected to assist the Barangay Captain or to be the acting chairman in absence of the Barangay Captain. The existing Executive Officer of the Barangay Vigilance Committee (called "Barangay Tanod") may be preferably appointed as the vice-chairman, because of the roles of the Staff Team and the Operations Teams mentioned below.
- The Staff Team and the Operations Team need to be organized as the executing body of BDCCs on disaster management. The Operations Team shall undertake the actual field works of dissemination of flood warning and support of resident's evacuations, while the Staff Team shall undertake the necessary logistical support for the smooth execution of the Operations Team. The existing organizations of the barangay such as the aforesaid Barangay Tanod or the Mediation Committee (called "Lupong Tagapamayapa") could take the roles of the said Operation and Staff Team. The details of roles required of the Staff Team and the Operations Team and are as listed in Table 9.4.
- If the Barangay is too large having the plural "puroks" (the communal unit of barangay), the Operations Team may be organized for each of the "puroks."
- The disaster operation center (DOC) shall be established to provide the necessary information to all members of the BDCC, and the members of the above Staff Team shall operate the DOC.

(2) Required Activities to Heighten Public Awareness

It is indispensable to heighten the public awareness of residents on the necessity and procedures of the proposed flood warning and evacuation. In order to heighten public awareness, each BDCC shall undertake the following activities:

- To determine the eligibility of evacuation centers among those specified by the PDCC/MDCC or to set up alternative evacuation centers exclusively for the barangay, if all evacuation centers specified by PDCC or MDCC are not applicable;
- To select the available evacuation routes to approach the centers, as well as the pick-up points for physically handicapped persons;
- To clarify the extent of potential flood area in the jurisdiction of the BDCC based on the flood risk map developed in the Study;
- To develop the flood risk map, which presents the above extent of probable flood inundation area, the flood evacuation center, the flood evacuation routes and other relevant information such as location of hospitals and list of telephone numbers of government offices relevant to rescue of evacuees;
- To regularly open briefing sessions, consultation meetings and/or workshops to disseminate to the residents information on the flood risk map and the procedures of flood warning and evacuation and/or to obtain requests and/or comments from the residents; and

- To repeat the training drills on flood warning and evacuation by the BDCC in collaboration with the residents so as to make the members of BDCC and the residents proficient.

Chapter 10. Environmental and Social Considerations on the Alternative Flood Mitigation Plan

10.1 Introduction

10.1.1 Necessity of IEE

The studies on environmental and social considerations for the Project have to be conducted to meet the guidelines of the Government of the Philippines (GOP) and Japan International Cooperation agency (JICA) according to the Implementation Arrangement agreed upon between DPWH/Provincial Government of Cavite and JICA. Based on the guidelines of the GOP, both of EIA and IEE are not necessary for the master plan study. However, this Project is classified as Category A under the guidelines of JICA because the Project could possibly cause significant adverse impacts of land acquisition and relocation/resettlement of project-affected-persons (PAPs). Hence, the IEE is to be conducted as a strategic environmental assessment for the preparation of the master plan. For the legal framework of environmental and social considerations in the Philippines, refer to Appendix 4-1 in Vol.4.

10.1.2 Scope of Work of the IEE

The objective of the IEE study is to assist the Project Proponent in the preparation of the optimum master plan through a strategic environmental assessment on the proposed master plan. For this purpose, the IEE study will include the following items of work:

(1) Identification, through scoping, of the environmental elements, which would receive significant adverse impacts with the implementation of the proposed projects;

(2) Assessment of the impacts on the environmental elements identified by the scoping as those that might be subject to significant or moderate impacts by the proposed projects;

(3) Identification of possible mitigation measures against the impacts where they exceed the allowable limit; and

(4) Identification of the necessary monitoring items in the future.

10.1.3 Baseline Environmental Conditions

The existing environmental conditions are adopted as the baseline for the environmental assessment of the proposed projects. The existing environmental conditions of nature, socio-economy and public hazard of the project area are as described in Chapter 2 and Chapter 3.

10.1.4 Alternative Projects

The impact is to be assessed for all the proposed alternative projects together with the “without project” situation. Eight (8) alternative measures are proposed for the prevention of river-overflow flood of the Imus and San Juan rivers with the combination of various structural measures (river improvement, off-site flood retarding basin, flood diversion channel, on-site flood regulation pond). Further, each alternative will vary according to the design flood scales of 2-year, 5-year, 10-year and 20-year return period. Since the Canas River can carry a flood-flow with a 20-year probability without riverbank overflow, it is excluded from the study on alternatives. For inland drainage of the low coastal area, two (2) alternatives consisting of different component projects are proposed for the design flood scale of 2-year. Those are listed in Table R 8.7 and R 8.24. For details, see Chapter 8, Sections 8.1 and 8.2.

10.2 Identification of Environmental Elements for Assessment (Scoping)

10.2.1 Methodology

The environmental elements to be assessed are identified by the two-dimensional matrix method. Those environmental elements cover three categorized elements of social and natural environments and public hazard, which are further subdivided into several elements, respectively, as enumerated below.

(1) Social Environmental Element includes: (a) involuntary resettlement and land acquisition; (b) impact on livelihood and local economy; (c) change in land use; (d) social institution; (e) social service and infrastructure; (f) poverty, indigenous people and ethnic minority; (g) uneven distributed losses and benefits; (h) historical and archaeological site; (i) regional conflicts of interests; (j) water use; and (k) fishery.

(2) Natural Environmental Element includes: (a) topography and geology; (b) groundwater; (c) soil erosion; (d) river flow regime; (e) seashore; (f) fauna, flora and ecological diversity; (g) landscape; and (h) global warming.

(3) Public Hazardous Element includes: (a) air pollution; (b) water pollution; (c) soil pollution; (d) solid waste; (e) noise and vibration; (f) ground subsidence; and (j) odor.

The matrix is prepared for both construction and operation phases. The adverse impacts are evaluated in terms of: (1) magnitude/extent; (2) occurrence probability; and (3) duration. These are then scored from A to C; namely, (A) stands for large impact, (B) for medium impact, (C) for uncertain, and No Score for no or negligible impact. In this study, the following criteria are applied for A and B.

A: Magnitude/extent of the impact is large and it continues for a long time or it will not recover.

B: All impacts other than A. Even if the magnitude/extent of the impact is large, the impact is categorized as B when it is temporary and recovery is made in the near future.

10.2.2 Identified Environmental Elements

Anticipated adverse impacts by the proposed projects in construction and operation phases are as described below.

(1) Pre-construction/Construction Phase

(a) The full-scale river improvement will cause a large number of house relocation.

(b) The off-site retarding basin is proposed to minimize the house relocation, by which the full-scale river improvement is scaled down to partial improvement. The combination of partial river improvement and off-site retarding basin will largely decrease the number of house relocation. On the other hand, this will require a considerable land acquisition of farmland/grassland for the off-site retarding basin.

(c) The diversion channel proposed for the San Juan River is an alternative of the off-site retarding basin. However, it will cause a moderate number of house relocation and a medium scale of land acquisition of farmland/grassland.

(d) The proposed structures for the inland drainage will also require a certain extent of house relocation and land acquisition of farmland/grassland and fishpond.

(e) Some people may lose their jobs due to house relocation, and tenant farmers and tenant fishpond operators may lose their jobs due to land acquisition of farmlands and fishponds.

(f) Improvement of the San Juan River, construction of the San Juan diversion channel, and construction of the coastal dikes for the inland drainage may need to clear some existing mangrove in the river mouth and coastal areas. Further, the construction of off-site retarding basin will clear the existing mangroves in some places.

(g) Excavation of the proposed off-site retarding basin and diversion channel might lower the groundwater table in the surrounding area, causing some adverse impacts on the existing well water uses. Further, the diversion channel will cause saline water intrusion in the new channel and it might affect the groundwater quality in the surrounding area in the future.

(h) The proposed off-site retarding basin and diversion channel may intersect the existing roads and irrigation canals. Further, the proposed coastal dike may hamper the anchor of small fishing boats (banca) inside the canals of the dike.

(i) The river improvement works will cause air pollution, water pollution and noise during the construction period. However, the off-site retarding, diversion channel and off-site

retention pond will cause less air pollution and noise during the construction stage, because their construction sites are rather far from the residential areas.

(j) The proposed on-site regulation pond for large industrial and housing development projects will require no land acquisition by the public sector. However, some governmental regulations are necessary to require the private sector to install such flood regulation ponds in their development projects.

(2) Operation Phase

(a) Control of land development in the project area might curb industrial development, resulting in decrease of employment opportunity.

(b) Control of land development in the project area might cause regional conflicts between the lower reaches as the beneficial area of flood mitigation and the upper reaches as the objective area for control of land development.

(c) The improved river, off-site retarding basin, diversion channel, drainage facilities and on-site regulation pond might induce people's garbage dumping.

(d) Wastewater from the surrounding areas might be discharged into the proposed off-site retarding basins, off-site retention pond and on-site regulation pond, resulting in emission of foul odor.

The identified environmental elements by the scoping on 10 alternatives are shown in Table 10.1 together with score of impact. For the detailed scoping matrixes, see Tables 1 to 3 of Appendix 4-2 in Vol.4.

10.3 Objective Environmental Elements of Impact Assessment

The environmental elements that will affect the proposed alternative projects of the master plan are identified through the scoping works described in the above Section 10.2. These elements are as summarized below.

(1) Pre-construction/Construction Phase

(1) Resettlement, (2) Land Acquisition, (3) Loss of Employment, (4) Disruption of Infrastructure, Water Use and Fishery, (5) Groundwater, (6) Mangrove, (7) Air Pollution, (8) Water Pollution, and (9) Noise

(2) Operation Phase

(1) Impact on Local Economy, (2) Regional Conflicts of Interest, (3) Solid Waste Disposal, (4) Water Pollution, and (5) Odor.

The impacts of the above elements are assessed for the proposed alternative projects as described below.

10.4 Impact Assessment and Possible Mitigation Measures for Proposed Projects

Adverse impacts of the above environmental elements on the river-overflow flood prevention project are assessed for the proposed eight alternatives with four design flood scales each, i.e., 2-year, 5-year, 10-year and 20-year (total cases: 32). Similarly, impacts on the inland drainage project are assessed for two alternatives with the fixed design flood scale of 2-year. Further, possible mitigation measures against the impacts are proposed when the impacts exceed the allowable limits.

10.4.1 Pre-construction/Construction Phase

(1) Resettlement

(a) Number of House Relocations

The full-scale river improvement will cause a large number of house relocation for the main rivers of Imus and San Juan. The tributary improvement of the Imus River (Bacoor and Julian rivers), the San Juan diversion channel and the ring/coastal dikes of the inland drainage will cause a considerable number of house relocation. The off-site

retarding basin and off-site retention pond will also cause a few number of house relocation.

The number of required house relocations in each alternative is shown in Table R 10.1 below. For the number of house relocations by each component project, refer to Table 10.2.

Table R 10.1 Number of House Relocation of Proposed Alternatives

Alternative	Design Flood Scale			
	2-year	5-year	10-year	20-year
River-Overflow Flood Prevention				
FI-1	1,080	1,350	1,480	1,610
FI-2	270	275	275	275
FI-3	260	275	275	275
FS-1	250	330	460	650
FS-2	71	73	74	76
FS-3	152	192	285	513
FS-4	160	189	204	224
FS-5	60	185	74	75
Inland Drainage				
D-1	121	-	-	-
D-2	341	-	-	-

Note: The alternative FS-5 consists of sub-projects of partial river improvement, retarding basin, diversion channel and on-site regulation pond. In this alternative, the least cost combination of sub-projects varies depending on the design flood scale as follows: (i) partial river improvement + on-site regulation pond for 2-year flood, (ii) partial river improvement + diversion channel + on-site regulation pond for 5-year flood, and (iii) partial river improvement + retarding basin + on-site regulation pond for 10-year and 20-year floods. In this alternative, number of the house relocation for 10-year and 20-year floods are smaller than that for 5-year flood since the retarding basin requires a smaller number of house relocation than the diversion channel.

(b) Sampling Survey on Household Conditions of Riverbank Residents

The JICA study team had conducted a sampling interview survey on the household conditions of the residents (277 households) who are living along the Imus, San Juan and Canas rivers. In order to get a more representative sample of potential resettling households, only the survey results from would-be affected barangays within the proposed project areas and immediately surrounding areas were used. Those are 199 samples distributing in 11 barangays of 6 municipalities as shown in the below Table R10.2.

Table R 10.2 Distribution of Surveyed Riverbank Residents

Municipality	No. of Surveyed Households by Barangay
Bacoor	Banalo: 10, Mabolo III: 9, Sineguelasan: 30
Kawit	Manggahan-Lawin: 19
Noveleta	San Juan II: 24, Santa Rosa I: 12, Santa Rosa II: 11
Rosario	Tejeros Convention: 14
General Trias	Tejero: 36
Tanza	Biwas: 16, Bucal: 18
Total	Barangay: 11, Households: 199

House relocation of the proposed alternatives is mostly caused by river and drainage channel improvement. The sampled households of 199 are all located on the riverbank areas which are affected by the proposed alternative projects. The sampled households are considered to be good representatives of the potential resettling households. Number of the sampled households is also considered sufficient, compared to the number of the house relocations in the proposed alternatives.

The survey results on the 199 households are summarized in Table 1 of Appendix 4-3 in Vol.4. The table presents the following conditions of each household: (i) location, (ii) family (size, respondent's sex/age/education and family head's sex/age), (iii) working family member (sex/age/job of each member), (iv) family income, (v) house/lot ownership and (vi) structure of house. Further, the survey inquired the perception for resettlement.

(c) Household Conditions

Household Population

Population of the 199 households distribute as shown in the below Table R 10.3 with an average of 5.69 persons per household.

Table R 10.3 Distribution of Household Population of Riverbank Residents

Population	1 - 3	4 - 6	7 - 9	10 <	No Data	Total
No. of Household	39 (20%)	93 (47%)	50 (25%)	15 (7%)	2 (1%)	199 (100%)

Gender and Age of Respondent/Family Head

To discuss the gender issue, sex of the family head should be confirmed. However, the head of each family was not identified through this interview. The respondents of the interview were not always the heads of family. They were mostly wives who were staying at home during the daytime.

On the other hand, income data of each working family member were obtained from most of the surveyed households. Hence, the biggest contributor to the family income is assumed to be the family head. In case the income data of each working family member are not available, the respondent is assumed to be the family head. Based on the above assumption, the family heads of 199 households were determined. Gender and age distribution of the respondents and family heads are summarized in the below Table R10.4.

Table R 10.4 Gender and Age Distribution of Respondent/Family Head of Riverbank Residents

Item	Gender		Age Distribution						
	Male	Female	< 30	31 - 40	41 - 50	51 - 60	61 <	No Data	Total
Respondent	59 (30%)	140 (70%)	45 (23%)	45 (23%)	39 (20%)	40 (20%)	29 (14%)	1 (1%)	199 (100%)
Family Head	136 (68%)	63 (32%)	57 (29%)	48 (24%)	42 (21%)	26 (13%)	25 (13%)	1 (1%)	199 (100%)

Income Sources

Total population of the responded 197 households is 1,120, averaging 5.69 persons per household. Among them, 367 persons are engaged in various kinds of jobs in the responded 193 households with an average of 1.90 persons per household. Their jobs are categorized as shown in the below Table 10.5.

Table R 10.5 Job of Family Members of Riverbank Residents

Category	Kind of Job	Number
Business/Sales	Buy and sell, store/shop, vendor, agent, goods production, rental, etc.	87 (24%)
Fishing/Farming	Fishing, farming	28 (8%)
Office Employee	Government/company office employee	30 (8%)
Technician	Mechanical/electrical technician	12 (3%)
Factory Worker	Factory/bakery/market worker	60 (16%)
Const. Worker	Carpenter, masonry, construction worker	18 (5%)
Driver	Car/jeepney/tricycle driver	31 (8%)
Health Care/Helper	Nurse, health care, maid, helper	14 (4%)
Sewing/Laundry	Sewing, laundry, manicure, etc.	22 (6%)
Others	Security guard, overseas worker, pension, small service worker, etc.	48 (13%)
No Data		17 (5%)
Total		367 (100%)

Income Level

Family income data are available for 186 households among the surveyed 199 households. With regard to the family income of woman-head households, data are available for 57 households among 63 woman-head households. Per capita monthly income distributions of the total households and woman-head households are shown in the below Table R10.6.

Table R 10.6 Per Capita Monthly Income Distribution of Riverbank Residents

Income Range (P/month)	No. of Total Household	No. of Woman-head Household
< P 1,700	94 (51%)	32 (56%)
P 1,701 – P 3,000	60 (32%)	17 (30%)
P 3,001 – P 4,000	12 (6%)	3 (5%)
P 4,001 – P 5,000	9 (5%)	0
P 5,001 <	11 (6%)	5 (9%)
Total No. of Household	186 (100%)	57 (100%)
Ave. Per Capita Income (P/month)	P 2,158	P 2,080

The National Statistical Coordination Board has estimated the annual per capita poverty threshold in Cavite Province at Php 14,965 for the year 2000. For the year 2007, it was estimated to be Php 20,952 by multiplying the price escalation rate of 1.4 during 2000-2007. Hence, the current monthly per capita poverty line in the project area is assumed at Php 1,700/person/month. (Source: National Statistical Coordination Board; NSCB Fact Sheet, January 2007.)

Fifty-one percent (51%) of the total households are considered to be below poverty line. With regard to the woman-head households, 56% are below poverty level. For details of the per capita family income distribution, see Table 2 of Appendix 4-3 in Vol.4.

Ownership of Lot/House and House Structure

Ownership of the housing lot and house building of the surveyed households are classified as shown in the following Table R 10.7.

Table R 10.7 Lot and House Ownership of Riverbank Residents

Lot			House		
Ownership	No. of Households	Remarks	Ownership	No. of Households	Remarks
Own Lot	31 (16%)		Own House	127 (64%)	
Family	74 (37%)	Incl. parents/parents in law and relatives	Family	31 (16%)	Incl. parents/parents in law
Private	33 (17%)		Relative	16 (8%)	
Government	35 (18%)	Informal occupation	Landlord	18 (9%)	
Others	21 (11%)		Others	7 (3%)	
No Data	5 (2%)		No Data	0	
Total	199 (100%)			199 (100%)	

Among 199 households, 16% have own lot and 64% have own house. However, the households which have both own lot and own house is limited to 29 (15%). About 35 households (18%) informally occupy the government land.

The house structures are generally classified into the followings: (i) built by mostly scrap materials, (ii) built by semi-concrete, (iii) built by concrete and (iv) others. The 199 houses are classified as follows in terms of structure. Scrap material house: 50 (25%), semi-concrete house: 83 (42%), concrete house: 56 (28%), other houses: 8 (4%) and no data: 2 (1%).

The households living in scrap material houses are naturally considered that they do not own the housing lot and are below the poverty level in family income.

Educational Attainment

The data of educational attainment are available only for the respondents of the interview survey. The highest educational attainment of the 199 respondents are as follows: (i) less elementary school: 21 (10%); (ii) elementary school graduate: 40

(20%); (iii) less high school: 33 (17%); (iv) high school graduate: 63 (32%); (v) less college: 11 (6%); (vi) college graduate: 22 (11%); (vii) others (vocational school): 6 (3%) and (viii) no data: 3 (1%).

(d) Required Capacity of New Settlement

Usually, families who own both housing lot and house can find new settlements by themselves with the compensation money. However, the other families may need governmental assistance in resettlement. In this study, it is assumed that all of these families (85% of the affected families) will resettle in new settlements provided by the government. The required capacity of a new settlement has been estimated for all alternative projects, as shown in the following Table R 10.8.

Table R 10.8 Required New Settlement Capacity of Proposed Alternatives

Alternative	Design Flood Scale			
	2-year	5-year	10-year	20-year
River-Overflow Flood Prevention				
FI-1	920	1,150	1,250	1,400
FI-2	230	235	235	235
FI-3	220	235	235	235
FS-1	210	280	390	550
FS-2	60	65	65	65
FS-3	130	160	240	440
FS-4	140	160	170	190
FS-5	50	160	65	65
Inland Drainage				
D-1	105	-	-	-
D-2	290	-	-	-

(e) Perception for Resettlement

Attitude on Relocation Issue

The interview survey involved 199 interviewees and their answers to the relocation issue are summarized as follows (some of them made multiple answers):

(i) To ask the government to give them enough time to prepare for house relocation: 41%

(ii) To coordinate with the barangay officials: 32%

(iii) To join community discussions about the issue: 14%

(iv) To oppose any relocation idea: 13%

Preferred Resettlement Area

As to the preferred resettlement area, the answer of all the 199 interviewees including those who oppose resettlement is as summarized in the following Table R 10.9.

Table R 10.9 Preferred Resettlement Area

Location	No. of Respondents	(%)
Cavite Province	161	81
Cavite Province (not specified)	55	28
Same/Near Place	16	8
Lower Area (Bacoor, Kawit, Noveleta , Rosario, Tanza)	43	22
Central Area (Imus, Dasmariñas, General Trias, Trece Martires)	34	17
Upper Area (Indang, Silang, Tagaytay)	10	5
Outside of the Basin (Naic, Alfonso)	3	1
Outside of Cavite Province	17	9
Others (Anywhere, Upland Area, Flood Free Area, etc.)	18	9
No Response	3	1
Total	199	100

(f) Possibility of Resettlement Problem Solution

The resettlement problems mentioned above could possibly be solved with no vital difficulty except the case of full-scale river improvement if the government takes appropriate mitigation measures, based on the following considerations:

(i) The provincial government is planning to develop resettlement sites consisting of 267 ha in total with the capacity of about 32,000 families to boost the clearing of informal settlers living in danger areas or other public lands. The potential resettlement sites include Bacoor (150 ha), Dasmariñas (5 ha), Trece Martires (53 ha), General Trias (44 ha) and Kawit/Imus/Noveleta/Rosario/Tanza (15 ha or 3 ha each). For details, refer to Chapter 11. (Note: The standard accommodation capacity of low cost housing development is 120 families per ha.)

(ii) The number of people who may oppose the house relocation is not large.

(iii) The number of people who may insist to live in the present place or nearby places is not large.

(iv) The government would formulate and execute a comprehensive resettlement program, which involves a variety of activities such as identification of the PAPs, appraisal of the necessary compensation/entitlement for the PAPs, and social/income restoration for the PAPs during the post-relocation stage. Details of the activities and arrangements required for the resettlement plan are as described in the under-mentioned subsections 11.5.

(2) Land Acquisition

(a) Land Area to be Acquired

The off-site retarding basin, diversion channel, off-site retention pond and coastal/ring dikes will require a considerable area of land. The existing use of the land is classified into active farmland, grassland (including idle/abandoned farmland, bush, etc.), active fishpond and abandoned fishpond. The land area to be acquired for each alternative is shown in the following Table R 10.10. For the land acquisition area of each component project, refer to Table 10.3. Table 10.3 excludes housing lot and public/government land. The land acquisition of housing lots is dealt together with house relocation in this study.

Table R 10.10 Land Area to be Acquired for Proposed Alternatives

(Unit: ha)

Alt. No.	Design Flood Scale															
	2-year				5-year				10-year				20-year			
	F		G		F.P		A.P		F		G		F.P		A.P	
	F	G	F.P	A.P	F	G	F.P	A.P	F	G	F.P	A.P	F	G	F.P	A.P
River-Overflow Flood Prevention																
FI-1	0	0	0	4	0	0	0	4	0	0	0	4	0	0	0	4
FI-2	21	37	40	25	31	49	40	25	36	53	40	25	44	62	40	25
FI-3	0	12	40	25	28	43	40	25	31	46	40	25	39	54	40	25
FS-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS-2	24	9	0	0	35	18	0	0	62	22	0	0	78	25	0	0
FS-3	0	1	0	5	0	1	0	7	0	2	0	9	0	2	0	12
FS-4	13	8	0	4	20	9	0	6	34	19	0	7	57	23	0	8
FS-5	0	0	0	0	0	1	0	6	58	22	0	0	76	24	0	0
Inland Drainage																
D-1	20	24	9	8	-	-	-	-	-	-	-	-	-	-	-	-
D-2	20	24	10	8	-	-	-	-	-	-	-	-	-	-	-	-

Note:
1) F: active farmland, G: grassland including idle/abandoned farm and bush, F.P: active fishpond, A.P: abandoned fishpond.
2) The above land acquisition area excludes housing lots and public/government land.

As shown the above table, the full-scale river improvement (FI_1 and FS_1) scarcely need to acquire farmland and fish pond. It is because the full-scale river improvements only widen the existing river channels, while both sides of the river channels to be improved are almost all built-up.

(b) Sampling Survey on Household Conditions of Tenant Farmers and Fishpond Operators

The JICA Study Team had conducted a sampling interview survey on the household conditions of tenant farmers and fishpond operators. The owner farmers and fishpond operators are excluded since the land acquisition will cause no significant social problems on them. The interview was conducted for 22 tenant farmers and 12 tenant fishpond operators distributing in the municipalities and barangays shown in the following Table R 10.11.

Table R 10.11 Distribution of Surveyed Farmers and Fishpond Operators

Tenant Farmers		Tenant Fishpond Operator	
Municipality	No. of Surveyed Households by Barangay	Municipality	No. of Surveyed Households by Barangay
Imus	Anabu I-G (Ragatan): 2, Anab II-B: 1, Malagasan: 14, Paliko: 1	Kawi	Kaingin: 4, Waks: 1
Kawit	Baton Dalig: 1	Noveleta	San Rafael III: 7
General Trias	Bacao II: 3		
Total	Barangay: 6, Households: 22		Barangay: 3, Households: 12

Sampling Adequacy of Farmers

As shown in Table 10.3, active farmland exists in only the retarding basins/retention ponds of I-1, J-1, J-2, S-1, Y-2, M-2 and E-2. These are all located in the downstream area of the Imus and San Juan rivers: along or between the both rivers. The sampling locations (barangays) are also all located in the same district/region. It is considered that the sampled farmers well represent the affected farmers by the proposed alternatives.

The maximum active farmland to be acquired among the proposed alternatives is approximately 140 ha. Number of the maximum affected farmers is roughly estimated to be 140 by assuming that (i) average farmland of one household is 2 ha and (ii) 50% of the farmland of each household is affected by the project on average. From the above discussions, number of the sampled farmers (22 farmers) is considered sufficient, compared to the number of affected farmers.

Note:

(1) The above average farmland area of 2 ha is assumed, based on the provincial statistical data of 2006 for the lower basin area.

(2) Some farmers are fully affected, while the others are partly affected. Hence, it is assumed that 50% of the farmland of each farmer is affected by the project on average.

Sampling Adequacy of Fishpond Operators

As shown in Table 10.3, active fishpond exists only in the retarding basins (B-1, B-2 and B-3), retention pond (K-1) and along the coastal dike. However, B-1, B-2, B-3 and K-1 are enclosed by housing areas, resulting in aggravation of the pond environments and probably decrease of fish production. Further, Bacoor Municipality has prepared a land use plan of its administrative area in which B-1, B-2 and B-3 are to be all reclaimed for urban use in the near future. Considering the above situation, the sample fishpond operators were selected from the typical fishpond areas of Kawi and Noveleta.

The maximum active fishpond area to be acquired among the proposed alternatives is approximately 50 ha. Number of the affected fishpond operators is roughly estimated to be 50, based on the same assumption as farmers that (i) average fishpond area of one household is 2 ha and (ii) 50% of the fishpond area of each household is affected by the project on average. From the above, number of the sampled fishpond operators (12 fishpond operators) is considered sufficient, compared to the number of the affected fishpond operators by the proposed alternatives.

Note: The above average fishpond area of 2 ha is assumed, based on the provincial statistical data of 2006 for the coastal basin area.

(c) Household Conditions

Based on the above sampling surveys, the household conditions of the tenant farmers and fishpond operators are summarized below. For the conditions of each household, see Table 3 and Table 4 of Appendix 4-3 in Vol.4.

Household Population

Household population of the surveyed farmers and fishpond operators distribute as shown in the below Table R 10.12 with an average of 4.41 persons per household and 5.08 persons per household, respectively.

Table R 10.12 Distribution of Household Population of Farmers/Fishpond Operators

Household Population	1 - 3	4 - 6	7 - 9	Total
No. of Farmer	8	10	4	22
No. of Fishpond Operator	3	6	3	12

Gender and Age Distribution of Family Head

Almost all the respondents of the interview survey are engaged in farming or fishpond operation as their main jobs. Hence, they are assumed as the family heads in this study.

Gender and age of the family heads of the surveyed farmers and fishpond operators distribute as shown in the below Table R10.13.

Table R 10.13 Gender and Age Distribution of Family Heads of Farmers / Fishpond Operators

Item	Gender		Age Distribution					
	Male	Female	< 30	31 - 40	41 - 50	51 - 60	61 <	Total
Farmer	16 (73%)	6 (27%)	3	3	4	6	6	22
Fishpond-Operator	8 (67%)	4 (33%)	1	-	6	2	3	12

Tenant Farmland and Fishpond Areas

The tenant farmland and fishpond areas of the surveyed households distribute as follows with an average of 2.38 ha and 1.81 ha, respectively.

Table R 10.14 Distribution of Tenant Farmland/Fishpond Area

Farmland/Pond Area (ha)	< 1.00	1.01–2.00	2.01-3.00	3.01-4.00	4.01 <	Total
No. of Farmer	6	5	6	3	2	22
No. of Fishpond-Operator	6	4	1	-	1	12

Income Sources

The major cultivated crops are rice, vegetable and fruit. The major fish species are milkfish and prawn.

The surveyed households have various income sources in addition to farming or fish cultivation as shown in the below Table R 10.15

Table R 10.15 Other Income Sources than Farming/Fishpond Operation

Item	Farmer	Fishpond Operator
No. of Responded Household	22	10
No. of Family Member	97	47
No. of Working Member [1)]	33 (tenant farming : 22, other job: 11)	25 (tenant fishpond: 10, other job: 15)
Kind of Other Job than Farming/Fishpond Operation	Bakery, driver, retail seller, factory worker, helper/maid, tenant, engineer, hospital director.	Small storeowner, plumber, janitor, factory worker, fisher man, const worker, retail seller.

Note: [1)]: Number of working member for farming/fishpond operation is assumed to be one person per household.

Share of Farm/Fishpond Income to Total Family Income

The interview survey obtained the data of: (i) income of the respondent (consisting of harvested income and income from side job other than farming/fishpond operation), (ii) income of the other members who are working for other jobs than farming/fish cultivation and (iii) total family income (total income of respondent and other working members).

The shares of farm/fishpond income (harvested income) to total family income are distributed as shown in the below Table R 10.16. For the income data of each households, see Table 3 and Table 4 of Appendix 4-3 in Vol.4.

Table R 10.16 Distribution of Share of Farm/Fishpond Income to Total Family Income

Range of Income Ratio	< 0.20	0.21-0.40	0.41-0.60	0.61-0.80	0.81-1.00	No Data	Total	Ave. Ratio
No. of Farmer	10	2	2	2	5	1	22	0.42
No. of Fishpond-Operator	9	0	0	0	1	2	12	0.16

Income Level

Distribution of the per capita monthly income of the farmers and fishpond operators are shown in the below Table R10.17.

Table R 10.17 Per Capita Monthly Income Distribution of Farmers/Fishpond Operators

Income Range (P/month)	No. of Farmers	No. of Fishpond Operators
< P 1,700	14	4
P 1,701 – P 3,000	3	2
P 3,001 – P 4,000	2	1
P 4,001 – P 5,000	1	1
P 5,001 <	1	2
No Data	1	2
Total No. of Household	22	12
Average Per Capita Income (P/month)	1,540	3,348

Note: P 1,700 is assumed to be the poverty level although the above income may not include the value of the products for self consumption. For estimation of the poverty level, see the income level of riverbank residents.

Educational Attainment

The data of educational attainment are available only for the respondents (assumed as family head) of the interview survey. The highest educational attainment of the respondents of farmers and fishpond operators are shown in the following Table R 10.18.

Table R 10.18 Respondent's Educational Attainment of Farmers/Fishpond Operators

School Level	L.E.S.	E.S.G.	L.H.G.	H.S.G.	L.C.	C.G.	V.S.G	Total
No. of Farmer	4	5	4	5	-	3	1	22
No. of Fishpond-Operator	4	5	1	2	-	-	-	12

Note: L.E.S.: less elementary school, E.S.G.: elementary school graduate, L.H.S. less high school, H.S.G.: high school graduate, ,L.C.: less college, C.G.: college graduate, V.S.G: vocational school graduate

(d) Number of Affected Tenant Farmers and Fishpond Operators

Some tenant farmers and fishpond operators will be fully affected, while the others will be partly affected by the project. The number of affected tenant farmers and fishpond operators in each alternative has been estimated as shown in Table R 10.19, assuming that an average of 50% of each farming/operating land area is acquired for the project.

Table R 10.19 Number of Affected Tenant Farmers/Fishpond Operators of Proposed Alternatives

(Unit: Household)

Alter-native	Design Flood Scale							
	2-year		5-year		10-year		20-year	
	Farmer	Fishpond Operator	Farmer	Fishpond Operator	Farmer	Fishpond Operator	Farmer	Fishpond Operator
River-overflow Flood Prevention								
FI-1	0	0	0	0	0	0	0	0
FI-2	18	44	26	44	30	44	37	44
FI-3	0	44	24	44	26	44	33	44
FS-1	0	0	0	0	0	0	0	0
FS-2	20	0	29	0	52	0	66	0
FS-3	0	0	0	0	0	0	0	0
FS-4	11	0	17	0	29	0	48	0
FS-5	0	0	0	0	49	0	64	0
Inland Drainage								
D-1	17	10	-	-	-	-	-	-
D-2	17	11	-	-	-	-	-	-

Note: The above figures were obtained by dividing the affected active farmland/fishpond areas by the average affected farmland/fishpond areas (50% of 2.38 ha per one farmer and 50% of 1.81ha per one fishpond operator)

(3) Loss of Employment

A considerable number of the relocated households may lose their jobs if they are resettled far away from their original place of residence. Besides, people with low educational attainment generally have difficulty in finding new jobs. According to the interview survey, about 50% of the respondents of riverbank residents are below less high school (including less high school).

The affected farmers may lose farming income more or less due to land acquisition. The impact on family income is considered significant because;

(a) Farming income shares a considerable portion of total family income in many farmers (see, Table R 10.16).

(b) Two thirds of the farmers are below poverty level in family income (see, Table R 10.17).

They may have to find new jobs to compensate for their income loss although it depends on the magnitude of land acquisition (ratio of acquired land to total land). In finding new jobs, they have the following negative and positive factors.

(a) Educational attainment of the farmers is comparatively low. About 60% of the respondents are below less high school (see, Table R 10.18).

(b) However, they are all living close to the urban area where employment opportunity is comparatively large.

Impact on the family income of fishpond operators is considered smaller than that of farmers from Table R 10.16 and Table R 10.17. However, a considerable number of fishpond operators may have to find new jobs to compensate for their income loss due to land acquisition. They have the same negative (low educational attainment) and positive (living close to the urban area) factors as farmers in finding new jobs.

Most (85% in area) of the active fishponds in the proposed alternatives are enclosed by housing area. The land use plans of the concerned municipalities (Bacoor and Kawit) propose to reclaim the ponds for urban use in the future. Unemployment problems of the fishpond operators shall be solved even if the flood mitigation project is not proposed.

To mitigate the unemployment problems, the government shall:

(a) Formulate the comprehensive resettlement plan to clarify the whole necessary procedures, strategies and measures to cope with the unemployment problems at the preparatory or pre-relocation stage, the actual relocation stage and the post-relocation stage,

(b) Give special consideration on people who may lose their jobs in the allocation of resettlement sites so that they can resettle within the same municipality or in a nearby area,

(c) Provide various vocational training courses to people who want to change their jobs,

(d) Assist in creation/introduction of jobs in which people with low-level education can engage, and

(e) Prepare and execute a practical income restoration program, which include the livelihood development and assistance for application of the micro-finance

(f) Undertake all other activities scheduled in the comprehensive resettlement plan (refer to Subsection 11.5.7).

(4) Disruption of Infrastructure, Water Use and Fishery

(a) Road and Bridge

The Imus and San Juan River improvement works require the reconstruction of several bridges, which will cause traffic disturbances during the construction period. The diversion channel intersects the existing roads at four sites and this will disturb traffic during the construction period of new bridges. Further, three retarding basins intersect the existing roads and this will disturb traffic during the construction period as well. (Refer to Table R 10.20)

Table R 10.20 Disrupted Roads and Bridges during Improvements Works

Alternative	Component	Disrupted Road/Bridge	Possible Mitigation Measures
FI-1	Full-scale river improvement	Imus Main: 3 bridges (L); Bacoor R.: 2 bridges (L), 8 bridges (S); Julian R: 5 bridges (S)	Reconstruction of bridges. Traffic will detour to neighboring roads during the construction period.
FI-2, FI-3	Partial river improvement	Bacoor R.: 2 bridges (L), 8 bridges (S) Julian R: 1 bridge (S)	Reconstruction of bridges. Traffic will detour to neighboring roads during the construction period.
	Retarding Basin	Bacoor R. (RB B4): 1 road (S) Julian R. (RB J1): 1 road (S) Julian R. (RB J2): 1 road (S)	RB B4: Reconstruction of the road. Traffic will detour to neighboring roads during the construction period. RB J1: Reconstruction of the road. Traffic will detour to neighboring roads during the construction period. RB J2: Construction of a new access road.
FS-1	Full-scale river improvement	San Juan Main: 4 bridges (L)	Reconstruction of the bridges. Traffic detour to neighboring roads during construction period.
FS-2, FS-4	Partial river improvement	San Juan Main: 1 bridge (L)	Reconstruction of the bridge. Traffic detour to neighboring roads during construction period.
FS-3, FS-5	Partial river improvement	San Juan Main: 1 bridge (L)	Reconstruction of the bridge. Traffic detour to neighboring roads during construction period.
	Diversion channel	Diversion channel: 4 roads (L)	Construction of new bridges and temporary roads to detour traffic during the construction period.

Note: The above roads/bridges include only road/bridge used for automobile traffic.
L: large road/bridge; S: small road/bridge

As shown in the table above, disruption of the national road is caused at two sites of the Bacoor River and two sites of the diversion channel. All the other disruptions concern the provincial/municipality road.

The above disruptions can be solved by the reconstruction of existing roads/bridges or construction of new road/bridges. Traffic disturbance during the construction period can be mitigated to an allowable level by detouring vehicles to neighboring roads or by

constructing temporary detour roads, because the existing traffic congestion will be largely alleviated after completion of the ongoing coastal highway project.

(b) Irrigation

Two irrigation canals will be intersected by the retarding basin (RB-J1) of the Julian River (tributary of the Imus River) proposed in alternatives FI-2 and FI-3. On the other hand, the San Juan diversion channel intersects no irrigation canal.

The existing function of the two irrigation canals intersected by the retarding basin (RB-J1) can be maintained by reconstructing them with no technical difficulty and at a low cost. Since the proposed retarding basin consists of two ponds separated by the existing road, uniting them and constructing a united canal on the shoulder of the road can maintain the function of the two intersected irrigation canals.

(c) Anchorage of Fishing Boat

As mentioned in Chapter 3, the sea fishery is divided into two types: commercial fishery and municipal fishery. Big boats that anchor in the fishery ports perform commercial fishery. On the other hand, small boats (banca) with engine or no engine that do not anchor in the fishery ports but on beaches, riverbanks or drainage canals perform the municipal fishery.

Coastal dikes covering the municipalities of Kawit, Noveleta and Rosario are proposed from the left bank of the Imus River to the right bank of the Canas River in Alternatives D-1 and D-2. (Note: In Alternative D-2, the ring dike in Kawit will substitute for part of the coastal dike.)

The coastal dikes are to be constructed just in front of the built-up area, i.e., between the fishponds and built-up areas in Kawit and Noveleta and on the coastal beach in Rosario. The coastal dikes will close the existing drainage canals to protect the built-up area from high tide and may hamper the boats from entering the inner area of the coastal dikes through the drainage canals. According to the interview survey with the Association of Fishermen, the anchorage places are as shown in Table R 10.21 below.

Table R 10.21 Anchorage Places of Municipal Fishing Boats

Item	Kawit	Noveleta	Rosario
Number of Boats	645	62	913
Ratio of Anchorage Place	100	100	100
(1) Beach (%)	-	100	100
(2) Riverbank (%)	50	-	-
(3) Drainage Canal (%)	50	-	-

In Noveleta and Rosario, all fishing boats are anchored on the beach at present. The coastal dikes will not affect the anchorage of fishing boats since the boats can be anchored in front of the dikes.

In Kawit, 50% of the boats anchor in the river, which will not be closed by the dikes. However, the remaining 50% anchor in the inner area of the proposed dikes through the drainage canals and will be affected by the dikes. This adverse impact can be solved or mitigated by constructing simple locks on the dikes instead of gates, which will allow the fishing boats to go in and out through the locks even at high tide.

(5) Clearing of Mangroves

Some proposed structural projects would clear the existing mangrove in the coastal areas as mentioned below. Location of the existing mangrove forests and strips in the coastal area relative to the alignment of the proposed projects is as shown in Fig. R 10.1.

(a) The river mouth widening of the San Juan River will clear the mangrove forests existing on both side riverbanks.

(b) The diversion channel will clear the mangrove forests existing near its exit to the sea.

(c) The Bacoor retarding basin project will convert the existing fishponds to the flood retarding pond, acquiring the land and clearing some existing mangrove.

(d) The coastal dikes to protect Kawit area are proposed along the existing drainage channel running in the east-west direction in front of the built-up area. Mangroves exist inside and on both side banks of the channel. The mangrove is not of forest type but of strip type, and the coastal dike will clear a strip of mangrove in some locations.

(e) The coastal dikes to protect Noveleta area are also proposed along the existing drainage channel. The mangrove is not of forest type but of strip type like that in Kawit area. However, the mangrove is mostly planted inside the channel. Clearing for the proposed dike is limited to some locations, since the coastal dikes are to be constructed outside the drainage channel.

The required clearing of mangroves has been estimated for each alternative as shown in Table R 10.22 below based on the aero-photo interpretation with field check.

Table R 10.22 Mangroves Cleared for the Proposed Structural Projects

Alternative	Component	Location	Cleared Mangrove		Remarks
			Forest (ha)	Strip (km)	
FI-2, 3	Retarding basin (B1, B2, B3)	Bacoor (fishpond)	-	5.2	
FS-1	Full-scale river improvement	San Juan River mouth	2.0	-	
FS-2, 3, 4, 5	Partial river improvement	San Juan River mouth	2.0	-	
	Diversion channel	Exit to sea	0.1	0.2	
D-1, 2	Coastal Dike	Kawit (fishpond)	-	1.1	Width: about 10 m
		Noveleta (fishpond)	-	0.5	Width: about 10 m
	Retention pond (K1)	Kawit (fishpond)	-	0.1	Width: about 10 m

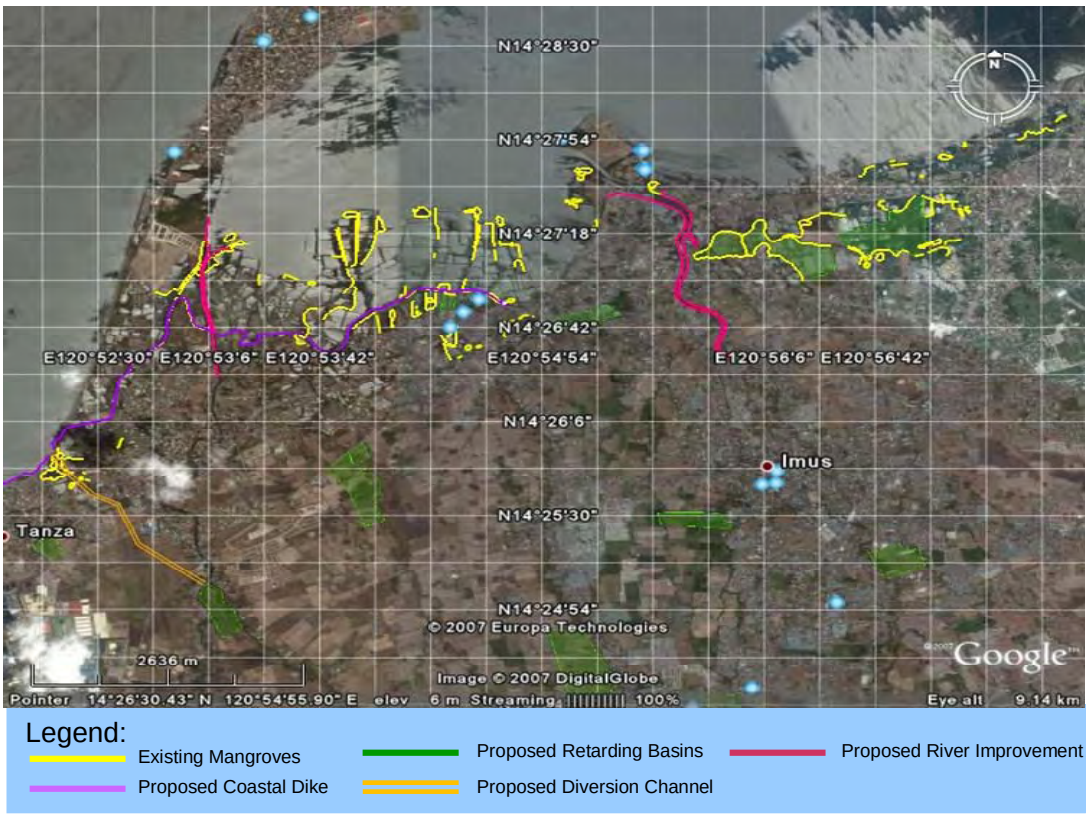


Fig. R 10.1 Location of the Existing Mangrove Forests and Strips

In order to mitigate the negative impacts to the existing mangrove, the following measures are proposed:

(a) The project makes it a rule to adopt transplantation of the whole mangrove to be affected by implementation of the project.

(b) The government shall conduct the following additional studies for conservation of the mangrove at the beginning of the project implementation:

- To reconfirm the updated habit of mangrove, which would be affected by the project implementation,
- To clarify the ecological system of the affected mangrove and judge whether the affected mangrove could be transplanted to the project site such as the area along the river channel improvement section and the area around the flood-retarding basin.
- To specify and secure the area, where the mangrove could be regenerated, when the transplantation of mangrove is judged to be difficult.
- To formulate the implementation plan for transplantation and/or regeneration of the mangrove.

(c) The land ownership of the mangrove area is to be certified through the patents issued by DENR. There are, however, other legal documents, which may also certify the landownership such as "Tax Declaration" for levy on the subject land issued by the Provincial/Municipal Office, and "Ownership Certificate of Title" issued by the Department of Justice. These legal documents are sometimes inconsistent certifying the different land ownership for the same land. In order to validate the ownership of the land, the government (the project proponent) shall conduct, at the beginning of the project implementation, identification of the ownership of the mangrove area based on the ROW survey/parcellary mapping and coordinate with the agencies related to registration of land ownership as required (refer to subsection 11.5.7, Item (1) – (b)).

(6) Groundwater

(a) Groundwater Lowering

Excavation of the proposed off-site retarding basins, off-site retention ponds and diversion channel will lower the groundwater table in their surrounding areas, more or less. It might affect the groundwater use of shallow wells if they are closely located near the retarding basins/retention ponds/diversion channel.

The JICA Study Team had surveyed 24 wells existing in the neighboring areas of the five representative retarding basins (I-1, S-1, Y-2, J-2, J-1), two representative retention ponds (P-1, E-2) and one diversion channel. They are all deep wells with well depths of approximately 20-100 m except one shallow well nearby the diversion channel. This shallow well is 10 m in well depth and 8.0 m in water level below the ground surface. Results of the sampling survey are shown in Table R 10.23 below.

On the other hand, the excavation depth of the retarding basins, retention ponds and diversion channel is 4-5 m, 2-3 m and 3-5 m, respectively. For location and main features of the above retarding basins, retention ponds and diversion channel, refer to Chapter 8.

From the above survey, it can be concluded that the proposed retarding basins, retention ponds and diversion channel will not affect the water level of the existing wells in the surrounding areas.

Table R 10.23 Well Inventory in the Neighboring Area of Proposed Projects

Project	Location (Barangay)	Well Depth (m)	WL below GS (m)	Salinity (g/kg)	Remarks
Imus RB (I-1)	Pasong Buaya	No. 1: 30	-	0.3	Deep well
		No. 2: 24	-	-	Deep well
		No. 3: 36	-	-	Deep well
		No. 4: 36	-	-	Deep well
San Juan RB (S-1)	Pasong Camachile	No. 1: 30	1.9	0.2	Deep well
		No. 2: 36	2.9	0.2	Deep well
Ylang-Ylang RB (Y-2)	Malagasang I-G	No. 1: 36	4.0	0.3	Deep well
		No. 2: 30	4.7	0.3	Deep well
Julian RB (J-1)	Calsadang Bago II	No. 1: >30	8.0	0.3	Deep well
	Poblacion IV C	No. 2: 28	4.7	0.3	Deep well
Julian RB (J-2)	Bucandala I	No. 1: 30	4.7	0.3	Deep well
		No. 2: 24	5.2	0.3	Deep well
Panamitan RP (P-1)	Batong Dalig	No. 1: >30	2.6	1.3	Deep well
		No. 2: 28	4.8	0.3	Deep well
EPZA RP (E-2)	Bacao I	No. 1: >30	6.0	0.2	Deep well
		No. 2: >30	5.8	0.3	Deep well
Diversion Channel (upper reaches)	Bacao II	No. 1: 10	8.0	0.4	Possibly shallow well
		No. 2: 23	7.4	0.4	Deep well
Diversion Channel (middle reaches)	Salcedo II	No. 1: 60	7.4	0.4	Deep well
		No. 2: >30	7.7	0.5	Deep well
	Salcedo I	No. 1: 18	6.2	0.7	Deep well
		No. 2: 18	5.5	0.8	Deep well
	San Rafael I	No. 1: 21	6.1	0.9	Deep well
		No. 2: 100	5.8	1.2	Deep well

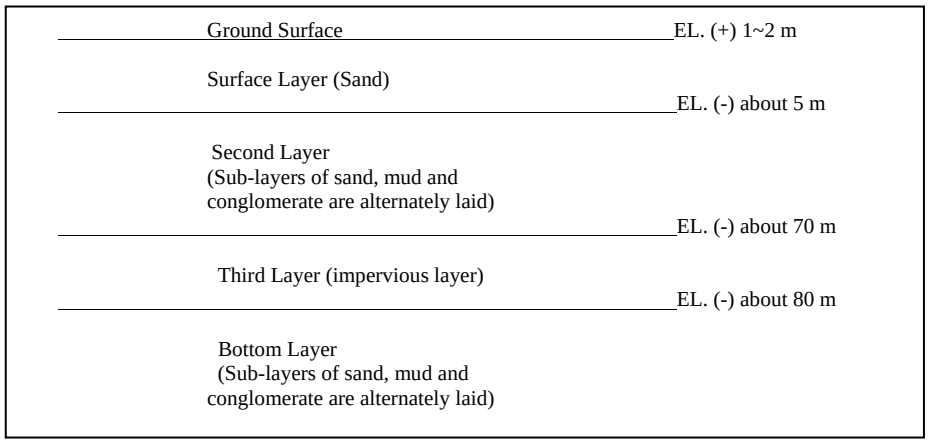
Note: WL: water level, GS: ground surface, RB: retarding basin, RP: retention pond, 0/00: g/kg

(b) Groundwater Saline Intrusion

The excavation depth of the diversion channel is between 3-5 m. The riverbed elevation of the proposed diversion channel varies from (–) 2.5 m MSL in the river mouth to 0.0 m MSL in the 1.5 km channel distance. The sea-water will intrude up to the 1.5 km distance of the new channel for a total distance of 2.4 km. For the design longitudinal profile of the diversion channel, refer to Chapter 8.

The JICA Study Team had surveyed the well depth and salinity content of the representative six wells existing along the middle reaches (built-up area) of the diversion channel. They are all deep wells with well depths of approximately 20-100 m, averaging 41 m. The salinity content of the wells varies from 0.4 g/kg to 1.2 g/kg or an average of 0.75 g/kg. Sea-water is considered to have already affected the well water to a little extent. For details, refer to the above Table R 10.23.

On the other hand, the geological stratums of the coastal area are roughly estimated as follows:



The existing deep wells mostly extract groundwater from the sand sub-layer of the second geological layer. It is considered that the diversion channel will not accelerate salinity intrusion into the second layer based on the following facts:

(i) The built-up area (where groundwater is extracted) is located 1.0 km upstream from the river mouth. Hence, the riverbed elevation of the diversion channel at this location will become (-) 1.0 m.

(ii) The surface layer (sand) below sea level is already affected by the lateral salinity intrusion of sea-water. The diversion channel will remove only the sand of the upper portion.

(iii) The riverbed elevation of the San Juan River is (-) 2-3 m at the neighboring location of the built-up area of the diversion channel. This means that the salinity intrusion effect of the diversion channel is smaller than that of the existing San Juan River.

(7) Air Pollution

The earth works of all the alternatives including excavation, embankment and hauling will generate dust, which may affect the people in the surrounding areas. However, this impact can easily be mitigated by sprinkling the construction sites with water and by covering dump trucks with sheets as required.

(8) Water Pollution

Some earth works in the river channel will make the river water turbid, which might affect the river and sea-water uses in the downstream. Potential works which might cause such impacts are as shown in the below Table R 10.24. Soil excavation works in all other component projects such as retarding basin, retention pond and diversion channel will less affect the river water quality. It is because they are mostly dry works, which are to be performed outside the river channel.

Table R 10.24 River Dredging Works of Proposed Alternatives

	Total Volume (m^3)	Location (River Distance)	Construction Period
Imus River			
Main River	120,000	0.0 – 3.0 km	10 years
Bacoor River	121,000	1.0 – 6.0 km	10 years
San Juan River	191,000	0.0 – 2.0 km	10 years

Note: River distance of the Bacoor River is measured from the river mouth to the sea.

There is no river water use in the downstream area of the river dredging sites. However, some shells (oyster and mussel) are cultivated in the offshore sites of the Cavite Bay all the year round. The sites are more than 300 m away from the coastal line.

On the other hand, DPWH had dredged the estuary part (river distance: 0.0 – 2.0 km) of the Imus Main and San Juan rivers once in every two to four years. The recent dredging volumes were 54,000 m^3 for the Imus Main River in 2006 and 39,120 m^3 for the San Juan River during 2005 to 2006.

The JICA Study Team had interviewed the Fishermen's Association in the project area concerning the impact on the shell cultivation, and they said that the shell cultivation has not suffered from damage by the dredging of DPWH. They further said that they have not been affected by the water pollution due to sediment run-off from the river during flood time.

From the above, the proposed dredging in the Imus and San Juan rivers is considered to cause no significant adverse impact on the shell cultivation as far as its implementation is not concentrated during a short period.

(9) Noise

The environmental standards of noise level of DENR are shown in Table R 10.25 below in comparison with those of Japan.

Table R 10.25 Standards of Noise Level

Area	Daytime	Nighttime
DENR		
Residential Area	55 dB	45 dB
Commercial Area	65 dB	55 dB
Japan		
Residential Area (exclusively)	55 dB (60 dB)	45 dB (55 dB)
Residential Area (mainly)	55 dB (65 dB)	45 dB (60 dB)
Commercial/Industrial Area*	60 dB (65 dB)	50 dB (65 dB)

Note: *: Includes a considerable number of residential houses.
Figures in parentheses are standards for areas facing road.

There is no regulation for the noise generation of construction works in the Philippines. Hence, in this study, the regulation of Japan is applied for the impact assessment of noise generated by the proposed projects. The objective areas and noise standards of the regulation are determined for each city, depending on the environmental conditions of the city. Generally, the standard noise level is set at 85 dB at the boundary of construction site with the following conditions concerning the construction work plan:

(i) working time (starting and finishing time of works); (ii) total working hour per one day; (iii) continuous working days at one place; and (iv) prohibition of work on Sundays/holidays.

However, the construction works, which do not employ large equipment is exempted from the regulation.

The full-scale river improvement, retarding basin and diversion channel include a large earth works by bulldozer, shovel and other equipment, which may cause a high level of noise. The noise generated by bulldozer and shovel is about 105 dB (power level noise). However, the noise level decreases at a high rate according to the distance from the equipment site as estimated by the following equation.

$L = Lo - 8 - 20 \log_{10} R$

Where, L (dB): noise level at the assessment point;
Lo (dB): power noise level of equipment; and
R (m): distance between the boundary of construction site and assessment point.

From the above equation, noise level corresponding to distance is calculated as follows:

R (m)	5	10	50	100
L (dB)	83	77	63	57

From the above discussions, the following can be concluded:

(a) Noise impact of all the construction works may be less than 85 dB. Hence, they can be managed by applying proper mitigation measures, if necessary.

(b) The major construction works of which site is closer than 50 m to the neighboring residential/commercial areas will cause significant impacts on the people. However, these impacts can be mitigated by paying such special considerations on the work plan as regulated in Japan.

(c) The construction works of which site is far or more than 50 m from the neighboring residential/commercial areas will cause no significant impact on the people. No special mitigation measures of the impact are required. The construction works can be implemented in the ways normally adopted in Philippines.

(d) Small-scale construction works will cause no significant impact on the neighboring residential/commercial areas even if the construction site is close to the neighboring residential/commercial area. No special mitigation measures against the impact are required. The construction works can be implemented in the ways normally adopted in Philippines.

The noise impacts of the proposed alternatives are shown in Table R 10.26 below.

Table R 10.26 Noise Impact and Mitigation Measures of Proposed Alternatives

Alt. No.	Component Project	Distance to Residential/Commercial Area	Noise Impact (dB)	Mitigation Measures
River-overflow Flood Prevention				
FI-1	Full-scale R. Imp.	All construction sites: very close	65 <N< 85	Proper work plan
FI-2	Partial R. Imp.	All construction sites: very close	65 <N< 85	Proper work plan
	Retarding basin (total: 7 basins)	(1) Const. site of 3 basins: <50 m (2) Const. site of 4 basins: >50 m	(1) 65 <N< 85 (2) 65 >N	(1) Proper work plan (2) Not necessary
FS-1	Full-scale R. Imp.	(1) Const. site of river mouth imp.: >50 m (2) Const. site of other works: very close	(1) 65 >N (2) 65 <N< 85	(1) Not necessary (2) Proper work plan
FS–2, 3, 4, 5	Partial R. Imp.	(1) Const. site of river mouth imp.: >50 m (2) Other works are very close but small in scale	(1) 65 >N	(1) Not necessary (2) Not necessary
FS–2, 4,	Retarding basin (total: 3 basins)	All construction sites: >50 m	65 >N	Not necessary
FS-3, 4, 5	Diversion channel	(1) Const. site of middle part (300 m): very close (2) Const. site of other part (2,100 m): >50 m	(1) 65 <N< 85 (2) 65 >N	(1) Proper work plan (2) Not necessary
Inland Drainage				
D–1, 2	Retention Pond (total: 6 ponds)	(1) Const. site of 2 ponds: <50 m (2) Const. site of 4 ponds: >50 m	(1) 65 <N< 85 (2) 65 >N	(1) Proper work plan (2) Not necessary
	Other works	Other works are very close but small in scale		Not necessary

The proper work plan shall be prepared to mitigate the noise impact as mentioned in the above table. The plan will contain the regulation for (i) working time (starting and finishing time of works); (ii) total working hour per one day; (iii) continuous working days at one place; and (iv) no work on Sundays/holidays.

10.4.2 Operation Phase

(1) Regional Economic Impact of Land Development Control

The JICA Study Team projected that the population of the project area will have an increment of 1.3 million from 1.1 million in 2000 to 2.4 million in 2020. On the other hand, there is a large area of convertible agricultural land for urban development in the project area (9,212 ha estimated according to the Regulation of Land Conservation, MC No. 54). This convertible land area is enough to accommodate the incremental population of 1.331 million as a whole. However, the distribution of this convertible land is imbalanced among the city/municipalities. Bacoor, Imus and Dasmariñas are short of land. Hence, the future population of these municipalities is estimated by applying the following planning policies: (i) increase of population density and (ii) redistribution of excessive population to the other city/municipalities with a sufficient land area.

Thus, the future urban land development required to accommodate the distributed population mentioned above was estimated by each city/municipality. The total required built-up area of the project area in 2020 is estimated to be 17,413 ha with an incremental area of 7,392 ha during 2003–2020. As a result, the ratio of the built-up area to the total project area will increase from 24.6% in 2003 to 42.7% in 2020. For details of the above projections of population and built-up area, refer to Chapter 4.

The proposed regional distributions of population and built-up area mentioned above are considered moderate and realistic. Further, the proposed built-up area is enough to accommodate the increasing population and it can be developed within the convertible agricultural land. Hence, no special land development control is necessary.

The proposed urban land use plan includes a sufficient business area covering industrial, institutional and commercial areas. The business area will increase from 1,544 ha (1.39 ha/thousand population as calculated based on the population in 2000 and business area

in 2003) in 2003 to 2,852 ha (1.17 ha/thousand population) in 2020. It will not restrict the increase of employment opportunity in the project area.

(2) Regional Conflicts of Land Development Control

The project area is divided into three parts, lower area, central area and upper area, covering several city/municipalities, respectively, as shown below.

- Lower Area: Bacoor, Kawit, Noveleta, Rosario and Tanza
- Central Area: Imus, Dasmariñas, General Trias and Trece Martires
- Upper Area: Amadeo, Indang, Silang and Tagaytay

The JICA Study Team had estimated the future population and built-up area of the project area by city/municipality as described in Chapter 4. These are summarized in Table R 10.27 below.

Table R 10.27 Population and Built-up Area by Region

Area	Population		Total Area	Built-up Area (ha)	
	2000	2020	(ha)	Existing	2020
Lower Area	337,236	575,920	6,149	2,485	3,556
Central Area	678,789	1,673,080	22,966	6,441	11,901
Upper Area	96,417	194,937	11,628	1,096	1,959
Total	1,112,442	2,443,936	40,743	10,021	17,417

A total land of about 7,400 ha will be developed by the year of 2020 of which about 6,300 ha or 85% is located in the upper and central areas. The land developments in the upper and central areas will increase the flood peak of the rivers by approximately 30% for the Imus River, 10% for the San Juan River and 10% for the Canas River, resulting in the increase of flood damages in the lower area (for details, refer to Chapter 5). The flood peak of the rivers will continue increasing even after 2020 due to the lasting land development in the central/upper area.

The JICA Study Team proposes a flood control system to compensate for the increase of flood peak due to land development. It obligates the land developers to construct on-site flood regulation ponds within their developed land. Cost of the on-site flood regulation pond will be added to the land development cost, increasing the selling price. For details, refer to Chapter 8.

The above regional conflicts are as summarized below.

Case	Benefited People	Affected People
Without Land Development Control	Land developer/user in the Upper/Central Area	People in the flooding area of Lower Area
With Land Development Control	People in the flooding area of Lower Area	Land developer/user in the Upper/Central Area

As stated above, both of without- and with-land development control may possibly cause the regional conflicts. In case of with-land development control, however, the construction cost of the on-site flood regulation pond is limited to only 157 pesos/m^2, which is less than 1% of land price for sale by the lot. Moreover, the annual maintenance cost for the on-site flood regulation pond is also limited to 180pesos/house lot, which is about 0.1% of the national annual average income in Philippines. Judging of these rate of cost shared by the land developers /users, the expense added by construction of on-site flood regulation pond would be within the tolerable level. Accordingly, the anxiety to the regional conflicts would be groundless in case of with-land development control.

(3) Solid Waste Disposal

The present solid waste disposal in the project area is managed by each city/municipality, covering the whole system including collection, hauling and final disposal. The present performance of the system is insufficient due to lack of collection/hauling capacity and shortage of the capacity of final disposal sites as well as financial constraints. Hence, many

people illegally dump garbage into the nearby rivers, drainage channels and other public open spaces.

The provincial government has programmed a new integrated provincial wide solid waste management system in order to cope with the above present problems. Operation of the system is expected to start in the third quarter of 2008. For the new system, refer to Subsection 6.4.2.

The illegal garbage dumping will be reduced by operation of the new system. However, it is virtually difficult to eradicate such illegal garbage dumping due to lack of discipline and incomplete coverage of public garbage collection system.

The proposed river channel improvement, retarding basins, diversion channel and drainage structures including retention ponds, coastal dikes, etc. may induce the people to dump garbage when the sites are not kept clean. Further, the floodwater of the rivers and drainage channels carries garbage and other drifts into the retarding basins, diversion channel and retention ponds, leaving a portion of them on the sites.

These adverse effects can be mitigated by periodically cleaning the sites as one of the maintenance works of the river channels, retarding basins, diversion channel, retention ponds and other drainage structures. DPWH will be responsible for the maintenance of the river channels, retarding basins and diversion channel. On the other hand, each municipality will be responsible for that of the drainage system including retention ponds, coastal dikes, etc. in its jurisdiction. The above responsible organizations shall collect the garbage/drifts accumulated on the project sites and convey them a short distance to the nearby transfer station of garbage to take part in the new solid waste disposal system.

The proposed on-site regulation ponds may also induce the people to dump garbage when they are not kept clean. The resident association of each sub-division shall collect the accumulated garbage in their on-site regulation pond. They can treat the collected garbage by the new solid waste disposal system.

(4) Water Pollution and Odor

The proposed off-site retarding basins and off-site retention ponds receive only floodwater of the rivers. The entered floodwater is completely drained soon after the flood ends. No river water enters into the retarding basins and retention ponds at a dry time. The wastewater in the surrounding area is discharged into the nearby rivers through the existing drainage channels at present.

The retarding basins/retention ponds can be kept comparatively clean unless the new subdivisions connect the wastewater drainage pipes to the retarding basins/retention ponds for easy wastewater disposal. Such a wastewater disposal should be prohibited. The concerned municipalities should not permit the development of subdivisions with such an illegal wastewater drainage system.

The proposed on-site regulation ponds are constructed at the lowermost location of the respective subdivisions. The regulation ponds receive storm water run-off with a mixture of wastewater from the subdivisions. On the other hand, the wastewater will directly be drained into the neighboring rivers at a dry time through a detour wastewater drainage channel. Principally, the water pollution and odor emission problems of on-site regulation ponds will not be significant if the regulation ponds are designed in a proper way. No special mitigation measures are necessary.

10.4.3 Impact Assessment without Project

The project area is affected by frequent floods, which cause serious damages on the people's lives and properties. The flood damages will increase in the future according to the population growth in the flood prone areas. On the other hand, the land development in the central and upper areas will increase the flood peaks in the downstream reaches of the rivers, resulting in further aggravation of flood damages in the low land areas. The flood damages vary depending on the scales of flood. The future

flood damages without project are estimated as shown in the below Table R 10.28, comparing with the existing ones.

Table R 10.28 Flood Damages without Project

Food Type/Scale	Existing Conditions		Future Conditions in 2020	
	Flooding Area (ha)	Damaged House (No.)	Flooding Area (ha)	Damaged Houses (No.)
River-Overflow Flood				
2-year	930	7,000	1,360	20,700
5-year	1,650	14,600	2,070	34,500
10-year	2,260	19,500	2,610	41,100
20-year	2,950	23,200	3,320	48,000
Inland Flood				
2-year	710	4,900	890	9,200

Further, the road networks including the national roads are frequently inundated at many places at present. It causes not only traffic disturbance but also damages on the economic activities of the project area. At a big flood time, the road inundation makes it difficult for the people to commute to the factories/offices and the factories/offices are forced to cease business. These damages on the economic activities will become more intensive in the future.

10.5 Identification of Necessary Monitoring Items

The major objectives of the monitoring in the environmental assessment are: (1) to check whether the proposed mitigation measures of the adverse impacts function well as expected; (2) to check whether the predicted adverse impacts may not be much different from the actual ones; and (3) to revise the proposed management plan of adverse impacts as required. Usually, the detailed monitoring plan will be prepared in the Feasibility Study (F/S) stage and the monitoring will be conducted during the construction period and after the completion of proposed projects.

In this master plan stage, only the necessary monitoring items are identified. The identified major monitoring items are listed in Table R 10.29 below.

Table R 10.29 Necessary Monitoring Items

Environmental Item	Monitoring Item	Description
(1) Resettlement	(a) Resettlement Site	Whether the resettlement sites are provided with necessary public facilities as planned?
	(b) Employment	Whether the resettled people are engaged in jobs?
	(c) Vocational Training	Whether necessary vocational trainings are provided for the people who want to change their jobs?
(2) Natural Environment	(a) Mangrove	Whether necessary re-planting of the cleared mangrove is implemented as planned?
(3) Public Hazard during Construction Period	(a) Traffic Disturbance	Traffic disturbance due to the reconstruction of road/bridge
	(b) River Water Turbidity	River water turbidity due to the river excavation.
	(c) Noise	Noise due to the operation of construction equipment.
(4) Public Hazard in Operation Phase	(a) Garbage Dumping	Illegal garbage dumping on the improved river channel, diversion channel, off-site retarding basin, off-site retention pond and on-site regulation pond.
	(b) Wastewater Discharge	Illegal wastewater discharge into the off-site retarding basin and off-site retention pond.

10.6 Results of Stakeholder Meetings and Actions to be taken in the Study

In a series of three (3) stakeholder meetings, proposed alternative projects for the M/P have been introduced and discussed among stakeholders. The recognized awareness and concerns through such stakeholder meetings have been considered for impact assessment and generation of possible mitigation measures. Their results and consideration to be taken in the Study including engineering aspects as well as natural and social environmental considerations are summarized below and the minutes of meetings are attached as Appendix 9 in Volume IV.

Table R 10.30 Summary of Stakeholder Meetings held in M/P Study

No.	Contents			
	Item	Details		
1st Stakeholder Meeting	Date:	9:00~12:00, Aug.10, 2007		
	Venue:	Sangguniang Panlalawigan Hall		
	Participants:	Statesman/Administrators: 4 National Gvrnmnt.: 16 Media: -	Provincial Officer: 17 Residents: 22 Study Team/Consultants/Staff: 13	LGU Officer: 17 NGO/Academia: 11 Total : 100
	Agenda:	Presentation of Applicable Flood Mitigation Alternative to be considered in the Study		
	Principle Queries/ Comments	A. Impact/Operation of on-going projects against flood damage in the Study area (Such as R-1 project).		
		B. Concerns about illegal dumping of garbage into river channel.		
	Action taken in the Study	(Actions for A): The Study has been undertaken taking into consideration on-going related projects and programs.		
		(Actions for B): The Study has pursued garbage dumping problem as one of significant issues of Non-structural measure for flood mitigation.		
2nd Stakeholder Meeting	Date:	9:00~12:00 Oct. 01, 2007 and 9:00~12:00 Oct. 03, 2007		
	Venue:	Board Room, Bayview Hotel		
	Participants:	Statesman/Administrators: - National Gvrnmnt.: 9 Media: -	Provincial Officer: 1 Residents: - Study Team/Consultants/Staff: 5	LGU Officer: - NGO/Academia: - Total : 15
		Statesman/Administrators: - National Gvrnmnt.: 10 Media: -	Provincial Officer: 2 Residents: - Study Team/Consultants/Staff: 9	LGU Officer: - NGO/Academia: - Total : 21
	Agenda:	Presentation of Alternatives for Structural Measures and Non-structural Measures and Progress of IEE Study		
	Principle Queries/ Comments	C. Reoccupation of informal settlers in the river area		
		D. Securement of lands as the proposed sites for structural flood mitigation measure		
	Action taken in the Study	(Actions for C): The Study has provided concepts on eligible measures for easements such as securement and designation of river area.		
		(Actions for D): The concepts to revise land use plans of each municipality have been prepared in collaboration with the Provincial Government including preparation of provincial ordinances regarding land use control.		
3rd Stakeholder Meeting	Date:	9:00~12:00, Nov.27, 2007		
	Venue:	Audio Visual Room, Municipal Building, General Trias		
	Participants:	Statesman/Administrators: - National Gvrnmnt.: 1 Media: -	Provincial Officer: 3 Residents: 35 Study Team/Consultants/Staff: 5	LGU Officer: 10 NGO/Academia: 2 Total : 56
	Agenda:	Presentation of Draft Master Plan and the IEE Results		
	Principle Queries/ Comments	E. Further dissemination for public awareness of the flood mitigation program.		
		F. Conducting repetitive public hearings, PCMs or stakeholder meetings for the projects before the pursuance of the project.		
	Action taken in the Study	(Actions for E): Counterparts and Study Team has conducted and enhanced IEC and Public Awareness Campaign such as preparation of leaflets and pilot project in the Study..		
		(Actions for F): Provincial Government assured a succession of public hearings for the Project.		

Chapter 11. Formulation of the Comprehensive Flood Mitigation Plan

11.1 Selection of Optimum Flood Mitigation Plan

The alternative structural flood mitigation plans and the potential non-structural flood mitigation measures have been examined in Chapters 8 and 9. The socio-economic consideration on the structural and non-structural flood mitigation plans were further made in Chapter 10. Based on the results of those examinations, the optimum flood mitigation plan is as described in this Section.

11.1.1 Optimum Structural Flood Mitigation Plan

The alternative flood mitigation plans against both river-overflow and inland floods present great differences in their project costs, economic viabilities, number of house relocations and extents of land acquisition. On the other hand, the natural environmental impacts inflicted by each of the alternatives make little difference; besides, no fatal negative impact is anticipated (refer to Chapter 10).

As the results of clarification, the following contents are proposed as the optimum structural flood mitigation plan:

- **Measures for Mitigation of River Overflow Flood:** Of the alternatives, Alt. No. F_I.3 and Alt. No. F_S.5, both of which are composed of off-site flood retarding basin, partial river improvement and on-site flood regulation pond, are selected as the optimum plans for Imus River and San Juan River respectively.
- **Measures for Mitigation of Inland Flood:** Alt. No. D.1, which involves tidal gates without ring dikes for protection, is selected as the optimum plan. Instead of a full-scale plan for Alt. No. D.1, however, a partial-scale plan is proposed (refer to Section 8.2 in Chapter 8) due to necessity of curtailment of project cost. The part curtailed in the partial-scale plan involves the abandonment of improvement/construction of drainage networks and construction of coastal dikes except those for the Municipality of Kawit.
- **Design Scale for River Overflow Flood:** The design scale for the mitigation of river-overflow is proposed to correspond to the peak probable flood discharge of 10-year return period both for Imus and San Juan River. However, the design scale for two tributaries of Imus River; namely; Bacoor river and Julian river; is proposed to be 2 and 5-year return periods respectively. All design scales are subject to flood runoff conditions under the land use states in 2020.
- **Design Scale for Inland Flood:** The design scale of 2-year return period is applied against inland flood.

Details of clarification of the optimum plan are as described below.

(1) Selection of Optimum Plan against River Overflow in Each Design Scale

The optimum plan against river overflow in each design scale (2 to 20-year return period) was firstly selected through examination of the following items (a) to (c).

(a) Ruling-out of the Alternative of Full Scale River Improvement

Among the alternative plans, the “full-scale river improvement plan” (Alt. No. F_I.1 and F_S.1) requires river widening along the riverine area which is densely packed with houses, therefore, causing a remarkably larger number of house relocations as compared with those of other alternatives, as shown in Tables R 11.1.

Table R 11.1 Number of House Relocations Required in Each Alternative Plan

Objective River	Alt. No.	2-year return Period	5-year return Period	10-year return Period	20-year return Period
Imus River	F_I.1	1,080	1,350	1,480	1,610
	F_I.2	270	275	275	275
	F_I.3	260	275	275	275
San Juan River	F_S.1	250	330	460	650
	F_S.2	71	73	74	76
	F_S.3	152	192	285	513
	F_S.4	160	189	204	224
	F_S.5	60	185 (D)[*2]	74 (RB)[*1]	75 (RB)[*1]

Note : (RB)[*1] : As the least cost, F_S.2 with On-site Regulation Pond is adopted as F_S.5.
(D)[*2] : As the least cost, F_S.3 with On-site Regulation Pond is adopted as F_S.5.

In contrast to the full-scale river improvement plan, the alternatives supported by the off-site flood-retarding basin (Alt. Nos. F_I.2, F_I.2, F_S.2, F_S.4) require a rather large extent of land acquisition, which will cause a negative impact to the tenant farmers of more or less 100 families and the tenant fishing operators of 53 families [refer to item (3) in Subsection 10.4.1]. Nevertheless, losses of those tenant farmers and fishing operators due to land acquisition are limited to 23% and 10% of their whole income on average, and they are expected to recover through the provision of alternative vocational training courses given by the project proponent in the relocation stage [refer to item (4) in Subsection 10.4.1]. Thus, the negative impact of land acquisition for the retarding basin is smaller than the large number of house evacuation by full-scale river improvement.

The full-scale river improvement plan further requires a far larger project cost than the other alternatives, as shown in Table R 11.2. Due to these dominant disadvantages, this alternative is ruled out from the candidates for the optimum plan.

Table R 11.2 Project Implementation Cost for Each Alternative

Objective River	Alt. No.	2-year return Period	5-year return Period	10-year return Period	20-year return Period
Imus River	F_I.1	5,132	5,585	6,216	6,441
	F_I.2	3,047	3,208	3,267	3,458
	F_I.3	4,749	5,642	5,682	5,817
San Juan River	F_S.1	894	1,083	1,704	2,695
	F_S.2	1,000	1,232	1,582	1,779
	F_S.3	838	1,064	1,515	2,319
	F_S.4	1,378	1,620	1,939	2,348
	F_S.5	1,811	2,369	2,951	3,162

Note : Unit: million pesos
The costs above are exclusive of Price Contingency and On-site Regulation Pond

(b) Ruling-out of Alternatives not supported by On-Site Flood Regulation Pond

As the second step of screening, the importance of on-site flood regulation pond was examined. As the result, it was clarified that the alternatives supported by on-site flood regulation pond could bring about outstanding advantages in the aspects of affordability for project implementation, as well as economic viability and efficiency for flood mitigation [refer to item (ii) below]. Thus, the alternatives supported by the on-site flood regulation pond are selected as candidates for the optimum plan.

(i) Affordability

Project cost is divided into the cost for construction of large-scale infrastructures (such as river channel improvement, off-site flood retention pond and off-site flood retarding basin) and the cost for the on-site flood regulation pond. The cost for the construction of a large-scale infrastructure would be shouldered by the national government agency, DPWH, referring to the precedents of similar major flood mitigation projects. On the other hand, the land developers of new subdivisions would share the cost of on-site flood regulation pond. As described

later, difficulty is foreseeable in the affordability of DPWH as to project cost; therefore, it would be preferable to share a part of the cost to the land developers. The anxiety is given to the decline of incentives to land development. However, the cost burden to each of the land developers is extremely small and, therefore, such an anxiety is groundless (refer to Subsection 8.4.2).

(ii) Economic Viability

Large-scale infrastructures (such as river channel improvement, off-site flood retention pond and off-site flood retarding basin) require a long construction period and during such construction period, the economic benefit (i.e. effect of flood mitigation) does not break out. On the other hand, the on-site flood regulation ponds could generate the economic benefit immediately after completion of land development of each subdivision. Due of these backgrounds, the alternatives supported by the on-site flood regulation pond could produce a far higher economic internal rate of return (EIRR) than the alternatives not supported by on-site flood regulation pond (refer to Section 8.5)

(iii) Efficiency

Large-scale infrastructures (such as river channel improvement, off-site flood retention pond and off-site flood retarding basin) need to be constructed in anticipation of the future progress of land development for subdivisions. Once the infrastructures are constructed, it is virtually difficult to adjust their structural size according to changes of the anticipated future land development. Accordingly, there is a risk that over or undersized infrastructures are constructed. On the other hand, the on-site flood regulation pond is constructed in accordance with the progress of land development, so that such risk could be avoided.

(c) Selection of Optimum Plan for Each Design Scale

As the third step of screening, the optimum plan for the mitigation of river overflow was selected based on the synthetic evaluation of project cost and the number of house evacuation among the alternatives with the exclusion of full-scale river improvement and inclusion of on-site flood regulation pond. As the result, the following alternatives are selected as the optimum plans for each of the design scales:

Table R 11.3 Optimum Plan for Each Design Scale

Design Scale	Alt. No.		Components of Mitigation Measures*		Project Cost (million pesos)*3	
	Imus River	San Juan River	Imus River	San Juan River	To be shouldered by DPWH	To be shared by land developers
2-year	F_I.3	F_S.5	RB, PRI	DC, PRI	2,225	4,335
5-year	F_I.3	F_S.5	RB, PRI	DC, PRI	3,677	4,335
10-year	F_I.3	F_S.5	RB, PRI	RB, PRI	4,299	4,335
20-year	F_I.3	F_S.5	RB, PRI	RB, PRI	4,644	4,335

Note *1: RB = Off-site flood retarding basin, PRI=Partial river improvement, DC=San Juan Diversion Channel

*2: Alt. F_S.5 is intended to have combination of off-site flood retarding basin and San Juan Diversion Channel. However, the project cost for combination is higher than the cost for single measure of either San Juan Diversion Channel or off-site flood retarding basin. Moreover, the least cost comes out in different component of the measures depending on the design scales. As the results, the optimum plan for San Juan has the different components of measures depending on the design scale.

*3: The costs above are exclusive of Price Contingency.

(2) Selection of Optimum Plan against Inland Flood

The following two alternatives are proposed for the mitigation of inland flood, as described in Chapter 8:

(a) Alt. D_1, which applies the costal dike with tidal gate for the protection of the Municipality of Kawit against tidal flood; and

(b) Alt. D_2, which applies the ring dike without tidal gate for the protection.

Of these alternatives, Alt. D_1 requires a lower project cost as well as a less number of house relocation than Alt D_2, as shown in Table R 11.4. Moreover, there is no dominant difference in natural impacts inflicted by both alternatives (refer to Chapter 10). From these points of view, Alt. D_1 is proposed as the preferable plan.

Table R 11.4 Project Cost and House Relocation for Alternative Plans against Inland Flood

Alternative Plan	Project Cost (million pesos)	Number of House Relocations
Alt. D_1 without On-site	6,302	323
Alt. D_2 without On-site	6,688	543
Alt. D_1 with On-site	6,304	323
Alt. D_2 with On-site	6,729	543

Note: The costs above are exclusive of Price Contingency.

Alt. D_1 with on-site flood regulation pond requires a project cost of 6,304 million pesos even on the premise of design scale of 2-year return period. This project cost is divided into the cost of 5,927 million pesos for infrastructures (such as coastal dike, tidal gate and improvement/constriction of drainage networks) and 378 million pesos for the construction of on-site flood regulation pond.

The national budget, most probably the budget of DPWH will shoulder the above project cost of 5,927 million pesos for the infrastructures. However, the cost is deemed again to be hardly affordable in the same way as the cost of the plan against river overflow. Therefore, a certain part of the proposed flood mitigation measures needs to be curtailed [see details in the following item (3)].

Hence, instead of the full-scale flood mitigation plan for the design scale of 2-year return period, the partial-scale flood mitigation plan is proposed as the optimum plan (refer to Table R 8.2 and Fig.8.13 in Chapter 8).

Table R 11.5 Project Cost and House Relocation for Alternative Plans by Partial-Scale Protection against Inland Flood

Alternative Plan	Project Cost (million pesos)		Number of House Relocations
	To be shouldered by DPWH	To be shared by land developers	
Alt. D_1 without On-site	2,831	65	121
Alt. D_2 without On-site	3,253	65	341
Alt. D_1 with On-site	2,559	378	121
Alt. D_2 with On-site	2,973	378	341

Note The costs above are exclusive of Price Contingencies.
Refer to Section 8.2 in Chapter 8

The parts curtailed in the partial-scale mitigation involve the abandonment of improvement/construction of drainage networks and construction of the coastal dikes except those for the Municipality of Kawit, which has an extremely low ground level of below EL. 0m compared to the mean highest high tide (EL. 0.8m). Due to this abandonment of drainage facilities, a certain inundation by stagnant storm rainfall and tidal flood has to be tolerated (refer to Fig. 8.10 ~ 8.13 in Chapter 8). Nevertheless, the off-site flood retention pond, the coastal dike for the Municipality of Kawit and tidal gates/flap gates along coasts and estuary of river are secured as the minimum requirement to shut out serious tidal floods and flood runoff from a rather extensive catchment in the southern part of the Diversion Road.

(3) Selection of Overall Optimum Plan

As described above, DPWH is most likely to undertake project implementation for the proposed flood mitigation measures except construction of on-site flood regulation pond, which will be constructed by the land developer. DPWH currently undertakes nine major flood control projects in the country and the average investment cost for the projects is limited to about 4,287 million pesos (refer to Subsection 6.3.1).

Should the project cost drastically exceed the above average investment cost, the project would be hardly implemented. However, the maximum project cost to be shouldered by DPWH for the Study Area is estimated at 8,390 million pesos (i.e., 3,623 million pesos for mitigation of river overflow flood at the design scale of 20-year return period and 4,767 million pesos for full-scale mitigation of inland flood based on construction base cost and compensation cost).

In due consideration of the above affordability and the design scales for flood mitigation against river over flow and inland flood applied in other river basins, the optimum plan is finally proposed as listed in Table R 11.6, R 11.7, R 11.8, Table 11.1 and Table 11.2 and illustrated in Fig. 11.1 and Fig. 11.2. Fig.11.3 shows the discharge distribution under the optimum plan.

Table R 11.6 Total Project Costs for Proposed Overall Optimum Flood Mitigation Plan

Item	Cost (Million Peso)	Share
(1) Construction Base Cost	3,852	43.4%
(2) Compensation Cost	1,476	16.6%
(3) Engineering Service Cost	616	7.0%
(4) Physical Contingency	297	3.4%
(5) Price Contingency	1,866	21.0%
(6) Administration	54	0.6%
(7) Duty/Value Added Tax	714	8.0%
Total	**8,875**	**100.0%**
(8) On-site Regulation Pond	4,007	66.9%
(9) Physical Contingency	200	3.3%
(10) Price Contingency	1,142	19.1%
(11) Duty/Value Added Tax	642	10.7%
Total	**5,991**	**100.0%**

The selected optimum plan has the following particular features:

- The project cost (sum of initial construction base cost and initial compensation cost exclusive of contingencies) would not drastically exceed the past average investment cost for major flood control projects in Philippines.
- The plan would take the highest or second highest EIRR among the alternatives.
- The plan would require the minimum number of house evacuations among the alternatives.
- The plan would not cause any fatal natural environmental impacts.

Table R 11.7 Proposed Overall Optimum Flood Mitigation Plan

Classification of Plan	Objective Area	Alt. No.	Design Scale (Return Period)	Project Cost(Million pesos)		EIRR	No. of House Evacuation
				Shouldered by DPWH	Shared by Developer		
Plan against River Overflow Flood	Imus River Basin	F_I.3	10-year*	2,855 (3,619)	2,826 (3,593)	32.4%	275
	San Juan River Basin	F_S.5	10-year	1,445 (1,863)	1,508 (1,918)	20.7%	74
Plan against Inland Flood	Entire drainage area	D-1 (Partial Scale)	2-year	2,560 (3,393)	378 (480)	8.1%	121
Total				6,860 (8,875)	4,712 (5,991)	22.2%	470
Annual O&M Cost				35	36	-	-

Note: (*) The design scales of two tributaries of Imus namely Bacoor River and Jurian River are limited to 2year return period and 5-year return period. due to the limited available channel flow capacity of river channel.

The costs above are exclusive of Price Contingency, otherwise the costs in parentheses show total grand costs under all considerations. (See Table 11.2)

Table R 11.8 Summary of Features of Proposed Overall Optimum Flood Mitigation Plan

Description	Quantity
Against River Overflow Flood	
Design Scale	10-year return period for mainstream for Imus and San Juan River 5-year return period for Jurian River 2-year return period for Bacoor River
Offsite Flood Retarding Basin	7 retarding basins of 139 ha in Imus river basin 3 retarding basins of 80 ha in San Juan river basin
Partial River Improvement	Improvement length of 3.4km for Imus Main Stream Improvement length of 6.4km for Bacoor River Improvement length of 9.0km for Jurian River Improvement length of 2.0km for San Juan River
Against Inland Flood	
Design Scale	2-year return period (Partial Protection)
Drainage System Improvement	Improvement length of 3.8km for Improvement of Existing Drainage Channel Improvement length of 2.6km for Construction of New Drainage Channel Improvement length of 4.4km for Construction of New Interceptor Improvement no. of 12 units for Tidal Gates Improvement no. of 18 units for Flap Gates 5 retention ponds of 52ha in total

11.1.2 Optimum Non-Structural Flood Mitigation Plan

The following five non-structural flood mitigation plans have been proposed in Chapter 9: (1) Cleanup of Waterway; (2) Prevention of encroachment to river area; (3) Control of excessive land development; (4) Legal arrangement for the introduction of on-site flood regulation pond; and (5) Establishment of flood warning/evacuation system and flood hazard map.

The above non-structural plans are not alternatives, and all of them take important roles in the different fields for flood mitigation. The local government units currently undertake the activities relevant to all of the plans except the above item (4), Legal arrangement for the introduction of on-site flood regulation pond, and therefore, the plans are highly realizable. The plan on item (4) is also indispensable to attain the full function of the afore-said structural flood mitigation plan.

From the above viewpoints, implementation of all of the non-structural plans for the above items (1) to (5) is proposed.

11.2 Selection of Priority Project

As described in Chapter 7, the afore-said optimum flood mitigation plan both for the structural and non-structural measures is classified into the short-term project and the long-term project. The short-term project is assumed to be urgently required as the priority project and at the same time expected to produce immediate flood mitigation effects within the rather short period. Based on this concept, the priority projects for the structural and non-structural flood mitigation measure are proposed, as described below.

11.2.1 Priority Project for Structural Flood Mitigation Measure

As described above, the optimum plan is broadly divided into three components; namely, (1) the plan against river overflow of Imus River; (2) the plan against river overflow of San Juan River; and (3) the plan for mitigation of inland flood. Each of these three plan components could independently effect flood mitigation. Of these three components, the plan against the river overflow of Imus River could relieve the largest number of houses and area, as listed in Table R 11.9. Moreover, the plan could generate the largest EIRR, as listed in the foregoing Table R 11.7. Judging from these flood mitigation effects and the economic viability, the plan against the overflow of Imus River shall take priority over all the other components of the proposed optimum plan.

Table R 11.9 Number of Houses and Area to be relieved by the Optimum Flood Mitigation Plan

Classification of Plan	Objective Area	Number of Houses to be relieved by the Optimum Plan			Area to be Relieved by the Optimum Plan (ha)		
		2-year Return Flood	5-year Return Flood	10-year Return Flood	2-year Return Flood	5-year Return Flood	10-year Return Flood
Plan against River Overflow Flood	Imus River Basin	6,911	10,356	10,500	839	1,000	1,056
	San Juan River Basin	99	3,146	4,963	93	477	867
Plan against Inland Flood	Drainage Area	1,926	-	-	291	-	-

The plan against the river overflow of Imus River is further divided into three components, namely:

(1) Construction of four upstream off-site flood-retarding basins; namely, Code Nos. RB-I1 and RB-B4 along Imus River and RB-J1 and RB-J2 along Jurian River, the tributary of Imus River (the locations of the proposed retarding basins are as shown in Fig. 11.1 attached).

(2) Construction of three downstream off-site flood-retarding basins namely, Code Nos. RB-B1, RB-B2 and RB-B3 along Bacoor River, the tributary of Imus River.

(3) Partial river improvement along the downstream sections of Imus River, Bacoor River and Jurian River (refer to Tables 11.1 and Fig. 11.1 attached).

(4) Construction of on-site flood regulation pond to be implemented one after another development of new subdivision.

Of the above components, the upstream off-site flood-retarding basin rules the peak flood discharge flowing to the downstream damageable river stretches and, therefore, most influential to the flood mitigation of Imus River. Moreover, the proposed site for the upstream off-site flood-retarding basin is currently vacant land that would require only seven houses to be relocated. However, the site would be possibly occupied by houses and/or other structures unless the site is secured as a right-of-way for construction of the off-site flood-retarding basin. Thus, construction of the upstream retarding basin is urgently required. Moreover, because of the small number of house relocations, the implementation period for construction could be made shorter, leading to the immediate effect of flood mitigation.

Judging from the above flood mitigation efficiency, the urgent necessity of project implementation and the immediate effect of the flood mitigation, it is proposed that construction of the upstream off-site flood-retarding basins as described in the above item (1) shall be the priority project, and the further detailed study for this project should be made in the following Feasibility Study Stage.

11.2.2 Priority Project for Non-Structural Measure

The non-structural flood mitigation plans as described in Subsection 11.1.2 could take the important roles for flood mitigation in the different fields and could bring out the immediate flood mitigation effect. From these points of view, all components of the non-structural flood mitigation plan are assumed as the priority project, and the following undertakings by the JICA Study Team are scheduled during the following Feasibility Study Stage:

(1) **Cleanup of Waterway:** In order to materialize the Information and Education Campaign (IEC) on the cleanup of the waterway, the two pilot projects shall be implemented through the Study for the period from January to February 2008. The expansion program for the pilot project shall be further proposed in the Feasibility Study Stage in 2008 (refer to Subsection 9.2.5).

(2) **Prevention of Encroachment to River Area:** The ongoing demolition and development of relocation site for informal dwellers by the local government shall be monitored and more detailed clarification shall be made on relocation of the houses located in the designated river area.

(3) **Control of Excessive Land Development:** Exchange of views on future land zoning in the Study Area shall be made between the JICA Study Team and the local government officials concerned so as to attain the appropriate revised plan of future land use.

(4) **Legal Arrangement for Introduction of On-Site Flood Regulation Pond:** Effort shall be made to revise the draft of the ordinance on "On-Site Flood Regulation Pond Requirement in a New Subdivision Project" through discussions with the local government officials concerned, and to support enforcement of the ordinance.

(5) **Establishment of Flood Warning/Evacuation System and Flood Hazard Map:** The prototype of the flood hazard map shall be developed in collaboration with the communities (the Barangay Disaster Coordinating Councils) and/or local government officials concerned. The Disaster Prevention Manual shall be further prepared.

11.3 Implementation Program

The proposed flood mitigation plan involves the structural project and non-structural project. The structural project is further divided into three packages; namely, (1) Package 1, for the project against river overflow flood of Imus River; (2) Package 2, for the project against river overflow flood of San Juan River; and (3) Package 3, for the drainage improvement project. Of these project packages, the priority of implementation shall be given to Package 1 because of the circumstances described in Subsection 11.2.1.

Package 1 for Imus River is proposed to commence in 2010, and the off-site flood retarding basins are scheduled to complete before the year of 2013 as the short-tem project, as shown in Table R 11.10. On the other hand, both of Packages 2 and 3 are assumed as the long-term projects to commence in 2011 and completed before the year 2020. The detailed implementation schedules for the structural projects of Packages 1 to 3 are as shown in Table 11.3 attached.

Table R 11.10 Implementation Program for Structural Flood Mitigation Projects

Package	Component	Short Term	Long Term
Structural Project: Package 1 (Project against Overflow of Imus River)	Upstream Off-Site Flood Retarding Basin	O	
	Downstream Off-Site Flood Retarding Basin	O	
	Partial River Improvement		O
Structural Project: Package 2 (Project against Overflow of San Juan River)	Off-Site Flood Retarding Basin		O
	Partial River Improvement		O
Structural Project: Package 3 (Drainage Improvement Project)	Whole component		O

Note: Detailed order of implementation is shown in Table 11.3 attached.

The non-structural project is divided into four components; namely, (1) Cleanup of waterway; (2) Prevention of encroachment to the river area; (3) Enforcement of ordinance on on-site flood regulation pond; and (4) Setup and execution of flood warning and evacuation system. Setting up of the entire non-structural project is proposed to commence even within the study period and complete before the year 2010. The detailed implementation schedule of the non-structural project is as shown in Table 11.4 attached.

11.4 Plan of Organizational Setup for the Implementation of Proposed Flood Mitigation Project

11.4.1 Proposed Execution Body for Each Project Component

The proposed flood mitigation project is divided into the structural and non-structural components, which are further divided into several sub-components. Taking the ongoing activities, budgetary affordability and available human resources into account, the organizations as described in the following items (1) to (7) are proposed as the eligible execution bodies for each of the project components. Of these organizations, those of items (3) to (7) are for the non-structural components and further detailed demarcations are proposed, as shown in Table 11.7 attached. As for items (1) and (2) and other related actions/implementation activities to be taken by each execution body regarding structural measures are tabulated in Table 11.5 and 11.6.

(1) Construction of Structures

The works for the structural project components as proposed in Chapter 8 are river channel improvement and the construction of flood retarding basin/diversion channel and coastal dike.

Development of these infrastructures would require the project cost of several billion pesos, and the eligible project implementation body for them has to be addressed solely to DPWH judging from budgetary affordability for such large-scale infrastructure projects (refer to Section 6.3).

DPWH shall undertake construction of all proposed flood mitigation structures except the on-site flood regulation pond, which shall be under the responsibility of the land developer. Undertakings of DPWH shall include, in principle, land acquisition and house relocation required for the construction works. As for the relocation of informal dwellers, however, the Provincial Housing and Urban Development Office shall undertake the necessary relevant works including preparation of relocation site and support of livelihood for them.

(2) Operation and Maintenance of Structures

Taking the work volume and required knowledge into account, the following entities are proposed to be responsible for the operation and maintenance of each of the structures:

(a) River Structure

DPWH shall undertake the following works through its district office in Cavite:

- Maintenance of river dike and revetment of Imus, San Juan and Canas rivers, including channel dredging.
- Maintenance of the proposed flood diversion channel for San Juan River and the flood retarding basins.

(b) Drainage Structures

Each of the municipalities of Bacoor, Imus, Kawit, Noveleta, Rosario, Tanza and General Trias shall undertake operation and maintenance of the drainage structures constructed in the concerned municipality's jurisdiction, including the coastal dike, drainage channel, tidal gate, flap gate and off-site flood retention pond.

(c) On-Site Flood Regulation Pond

Routine maintenance such as removal of weeds and garbage shall be entrusted either to the land developer if contracted by the resident associations or the resident associations themselves if the land developer is not contracted. Corrective maintenance such as rehabilitation of side slopes and repair of outlet pipes shall be under the responsibility of the concerned city/municipality.

(3) Cleanup of Waterway

The following organization shall undertake the relevant works with the coordination of the Flood Mitigation Committee, as described below:

(a) Removal of Drifting Material at Critical Bottlenecks

The DPWH District Office in Trece Martires and the Municipal Engineering Office (MEO) shall undertake the monitoring and removal of drifting materials and sediment deposits at 20 critical bottlenecks of river and drainage channel as proposed in Subsection 9.2.1.

(b) Information and Education Campaign (IEC)

The IEC on the cleanup of waterway shall be to the responsibility of the provincial/municipal executive committee and technical working group for the "Oplan Linis Cavite," which currently focuses on province-wide cleanup. The Provincial Environmental and National Resources Office (PG-ENRO) heads the provincial working group for Oplan Linis Cavite, and all cities and municipalities organized their own executive committees and technical working groups for actual execution of the cleaning works. Moreover, the Oplan Linis Cavite involves several NGOs such as Lallian Community Development Center and Sagip Ilog Cavite Group.

(4) Relocation of Informal Dwellers in River Area and Prevention of Re-Encroachment

The relocation of informal dwellers in river areas as proposed in Subsection 9.3.2 shall be undertaken by the Task Force against Professional Squatters and Squatting Syndicates (TFPSSS). The Provincial Housing and Urban Development Office and the Provincial Legal Service Office head the Task Force, which currently undertake relocation of informal dwellers. The Provincial Task Force headed by the Provincial Philippine National Police (PNP) shall also serve as the operational arm for the drive against professional squatters and squatting syndicates.

In parallel with the relocation works, the TFPSSS at the municipality level in collaboration with the City/Municipal Disaster Coordinating Council (CDCC/MDCC) shall setup the management system of the river area to prevent re-encroachment including the system of river patrol and installation of signboards. The City/Municipal Planning and Development Offices (CPDO/MPDO) in collaboration with CDCC/MDCC shall also prepare the land zoning map of the river area including those of river park and sports ground.

(5) Control of Excessive Land Development in River Basin

The Provincial Planning and Development Office (PPDO) headed by the Provincial Planning and Development Coordinator (PPDC) shall monitor and evaluate excessive land development and control it based on coordination and formulation of the provincial wide economic, social and infrastructure plans. At the same time, CPDO/MPDO shall control excessive land development in its jurisdiction through the formulation of a land use plan for its jurisdiction.

(6) Legislation on the Construction of On-Site Flood Regulation Pond in New Subdivisions

The Provincial Legislative Office in collaboration with PPDO shall prepare the draft of the ordinance on the construction of the on-site flood regulation pond proposed in the Study. The draft ordinance shall be evaluated and approved by the Legislative Council (Sangguniang Panlalawigan) and promulgated by the Provincial Governor.

(7) Flood Warning and Evacuation

The Disaster Coordinating Council (DCC) from the provincial to the barangay level shall undertake all necessary activities of the flood warning and evacuation proposed in Section 9.4.

11.4.2 Establishment of Flood Mitigation Committee (FMC)

(1) Background and Objectives of FMC

During the preparatory stage of the Study, the DPWH, the Provincial Government of Cavite and the JICA Preparatory Study Team agreed to organize the “Flood Mitigation Committee (hereinafter referred to as FMC)” at the local level (refer to “Minutes of Discussion on Implementation Agreement for the Study, Nov. 24, 2006”). The FMC is in line with the concept deliberated by the RBCO-DENR [refer to Subsection 6.2.3(2)].

The FMC needs to be set up during the study period so as to promote participation of the various stakeholders in the programs proposed in the Study and further, to facilitate execution of the pilot project to be undertaken by the JICA Study Team in collaboration with the NGOs/the local community. The FMC is also expected to function as the coordinating body for a variety of executing bodies for the proposed project components during and after the Study. From these points of view, the FMC shall have the following objectives:

(a) To support the JICA Study Team in disseminating information and knowledge acquired through the Study to the stakeholders;

(b) To reflect the comments, suggestions and recommendations of the stakeholders in the Study;

(c) To coordinate and support execution of the proposed structural flood mitigation programs;

(d) To coordinate and support execution of the ongoing and proposed non-structural flood mitigation programs including those for the community-based activities as well as enactment of an Ordinance/Regulation on land use control, which shall be proposed as one of the flood mitigation measures in the Study; and

(e) To coordinate and support sustainable operation and maintenance of the existing and proposed flood mitigation facilities.

(2) Organizational Setup of FMC

The FMC shall ideally include all stakeholders at the local level such as the members of the provincial and city/municipal government units, educational institutions, the barangays, the NGOs and the communities relevant to the proposed project in the Study Area. However, there are an extremely large number of stakeholders, and it is virtually difficult to integrate all of them as members of FMC.

At the same time, the proposed structural and non-structural programs could be executed as the extension and/or part of the ongoing activities by the existing organizations described in Subsection 11.4.1 and therefore mandated to them. The required function of FMC shall be oriented to coordination with the organizations and monitoring of the activities performed by them. From this point of view, the members of the provincial government agencies involving the head of the organizations are as proposed in the following table.

Table R 11.11 Proposed Members of FMC

Designation	Personnel(*) and Organization	Number of Personnel
Chairperson	Provincial Planning and Development Coordinator	1
Secretariat	Provincial Planning and Development Office (PPDO)	1
Vice-chairperson	District Engineer of DPWH in Tress Martires City	1
Member	Provincial Director of Philippine National Police (PNP)	1
Member	Head of PG-Environmental and natural Resources Office (PG-ENRO)	1
Member	Head of Provincial Housing and Urban Development Office	1
Member	Head of Provincial Engineering Office (POE)	1
Member	Representative from District Office of DENR in Tress Martires City	1
Member	Representative from District Office of NIA in Naic, Cavite	1
Total		9

(*): To be selected by the routine system

(3) Roles Required of FMC

The FMC shall undertake the following works (refer to Fig. 11.4 attached):

(a) During the Study Period

(i) Operation, Monitoring and Evaluation

- Monitor and evaluate establishment of the new provincial wide solid waste management system (refer to Subsection 6.4.2).
- Collaborate with the JICA Study Team on the enactment of an ordinance/regulation on land use control, which is proposed as one of flood mitigation measures in the Study (refer to Section 9.5).
- Coordinate setup of the project implementation system.
- Setup the coordinating system with the relevant authorities, which may include: (i) DPWH as the execution body for construction of proposed flood mitigation structures, (ii) executing committee/technical working group of "Oplan Linis Cavite," (iii) task force for relocation of informal dwellers, (iv) CPDO/MPDO for formulation of land use plan, (v) the PDCC for establishment of flood warning and evacuation.

- Monitor and evaluate the reorganization of PDCC, CDCC/MDCC and BDCC, and the preparation of the "Calamities and Disaster Preparedness Plan" by each disaster coordinating council.

(ii) Public Information and Training

- Support the JICA Study Team in providing the stakeholders with information and knowledge acquired in the Study through workshops, stakeholder's meeting, public consultation meetings and other dialogs.
- Coordinate with the communities on the execution of the pilot projects for cleanup of waterway proposed in the Study (refer to Subsection 9.2.5).
- Support the JICA Study Team in developing the model flood risk map in collaboration with the municipal governments and the communities.

(b) After Completion of the Study

(i) Operation, Monitoring and Evaluation

- Set the boundary of the river area and inventory the informal dwellers in the river area in collaboration with the Provincial Housing and Urban Development Office.
- Monitor and evaluate land acquisition and house evacuation required for construction of the flood mitigation structures proposed in the Study.
- Monitor and evaluate relocation of informal dwellers in the river area as proposed in the Study in collaboration with the Provincial Housing and Urban Development Office and the Provincial Legal Service Office.
- Monitor and evaluate declogging of garbage at the 14 critical bottlenecks and dredging along 6 critical drainage channels identified in the Study (refer to Subsection 9.2.1).
- Monitor and evaluate re-encroachment of informal dwellers after their relocation in collaboration with the PNP.
- Monitor and evaluate development of the procedures for flood warning and evacuation based on the plan proposed in the Study.
- Coordinate with PDCC and CDCC/MDCC in establishing the disaster operation center and the disaster evacuation center.
- Support and coordinate with PDCC and CDCC/MDCC in procuring the necessary rainfall gauging equipment and communication equipment for flood warning and evacuation.
- Support the CDCCs/MDCCs and BDCCs in establishing their own flood risk maps and in distributing them to the residents.

(ii) Public Information

- Coordinate and support promotion of the IEC on cleanup of waterway in collaboration with the executive committee/technical working group for "Oplan Linis Cavite."
- Coordinate and support promotion of the IEC on regulations for maintenance and management of the river area in collaboration with the Provincial Offices of DPWH and DENR.
- Coordinate and support promotion of the necessity of control of excessive land development from the viewpoint of flood mitigation in collaboration with PPDO and CPDO/MPDO.

- Coordinate and support to promote on flood warning and evacuation system in collaboration with PDCC, CDCC/MDCC and BDCC.

(iii) Training, Research and Development

- Coordinate with the executive committee/technical working group of "Oplan Linis Cavite" in the execution of the following activities: (1) opening and organizing seminars/workshops and distribution of manuals on the cleanup of waterways; and (2) organizing community-based field practices on the cleanup of waterways.
- Coordinate with the CDCC/MDCC on the regular conduct of trainings/drills on flood warning and evacuation.

11.5 Preliminary Plan for Resettlement

11.5.1 Resettlement Policy

The basic national policy governing involuntary resettlement and land acquisition is enshrined in the Philippine Constitution. Article II, Section 9 of the Bill of Rights guarantees that in the State's exercise of eminent domain "no person shall be deprived of property except by competent authority and for public use and always upon payment of just compensation." Article III, Section 1 reiterates that in the pursuit of government development objectives "private property shall not be taken for public use without just compensation."

There are parallel operational directives, guidelines and checklists governing resettlement issued by international funding agencies such as the World Bank (WB), the Asian Development Bank (ADB), the Japan Bank for International Cooperation (JBIC) and the Japan International Cooperation Agency (JICA) in consideration of environmental and social dimensions. These issuances uphold in principle that:

(1) Involuntary resettlement should be avoided or minimized where feasible by exploring all viable project options;

(2) Displaced persons should be compensated for their losses at full replacement cost prior to actual relocation;

(3) The absence of formal legal title to land by some affected groups should not be a bar to compensation;

(4) Displaced persons should be assisted during relocation and should be supported during the transition period after relocation to help them re-establish their social and economic base;

(5) The affected communities should be fully informed and consulted on resettlement and compensation options;

(6) Particular attention should be paid to the needs of the poorest affected persons, including those without legal title to assets, female-headed households and other vulnerable groups; and

(7) Involuntary resettlement should be conceived and executed as part of a development project and resettlement plans should be prepared with appropriate time-bound actions and budget.

In 1999, DPWH formulated a comprehensive *Land Acquisition, Resettlement and Rehabilitation Policy (LARRP)*, or simply the "Resettlement Policy," to govern all land acquisition, compensation, and resettlement of PAPs and vulnerable communities affected by the National Road Improvement Project (NRIMP). The Policy upholds the principle that PAPs should be provided with sufficient compensation for lost assets and resettlement to help them improve or at least maintain pre-project standards of living. Since then, the Resettlement Policy has undergone updating and revision, which finally lead to the adoption of the *Land Acquisition, Resettlement and Indigenous Peoples Policy* in 2006. The LARIPP now serves as the overall framework governing right-of-way (ROW) acquisition, payment of compensation and preparation of Land Acquisition, Resettlement and Indigenous People's Action Plans (LARIPAPs) for all types of DPWH projects.

11.5.2 Impacts of Resettlement

The implementation of this Master Plan would necessitate land acquisition in order to secure the right of way (ROW) of the potential flood control structures. This would likely create direct and indirect impacts, which could be significant in both social and economic terms. These impacts will affect not only the resettling communities but also on the host or receiving communities.

The adverse social impacts on resettling communities are likely to include loss of access to basic social infrastructures and services as well as the disintegration of social support systems and relationships. The significant economic impacts on would-be resettlers would likely include loss of assets (land, crops and structural improvements on land) and loss or diminution of income and economic opportunities.

On the other hand, the adverse impacts on the host communities are likely to include land speculation, increased population and in-migration, bigger administrative responsibilities for receiving LGUs, competition over limited resource, livelihood opportunities and existing social services.

In order to mitigate these potential impacts, JICA's Guidelines for Social and Environmental Consideration (2004) calls for resettlement to be undertaken as an integral component of the proposed interventions. With this end in view, resettlement concerns are examined in this early stage of project formulation. Care is taken in the course of selecting potential flood mitigation measures, to ensure that optimum benefits would be achieved while minimizing involuntary resettlement. Further, recommendations are put forward that will facilitate the Resettlement Action Plan (RAP) formulation and implementation in the succeeding stages of project development.

11.5.3 Scope of Resettlement

Preliminary investigation of the scope of potential resettlement was done using NAMRIA digital topographic maps (1990), time series SPOT and Quickbird satellite imageries (2002 to 2004) and JICA CALA Road Study (2003). These were further verified through field reconnaissance surveys. It is estimated that 470 houses/structures are likely to be affected by the proposed structural flood mitigation measures under the Master Plan.

The distribution of potential project-affected families (PAFs) is summarized in Table R 11.12.

Table R 11.12 Estimated Number of Houses/Structures Affected by the Potential Flood Mitigation Projects under the Master Plan

Municipality	Total No. of Barangays	No. of Barangays Affected	Number of Houses/Structures that may be Affected by Potential Projects					
			River Improvement	Off-site Retarding Basin	Off-site Retention Pond	Drainage Improvement	Coastal Dike	*Total*
Bacoor		11	120					
		6		30				
		1				10		
	73	**18**	***120***	***30***		***10***		***160***
Imus		26	80					
		6		15				
		1				2		
	97	**33**	***80***	***15***		***2***		***97***
Kawit		5	35					
		2				10		
		7					78	
	23	**14**	***35***			***10***	***78***	***123***
Noveleta		3	55					
	16	**3**	*55*					***55***
Rosario		1			1			
		2				10		
	20	**3**			*1*	*10*		***11***
Gen. Trias		4		14				
		1				10		
	33	**5**		***14***		***10***		***24***
Tanza	**41**	**0**						***0***
TOTAL	**303**	**76**	**290**	**59**	**1**	**42**	**78**	***470***

Source: JICA Study Team, 2007

At an average household size of 4.78 (the provincial average, NSO CY 2000), the total figure above readily translates to more than 2,200 potential project-affected persons (PAPs) who may need to be resettled when the Master Plan is implemented. It must be noted that from 2003-2005 the province posted a positive average annual population growth rate of 2.63 percent. This could mean that the number of potential PAPs may be more than 2,500 by the time the projects are undertaken.

The potential PAPs are distributed among 76 barangays within the jurisdiction of six municipalities; namely, Kawit, Noveleta, Rosario, Bacoor, Imus and General Trias. Some barangays will be affected by more than one of the proposed flood mitigation measures.

The most significant number of potential resettlers is from the municipality of Bacoor. This involves 18 barangays with 160 families. Kawit follows with 123 potential PAFs distributed in 14 barangays, then Imus with 97 potential PAFS distributed in 33 barangays. The municipality of Rosario would be least affected, since there are only 11 families from three barangays who may need to resettle.

11.5.4 Socio-Economic Conditions of Potential Resettlers

The Study Team conducted an interview survey among river residents and farm lot/fishpond occupants as part of the Initial Environmental Examination (IEE) Study. The sampled population represents the potential resettling families from barangays within and immediately surrounding the proposed project areas,as shown in Table R 11.13. The respondents included the following**:** (i) 199 river residents representing 11 barangays distributed in Bacoor, Kawit, Noveleta, Rosario, Gen. Trias and Tanza; (ii) 22 farm lot occupants (tenants) representing 6 barangays in Imus, Kawit and Gen. Trias; and (iii) 12 fishpond occupants (tenants) representing 3 coastal barangays in Kawit and Noveleta.

The survey results were supplemented with secondary information obtained from the official data banks of the LGUs and the National Statistics Coordination Board (NSCB) of the National Statistics Office (NSO). Together, the data sets were used to preliminarily profile and describe the socio-economic characteristics of the potential resettlers. A more detailed socio-economic analysis will be undertaken later to fully characterize the would-be affected families after they shall have been identified during the census-tagging activities, as explained in Section 11.5.7.

Table R 11.13 Distribution of Respondents of Social Survey

Municipality	River Bank Residents	
	Barangays Surveyed	No. of Respondents
Bacoor	3 Banalo	10
	Mabolo III	9
	Sineguelasan	30
	Sub-Total	***49***
Kawit	1 Manggahan-Lawin	19
	Sub-Total	***19***
Noveleta	3 San Juan II	24
	Santa Rosa I	12
	Santa Rosa II	11
	Sub-Total	***47***
Rosario	1 Tejeros Convention	14
	Sub-Total	***14***
Gen. Trias	1 Tejero	36
	Sub-Total	***36***
Tanza	2 Biwas	16
	Bucal	18
	Sub-Total	***34***
TOTAL	***11***	***199***

Municipality	Farm Land Occupants	
	Barangays	No. of Respondents
Imus	4 Anabu I-G (Ragatan)	2
	Anabu II-B	1
	Malagasang	14
	Paliko	1
		18
Kawit	1 Batong Dalig	1
		1
Gen. Trias	1 Bacao	3
		3
TOTAL	***6***	***22***

Municipality	Fishpond Occupants	
	Barangays	No. of Respondents
Kawit	2 Kaingin	4
	Wakas	1
		5
Noveleta	1 San Rafael III	7
		7
TOTAL	***3***	***12***

Source: JICA IEE Study, 2007.

The socio-economic conditions of the families in the potential project areas and vicinities are described hereafter.

(1) Population and Demographic Characteristics

(a) Household Population/Size

Table R 11.14 shows the household size of potential resettlers. Among the riverbank residents, 80% of families have more than three children. The largest group (47%) has 4-6 members, 25% has 7-9 members and only 20% has 1-3 members. The biggest families belong to 8% of riverbank residents, from Bgy. Biwas (Tanza) and Bgy. Manggahan (Kawit), both of which have more than 20% of families with 10 or more members.

The condition is similar among farmland and fishpond residents, where 46% and 50% of the families, respectively, have 4-6 members and only 36% and 25% of the households, respectively, have 1-3 members.

The figures appear to be consistent with recent census data (NSCB, CY 2000), which puts the provincial average household size at 4.78 members per household.

Table R 11.14 Size of Households of Social Survey Respondents

Municipality	Household Size										
	1-3	%	4-6	%	7-9	%	10 & Above	%	NR*	%	Total No. of Respondents
RIVER BANK RESIDENTS											
Bacoor	7	14%	20	41%	19	39%	3	6%	0	0%	49
Kawit	5	26%	6	32%	4	21%	4	21%	0	0%	19
Noveleta	8	17%	30	64%	7	15%	1	2%	1	2%	47
Rosario	4	29%	5	36%	3	21%	2	14%	0	0%	14
Gen. Trias	8	22%	18	50%	8	22%	1	3%	1	3%	36
Tanza	7	21%	14	41%	9	26%	4	12%	0	0%	34
TOTAL	***39***	***20%***	***93***	***47%***	***50***	***25%***	***15***	***8%***	***2***	***1%***	***199***
FARMLAND OCCUPANTS											
Imus	7	39%	8	44%	3	17%					18
Kawit	1	100%	0	0%	0	0%					1
Gen. Trias	0	0%	2	67%	1	33%					3
TOTAL	***8***	***36%***	***10***	***46%***	***4***	***18%***					***22***
FISHPOND OCCUPANTS											
Kawit	2	40%	2	40%	1	20%					5
Noveleta	1	14%	4	57%	2	29%					7
TOTAL	***3***	***25%***	***6***	***50%***	***3***	***25%***					***12***

*NR = no response

Source: JICA IEE Study, 2007.

(b) Gender Distribution

The respondents of the surveyed riverbank households are not always the head of each family. They are mostly wives who are staying at home while the husband and other family members are at work during the day-time. As surveyed, the gender distributions of the respondents of the riverbank households (199) are as follows: male, 59 (30%) and female, 140 (70%).

However, gender of the household head is more useful for describing the characteristics of the severely vulnerable resettling families. The survey obtained data on gender, along with other socio-economic indicators such as age, livelihood occupation and income of each working family member from most of the surveyed households. Based on these data, the biggest contributor to family income is assumed to be the head of each household. When, the income data are not available, the respondents are assumed as the head of household.

Among the farm and fishpond tenants, almost all the respondents are engaged in farming or fishpond operation as their main occupation. They are assumed to be the head of household.

On the above assumptions, Table R 11.15 shows the gender distribution of the heads of surveyed households. Among the riverbank residents, 32% constitute the female household heads. Among farmland and fishpond occupants, the females constitute 27%

and 33% of the household heads, respectively.

Female-headed households would need extra help to get their social and economic base rehabilitated after involuntary displacement. This is because females rely heavily on social networks and institutional support in order to effectively carry out the dual function of caring for the children and providing for the family's basic needs. However, women have more limited access to economic opportunities compared to their male counterparts.

Table R 11.15 Gender Distribution of Household Heads

Municipality	Gender				
	Male	%	Female	%	Total
RIVERBANK RESIDENTS					
Bacoor	40	82%	9	18%	49
Kawit	15	79%	4	21%	19
Noveleta	29	62%	18	38%	47
Rosario	9	64%	5	36%	14
Gen. Trias	20	56%	16	44%	36
Tanza	23	68%	11	32%	34
TOTAL	***136***	***68%***	***63***	***32%***	***199***
FARMLAND RESIDENTS					
Imus	12	67%	6	33%	18
Kawit	1	100%	0	0%	1
Gen. Trias	3	100%	0	0%	3
TOTAL	***16***	***73%***	***6***	***27%***	***22***
FISHPOND RESIDENTS					
Kawit	5	100%	0	0%	5
Noveleta	3	43%	4	57%	7
TOTAL	***8***	***67%***	***4***	***33%***	***12***

Source: JICA IEE Study, 2007.

(c) Age Structure

There are no data to show the age structure of would-be affected population. Table R 11.16 shows the age distribution of the household heads only. Poor households that are headed by the elderly are also extremely vulnerable to impoverishment as a result of involuntary displacement and will therefore need special attention.

Table R 11.16 Age Distribution of Household Heads

Municipality	Age												
	30 yrs. Below	%	31-40	%	41-50	%	51-60	%	61 & Above	%	No Response	%	Total
RIVERBANK RESIDENTS													
Bacoor	12	24%	9	18%	17	35%	5	10%	6	12%	0	0%	49
Kawit	4	21%	8	42%	3	16%	2	11%	2	11%	0	0%	19
Noveleta	15	32%	10	21%	7	15%	10	21%	5	11%	0	0%	47
Rosario	3	21%	3	21%	2	14%	3	21%	3	21%	0	0%	14
Gen. Trias	12	33%	11	31%	7	19%	3	8%	3	8%	0	0%	36
Tanza	11	32%	7	21%	6	18%	3	9%	6	18%	1	3%	34
TOTAL	***57***	***29%***	***48***	***24%***	***42***	***21%***	***26***	***13%***	***25***	***13%***	***1***	***1%***	***199***
FARMLAND RESIDENTS													
Imus	3	17%	2	11%	3	17%	4	22%	6	33%	0	0%	18
Kawit	0	0%	0	0%	0	0%	1	100%	0	0%	0	0%	1
Gen. Trias	0	0%	1	33%	1	33%	1	33%	0	0%	0	0%	3
TOTAL	***3***	***14%***	***3***	***14%***	***4***	***18%***	***6***	***27%***	***6***	***27%***	***0***	***0%***	***22***
FISHPOND RESIDENTS													
Kawit	1	20%	0	0%	3	60%	0	0%	1	20%	0	0%	5
Noveleta	0	0%	0	0%	3	43%	2	29%	2	29%	0	0%	7
TOTAL	***1***	***8%***	***0***	***0%***	***6***	***50%***	***2***	***17%***	***3***	***25%***	***0***	***0%***	***12***

Source: JICA IEE Study, 2007

Among the river bank residents, 73% of the household heads are younger than 50 years old. The biggest age group (29%) belongs to household heads aged 30 years and below. Those aged 31-40 comprise 24% of the household heads, while those aged 41-50 comprise 21%. Only a few (13%) are senior citizens aged over 60 years old.

Farmland and fishpond household heads appear to be older in comparison to their riverbank counterparts. Among farm tenants, the senior citizens who are over 60 years of age comprise nearly a third (27%) of the family heads. Among fishpond tenants, the largest group (50%) belongs to the 41-50 age bracket. At least 25% of the household heads are senior citizens.

Overall, more than 70% of all household heads are still in their child bearing and economically productive years, i.e., below 60 years old. This could be indicative of an actively growing population, both in numerical and economic terms.

(2) Economic Conditions

(a) Livelihood and Income Sources

Table R11.17 shows the primary sources of income and livelihood of household heads among riverbank residents.

Table R 11.17 Primary Sources of Income and Livelihood of Household Heads

Municipality	Source of Income																
	A	%	B	%	C	%	D	%	E	%	F	%	G	%	NR	%	Total
RIVERBANK RESIDENTS																	
Bacoor	9	18%	15	31%	13	27%	3	6%	4	8%	2	4%	1	2%	2	4%	49
Kawit	5	26%	7	37%	0	0%	4	21%	2	11%	1	5%	0	0%	0	0%	19
Noveleta	13	28%	19	40%	1	2%	9	19%	2	4%	1	2%	1	2%	1	2%	47
Rosario	4	29%	7	50%	0	0%	1	7%	0	0%	1	7%	0	0%	1	7%	14
Gen. Trias	4	11%	14	39%	0	0%	6	17%	1	3%	4	11%	0	0%	7	19%	36
Tanza	7	21%	17	50%	0	0%	6	18%	3	9%	0	0%	0	0%	1	3%	34
TOTAL	***42***	***21%***	***79***	***40%***	***14***	***7%***	***29***	***15%***	***12***	***6%***	***9***	***5%***	***2***	***1%***	***12***	***6%***	***199***

Note: A: Business / Sales
B: Employment
C: Agriculture (Farm / Fishing)
D: Driving
E: Technical/ Machine Works
F: Odd Jobs
G: Pension
NR: No response

Source: JICA IEE Study, 2007.

The largest group (40%) of the household heads among riverbank residents are employed as office worker, factory worker, skilled worker, construction worker, care/health worker, security guard, etc. A relatively large percentage (21%) engages in business/sales such as buy-and-sell, goods production, sales agent, small variety ("sari-sari") stores, food vending and house rental. About 15% derive their income from driving public transport vehicles and 7% from agricultural activities such as farming, fishing and poultry-raising. A smaller segment includes technicians/machine workers (6%), odd jobs (5%) and pensioners (1%). The odd jobs include such services as laundry, sewing and manicure.

If relocated off-site, most of these PAPs would probably spend more money in terms of transportation cost to and from their present work places. Many others would likely need help in terms of re-establishing their businesses or starting new ones, access to credit facilities, and capacity building in entrepreneurial skills. A few would need to relocate to other areas where they can re-engage in farming and fishing.

The household heads from the farmlands and fishpond areas are mostly tenants who engage in farming and aquaculture fisheries activities. Farmers engage in the production of rice, corn, vegetable, fruit trees and livestock (hogs, goats, chickens and ducks). Fishpond tenants engage in milkfish and shrimp culture, and salt production. These categories of PAFs may need assistance in terms of learning new livelihood skills, if not provided with similar income-earning opportunities in the new location.

(b) Income Levels

Table R 11.18 shows the per capita monthly income among the surveyed riverbank residents and farm and fishpond tenant-households. The data reflect incomes from both primary and secondary sources of the household heads, along with other economically active family members, who significantly contribute to the household's composite earnings.

Table R 11.18 Per Capita Monthly Income among Riverbank Residents and Farm/Fishpond Tenant-Households

Municipality	Income per Capita														
	A	%	B	%	C	%	D	%	E	%	F	%	NR	%	No. of Households
RIVERBANK RESIDENTS															
Bacoor	12	24%	13	27%	11	22%	3	6%	8	16%	1	2%	1	2%	49
Kawit	5	26%	3	16%	7	37%	0	0%	0	0%	1	5%	3	16%	19
Noveleta	11	23%	7	15%	17	36%	2	4%	1	2%	6	13%	3	6%	47
Rosario	5	36%	1	7%	4	29%	1	7%	0	0%	1	7%	2	14%	14
Gen. Trias	10	28%	6	17%	12	33%	4	11%	0	0%	1	3%	3	8%	36
Tanza	15	44%	6	18%	9	26%	2	6%	0	0%	1	3%	1	3%	34
TOTAL	***58***	***29%***	***36***	***18%***	***60***	***30%***	***12***	***6%***	***9***	***5%***	***11***	***6%***	***13***	***7%***	***199***
FARMLAND TENANTS															
Imus	10	56%	1	6%	3	17%	1	6%	1	6%	1	6%	1	6%	18
Kawit	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1
Gen. Trias	1	33%	1	33%	0	0%	1	33%	0	0%	0	0%	0	0%	3
TOTAL	***12***	***55%***	***2***	***9%***	***3***	***14%***	***2***	***9%***	***1***	***5%***	***1***	***5%***	***1***	***5%***	***22***
FISHPOND TENANTS															
Kawit	2	40%	0	0%	0	0%	0	0%	0	0%	1	20%	2	40%	5
Noveleta	2	29%	0	0%	2	29%	1	14%	1	14%	1	14%	0	0%	7
TOTAL	***4***	***33%***	***0***	***0%***	***2***	***17%***	***1***	***8%***	***1***	***8%***	***2***	***17%***	***2***	***17%***	***12***

Note: A: Php 1,100 & Below
B: Php 1,101 – 1,700
C: Php 1,701 – 3,000
D: Php 3,001 – 4,000
E: Php 4,001 – 5,000
F: Php 5,000 & Above
NR: No Response

Source: JICA IEE Study, 2007.

During the census year 2000, the annual per capita poverty threshold and per capita food threshold in the Province of Cavite was estimated at Php 14,965 and Php 9,457, respectively. For the year 2007, these were projected to be Php 20,952 and Php 13,240, respectively, by multiplying the price escalation rate of 1.4 during the period 2000-2007. Hence, the current monthly per capita poverty threshold and per capita food threshold in the project area are estimated at Php 1,746 and Php 1,103, respectively.

Based on these poverty indicators, a significant percentage (47%) of the riverbank residents live below poverty level and about 29% can barely eat three decent meals a day. Moreover, the largest group (64%) of the farm tenant families live below poverty and 55% could hardly meet their food threshold level. Similarly, one-third of the fishpond tenant families also live below the poverty and food threshold levels.

The families just described are considered among the poorest of the poor. Without a sound livelihood development and income restoration program to rehabilitate them, these vulnerable families are prone to further impoverishment due to involuntary displacement as a result of the project.

(c) Dependency

The number of children below the age of 18 is shown in Table R 11.19. They comprise the economically dependent or non-earning members of the surveyed households.

The figures indicate that largest group of the families (56% of riverbank residents, 55% of farmland tenants and 42% of fishpond tenants) have only one to three dependent children. Still, a significant percentage has four or more dependent children. A few riverbank residents, in particular, have as many as 10 or more children.

The high economic dependency of non-working members of the family puts more pressure on the scarce family resources. The livelihood and income restoration efforts after resettlement should take this matter into consideration.

Table R 11.19 Number of Dependent/Non-earning Children

Municipality	Total No. of Dependent Children												
	None	%	1-3	%	4-6	%	7-9	%	10 & Above	%	NR*	%	No. of Households
RIVERBANK RESIDENTS													
Bacoor			24	60%	14	35%	2	5%	0	0%	9	0%	49
Kawit			9	47%	5	26%	4	21%	0	0%	1	5%	19
Noveleta			26	55%	12	26%	4	9%	1	2%	4	9%	47
Rosario			5	50%	3	30%	1	10%	1	10%	4	0%	14
Gen. Trias			19	61%	5	16%	7	23%	0	0%	5	0%	36
Tanza			14	50%	12	43%	0	0%	2	7%	6	0%	34
TOTAL			***97***	***56%***	***51***	***29%***	***18***	***10%***	***4***	***2%***	***5***	***3%***	***199***
FARMLAND TENANTS													
Imus			11	61%	4	22%	3	17%					18
Kawit			0	0%	1	100%	0	0%					1
Gen. Trias			1	33%	2	67%	0	0%					3
TOTAL			***12***	***55%***	***7***	***32%***	***3***	***14%***					***22***
FISHPOND TENANTS													
Kawit	1	20%	2	40%	2	40%	0	0%					5
Noveleta	0	0%	3	43%	3	43%	1	14%					7
TOTAL	***1***	***8%***	***5***	***42%***	***5***	***42%***	***1***	***8%***					***12***

*NR = no response

Source: JICA IEE Study, 2007

(d) Skills

According to Table R 11.20**,** most of the household heads of river bank residents appear to be skillful at business enterprise and home-based cottage industries. A considerable number possess technical skills for driving (15%), technical work, auto mechanic and welding (12%), factory work (13%), construction work, carpentry and masonry (3%), and vocational skills like sewing, manicure, health care and the like (16%). These skills may be enhanced to meet possible employment demands in related industries and factories that now operate in Cavite.

Table R 11.20 Livelihood Skills of Household Heads

Municipality	Livelihood Skills																				
	A	%	B	%	C	%	D	%	E	%	F	%	G	%	H	%	I	%	NR	%	No. of HH Heads
	RIVERBANK RESIDENTS																				
Bacoor	9	18%	3	6%	13	27%	4	8%	1	2%	2	4%	5	10%	7	14%	2	4%	3	6%	49
Kawit	5	26%	4	21%	0	0%	4	21%	3	16%	0	0%	0	0%	2	11%	1	5%	0	0%	19
Noveleta	13	28%	9	19%	1	2%	6	13%	8	17%	1	2%	2	4%	4	9%	1	2%	2	4%	47
Rosario	4	29%	1	7%	0	0%	0	0%	2	14%	1	7%	2	14%	2	14%	1	7%	1	7%	14
Gen. Trias	4	11%	6	17%	0	0%	3	8%	6	17%	0	0%	3	8%	3	8%	4	11%	7	19%	36
Tanza	7	21%	6	18%	0	0%	6	18%	6	18%	2	6%	3	9%	3	9%	0	0%	1	3%	34
TOTAL	***42***	***21%***	***29***	***15%***	***14***	***7%***	***23***	***12%***	***26***	***13%***	***6***	***3%***	***15***	***8%***	***21***	***11%***	***9***	***5%***	***14***	***7%***	***199***

Note: A: Business / Sales; B: Driver; C: Farming / Fishing; D: Technician / Skilled Worker; E: Factory Worker; F: Construction Worker; G: Office Employee; H: Health Worker / Security; I: Odd Jobs; NR: No response incl. pension

Source: JICA IEE Study, 2007

Nevertheless, a thorough skills assessment should be carried out in order to adequately profile the employment qualifications and income-earning skills of PAPs. This should be matched with the results of environmental scanning of the resource base, opportunities and support mechanisms available in the host communities. The process will help facilitate the identification of livelihood and vocational trainings necessary to equip the resettling families towards more sustainable economic activities after relocation.

(3) Social Conditions

Table R 11.21 shows the educational attainment of the survey respondents. There are no specific data to show educational attainment of other economically active members, especially household heads and other income-earners.

Table R 11.21 Educational Attainment of Social Survey Respondents

Municipality	Educational Attainment														
	A	%	B	%	C	%	D	%	E	%	F	%	G	%	No. of Respondents
RIVERBANK RESIDENTS															
Bacoor	6	12%	6	12%	10	20%	15	31%	5	10%	7	14%	0	0%	49
Kawit	0	0%	3	16%	7	37%	5	26%	2	11%	1	5%	1	5%	19
Noveleta	6	13%	16	34%	7	15%	14	30%	0	0%	1	2%	3	6%	47
Rosario	1	7%	0	0%	3	21%	7	50%	1	7%	2	14%	0	0%	14
Gen. Trias	6	17%	8	22%	3	8%	8	22%	3	8%	3	8%	5	14%	36
Tanza	2	6%	7	21%	3	9%	14	41%	0	0%	8	24%	0	0%	34
TOTAL	***21***	***11%***	***40***	***20%***	***33***	***17%***	***63***	***32%***	***11***	***6%***	***22***	***11%***	***9***	***5%***	***199***
FARMLAND RESIDENTS															
Imus	2	11%	5	28%	3	17%	4	22%	0	0%	3	17%	1	6%	18
Kawit	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1
Gen. Trias	1	33%	0	0%	1	33%	1	33%	0	0%	0	0%	0	0%	3
TOTAL	***4***	***18%***	***5***	***23%***	***4***	***18%***	***5***	***23%***	***0***	***0%***	***3***	***14%***	***1***	***5%***	***22***
FISHPOND RESIDENTS															
Kawit	2	40%	2	40%	0	0%	1	20%	0	0%	0	0%	0	0%	5
Noveleta	2	29%	3	43%	1	14%	1	14%	0	0%	0	0%	0	0%	7
TOTAL	***4***	***33%***	***5***	***42%***	***1***	***8%***	***2***	***17%***	***0***	***0%***	***0***	***0%***	***0***	***0%***	***12***

Note : A: Elementary School Undergraduate
B: Elementary School Graduate
C: High School Undergraduate
D: High School Graduate
E: College Undergraduate
F: College Graduate
G: Others / Vocational School

Source: JICA IEE Study, 2007.

A large percentage (54%) of respondents among the riverbank residents are at least high school graduates. Of these about 20% of these have gone to college and 11% are college degree holders.. A smaller percentage (20%) finished basic elementary education only, while 11% reached elementary school level.

The respondents among farmland and fishpond residents have lower educational attainment. Among farmer-respondents, only 23% finished primary school only, while 42% attained high school and higher level tertiary and vocational education.

Fishpond tenants appear to have the lowest educational attainment; 42% of the respondents are elementary graduates only, while 33% did not finish even elementary education. Only 17% graduated in high school. In order that these PAFs will not be worse off after relocation, the kind of livelihood opportunities and resources available in their new location should at least match their present social realities and potentials.

Among the municipalities, Rosario has the most number of high school, vocational school and college graduates (71%), followed by Tanza (65%) and Bacoor (55%). Comparatively speaking, respondents from these municipalities may be better equipped to hurdle employments requiring technical, vocational and clerical skills, if displaced from their present sources of livelihood.

(4) Tenurial Characteristics

Experience in past interview surveys shows that potential resettlers tend to provide inconclusive answers when questioned about land tenure and ownership of property and improvements. The interview results presented below could only serve as preliminary information. It is crucial to ascertain the actual tenurial status of PAFs in order to determine their eligibility to receive compensation and other entitlements. Verification will be done during the master list preparation after the conduct of census/tagging (C/T) activities based on legal titles or claims to properties as presented by PAFs, or on official documents/records of the Municipal/Provincial Assessor, the Registry of Deeds and/or the DENR-Land Management Bureau (LMB). The PAF's eligibility to compensation will be discussed further in Section 11.5.7.

As a policy, DPWH provides cash compensation to legitimate owners of land, crops, structure and/or other improvement on affected real properties based on fair market value. Renters, sharers and rent-free occupants are only assisted financially or in kind during demolition,

transfer and transition period in the new settlements. The compensation policy will be discussed more thoroughly in Section 11.5.7.

(a) Ownership of Lot

Table R 11.22 below shows the status of land ownership according to survey respondents.

Table R 11.22 Lot Ownership among Social Survey Respondents

Municipality	Lot Ownership														
	A	%	B	%	C	%	D	%	E	%	F	%	NR	%	No. of Respondents
RIVERBANK RESIDENTS															
Bacoor	3	6%	9	18%	21	43%	6	12%					10	20%	49
Kawit	2	11%	8	42%	5	26%	2	11%					2	11%	19
Noveleta	13	28%	8	17%	9	19%	8	17%					9	19%	47
Rosario	0	0%	3	21%	8	57%	1	7%					2	14%	14
Gen. Trias	3	8%	3	8%	27	75%	2	6%					1	3%	36
Tanza	10	29%	4	12%	4	12%	14	41%					2	6%	34
TOTAL	***31***	***16%***	***35***	***18%***	***74***	***37%***	***33***	***17%***					***26***	***13%***	***199***
FARMLAND TENANTS															
Imus	8	47%							0	0%	7	41%	2	12%	17
Kawit	0	0%							0	0%	1	100%	0	0%	1
Gen. Trias	2	67%							0	0%	1	33%	0	0%	3
TOTAL	***10***	***48%***							***0***	***0%***	9	*43%*	***2***	***9%***	***21***
FISHPOND TENANTS															
Kawit	2	40%							0	0%	3	60%			5
Noveleta	5	71%							1	14%	1	14%			7
TOTAL	***7***	***58%***							***1***	***8%***	***4***	***34%***			***12***

Note: A: Own Lot C: Relatives E: Rent NR: Others / No Response
B: Government D: Private F: Rent-Free

Source: JICA IEE Study, 2007.

Among riverbank residents, only 16% of the respondents claim that the lots occupied by their residential structures belong to them. The largest group of the respondents admits that the land is owned by other family members/relatives (37%). Otherwise, the home lots are owned by the government (18%) or other private entities (17%).

In contrast, a significant percentage of farmland tenants (48%) and fishpond tenants (58%) claim that they own the land where they live. A relatively big segment of farm lot and fishpond tenants (43% and 34%, respectively) are rent-free occupants. The rest are either renting or presumably have other forms of arrangements with the landowner.

(b) Ownership of House

As to house ownership (Table R 11.23), a big majority of respondents (64% of riverbank residents, 73% of farm lot occupants and 58% of fishpond tenants, respectively) claim they own the house structures where they live. About 25% of riverbank residents say that their parents, relatives or employers own the structures. The rest are either renting (9%) or enjoy some other form of occupancy arrangement. Some fishpond tenants (33%) and farm tenants (18%) occupy their present dwelling units for free.

Table R 11.23 House Ownership among Social Survey Respondents

Municipality	House Ownership														
	A	%	B	%	C	%	D	%	E	%	F	%	NR	%	No. of Respondents
RIVERBANK RESIDENTS															
Bacoor	34	69%	7	14%	4	8%	4	8%	0	0%			0	0%	49
Kawit	12	63%	3	16%	1	5%	3	16%	0	0%			0	0%	19
Noveleta	30	64%	5	11%	5	11%	5	11%	1	2%			1	2%	47
Rosario	9	64%	1	7%	3	21%	1	7%	0	0%			0	0%	14
Gen. Trias	24	67%	6	17%	3	8%	1	3%	0	0%			2	6%	36
Tanza	18	53%	9	26%	0	0%	4	12%	0	0%			3	9%	34
TOTAL	***127***	***64%***	***31***	***16%***	***16***	***8%***	***18***	***9%***	***1***	***1%***			***6***	***3%***	***199***
FARMLAND TENANTS															
Imus	14	78%					0	0%			2	11%	2	11%	18
Kawit	0	0%					0	0%			1	100%	0	0%	1
Gen. Trias	2	67%					0	0%			1	33%	0	0%	3
TOTAL	***16***	***73%***					***0***	***0%***			4	*18%*	***2***	***9%***	***22***
FISHPOND TENANTS															
Kawit	2	40%					0	0%			3	60%			5
Noveleta	5	71%					1	14%			1	14%			7
TOTAL	***7***	***58%***					***1***	***8%***			***4***	***33%***			***12***

Note: A: Own house B: Parents C: Relatives D: Rent E: Employer F: Rent-Free NR: Others / No Response

Source: JICA IEE Study, 2007.

11.5.5 Housing Program of Cavite Province

The government housing initiative of Province of Cavite is still in its infancy, having been birthed only in January 2007. The overarching goal of the program is to provide adequate, decent and affordable housing to underprivileged and homeless Caviteños. Housing is now among the flagship programs of the province under the present administration.

The Provincial Housing Development and Management Office (PHDMO) is the executive arm tasked with the implementation of the housing and resettlement program of Cavite. Consistent with its mandate, the PHDMO prepared the blueprint of the Province's comprehensive shelter program. It includes plans to develop present and potential resettlement sites to address the province's housing backlog.

The PHDMO in coordination with the Urban Poor Affairs Office (UPAO) started taking census of informal settlers in 2007. Census survey and documentation is still in progress, with a view to prepare a comprehensive master list of potential beneficiaries of the province's housing program.

On this positive note, the Provincial Government is now poised to respond to the resettlement concerns vis-à-vis the eventual implementation of the Master Plan. It has started addressing the vicious cycle of squatting and its attendant social ills by waging a relentless campaign to weed out squatters and squatting syndicates throughout the province by year 2010 starting with the so-called "danger zones," including river banks.

According to PHDMO, the Provincial Task Force Against Professional Squatters and Squatting Syndicates (PTFAPSSS) began the demolition of house structures along the danger areas in September 2007. Todate most squatter shanties along the riverbanks and other danger areas in Dasmariñas and Trece Martires City have been removed. More shanties are scheduled for immediate demolition in Imus, Bacoor and Kawit.

Table R 11.24 shows the target beneficiaries of the province's shelter development program based on preliminary estimates by the PHDMO. As of 2007, there were 84,617 homeless families residing in 335 of the 830 barangays throughout the province. PHDMO envisions the resettlement of these families to proceed in several phases until all informal settlers shall have been fully resettled and rehabilitated.

Table R 11.24 Estimated Number of Informal Settlers subject to Resettlement under the Housing Development Program of the Province of Cavite

Municipality	Total No. of Barangays	No. of Barangays with Informal Settlers	ESTIMATED NO. OF FAMILIES (As of 2007)			
			Private Land	Public Land	Danger Zone	All
1 Kawit	23	22	226	2,750	1,859	*4,835*
2 Noveleta	16	9	268		646	*914*
3 Rosario	20	20	8,270	5,075	1,037	*14,382*
4 Cavite City	84	37	105		15,632	*15,737*
5 Bacoor	73	59	10,675		10,310	*20,985*
6 Imus	97	9			5,150	*5,150*
7 Dasmariñas	73	14	234	1,264	635	*2,133*
8 GMA	27	16	1,095	2,614		*3,709*
9 Carmona	14	3			239	*239*
10 Gen. Trias	33	17	663	263	778	*1,704*
11 Tanza	41	8	135	320	190	*645*
12 Trece Martirez City	13	6	3,107		498	*3,605*
13 Silang	64	21	805	598		*1,403*
14 Amadeo	26	4			13	*13*
15 Tagaytay City	34	29	2,000			*2,000*
16 Alfonso	32	8	121			*121*
17 Indang	36	5			43	*43*
18 Mendez	24	7	125		8	*133*
19 Magallanes	16	0				
20 Maragondon	27	2			465	*465*
21 Gen. Aguinaldo	17	0				
22 Ternate	10	10	345		428	*773*
23 Naic	30	29	98	1,111	4,419	*5,628*
Total (Province-wide)	***830***	***335***	***28,272***	***13,995***	***42,350***	**84,617**
Total (Study Area)		***68***	***60***	***120***	***290***	**470**

Source: PHDMO, UPAO (Cavite Province), 2007

As already discussed in Sub-section 11.5.3, about 470 families are likely to be displaced by the proposed projects. These families are distributed in 76 barangays within six of the seven municipalities affected by the Master Plan. Of these, 290 families may likely be removed from riverbanks, which are proposed for river improvement. Some (120 families) may likely be removed from public lands that will be needed for drainage improvement and coastal dike. Others (60 families) may likely be removed from private lands that will be needed for off-site retarding basins and retention ponds.

The 470 potential resettlers owing to the proposed structural measures include both formal and informal settlers. This constitutes less than .05% of the total number of informal settlers who are subject to resettlement under the Province's housing development program.

11.5.6 Potential Resettlement Sites for the PAFs

More or less 5.0 hectares of land will be needed to provide a suitable resettlement site for the 470 potential PAFs. This area will include adequate spaces for socialized housing structures as well as basic support infrastructures such as roads, drainage, water supply and power lines. It may also include spaces for public schools, wet market, chapels, health care centers, materials recovery facility (MRF) and such other social facilities as may be necessary to help restore the social and economic base of PAFs.

DPWH as the proponent has an option to acquire land for resettlement site development through GOP funds. Otherwise, it may enter into a memorandum of understanding (MOU) with the Provincial government of Cavite in coordination with the municipal/city governments to develop existing or potential resettlement sites acquired by the LGUs. Either way, the development of resettlement sites may be financed with a component of the loan earmarked for implementing the Master Plan, subject to negotiation with JBIC or other funding agencies.

The Provincial government presently operates one existing resettlement and developing a new one. It also assists in the improvement and upgrading of other sites in coordination with the National Housing Authority (NHA), the municipal/city LGUs and non-government organizations (NGOs),as will be

discussed in more detail below. Meanwhile the PHDMO is actively pursuing land banking activities in anticipation of the full-scale implementation of the province's shelter development program. Plans are now in place for the acquisition of additional resettlement lands; some of these are proposed for inclusion in the 2009 budget of the province.

The province has also initiated dialogues with each municipal and city government to address the problem of squatting in a comprehensive manner. The ultimate plan is for each LGU to provide at least one resettlement site within the respective municipality/city to accommodate some of the informal settlers in the respective jurisdiction. Where the proposed projects under the Master Plan are concerned, on-site relocation of families within the respective municipalities would be more advantageous and preferable. This possibility should be explored as one of the best resettlement options to address the effects of project-induced displacement.

At least eleven existing and proposed resettlement sites within the vicinity of the projects areas were identified by the Study Team in consultation with different housing agencies in Cavite, including the PHMDO, NHA, concerned municipal/city LGUs and NGOs. All in all, the sites have an aggregate area of more than 122.0 hectares. If acquired and/or developed before the Master Plan is implemented, these resettlement sites could accommodate the influx of potential resettlers who will be displaced due to the proposed flood mitigation structures. Table 11.8 shows the availability and status of these resettlement sites. Fig. 11.5 shows the individual location. A description of the potential resettlement sites in each LGU is given below:

(1) Dasmariñas

There are two potential sites in the municipality of Dasmarinas. One is a 7.0 ha resettlement site located in Barangay Langkaan I and the other is a 5.0-ha lot proposed to be acquired in Bgy. Langkaan II. The one in Langkaan I is known as the "Abot-Kamay Hometown Village." This is the first fully operational resettlement site developed by the provincial government. It was initially established as a socialized housing village under the Community Mortgage Program (CMP) financed by the National Home Mortgage Finance Corporation (NHMFC). Some of the families affected by the first wave of demolition activities were moved to this site.

Due to the limited capacity, the present CMP site in Bgy. Langkaan I and the proposed site in Langkaan II may be able to accommodate only a few families, possibly the PAFs from Gen. Trias who will be displaced by the off-site retarding basin and/or drainage improvement works.

(2) General Trias

A 53-hectare land in Barangay Pasong Kawayan II, General Trias was acquired by the Province in early 2008 for its shelter program. Priority beneficiaries include qualified PAG_IBIG members from among the office and factory work force of the province. Land development works are currently in progress. The scale model and development plans of this resettlement site have been prepared. Housing development will include construction of economic structures (duplex units) for as many as 6,700 families.

According to PHDMO, some 25%-30% of the area will be earmarked to provide socialized housing to qualified informal settlers who were affected by demolition along the danger areas. Target beneficiaries include bona fide PAG-IBIG members who have the capacity to pay a reasonable monthly amortization so as to ensure recoupment of the development cost and to guarantee loan repayment.

The Pasong Kawayan II site has a good chance to accommodate most, if not all, 300 or so families from Bacoor, Kawit and Imus who will be displaced by the proposed river improvement, off-site retarding basin and drainage improvement in these areas.

Another relocation site will be developed as a sequel to the Bgy. Pasong Kawayan II Resettlement Site namely, a 44.0 ha lot in Bgy. Pasong Camachile. This site is also intended for informal settlers who will be displaced by the ongoing demolition operations. Depending on availability of slots by the time the projects are implemented, the site may be able to

accommodate PAFs from Bacoor, Kawit and Imus who will be displaced by the proposed river improvement, off-site retarding basin and drainage works.

(3) Imus

The Imus municipal government developed a 2.3 hectare land in Barangay Alapan II. The site used to be an abandoned municipal dumpsite. It is now known as "Pamayanang GK ng Imus" after Gawad-Kalinga, a shelter program sponsored by Couples for Christ, a church-based NGO, came in as a community development partner. GK provided material and financial support for construction of duplex housing units and socio-economic rehabilitation.

The current beneficiaries belong to the poorest of the poor coming from blighted areas of Imus. The first batch of resettlers consists of 32 households; the next batch is due to relocate before the end of 2008. Initial road networks, lighting system, water supply, pre-school facilities are already in place. The land is under a stewardship arrangement with the LGU; beneficiaries will neither pay a rent or own the lots.

About 1.5 ha of this area remain idle and could be developed to host all the PAFs from Imus. Negotiations with the municipal LGU should be initiated immediately to secure the remainder of the area for 97 or so families that may be displaced by the proposed river improvement, off-site retarding basin and drainage improvement works in the municipality.

(4) Kawit

The PHDMO plans to acquire a 1.3-ha resettlement site in Bgy. Toclong to accommodate resettling coastal communities and those affected by recent demolition activities within the Aguinaldo Shrine. Negotiations with the land owner is ongoing. At the same time, the municipal government of Kawit is also negotiating to acquire another 4.0 ha lot in the same barangay for other informal settlers from coastal and fishpond areas. Also, the municipal government of Bacoor has already identified and will soon negotiate with landowner to purchase another 2.0 ha land within this same barangay for the municipality's informal fishpond occupants. All in all, 7.3 ha of land may be developed separately as resettlement sites in Kawit.

Considering that Bacoor and Kawit are two of the municipalities with the most number of potential PAFs, these resettlement sites collectively will be an attractive option to host fisherfolk communities from Kawit and Bacoor who may be displaced by the proposed river improvement, drainage improvement and coastal dike structures.

(5) Bacoor

NHA has two resettlement sites in Barangay Pag-asa in Bacoor, namely St. Joseph Subdivision (3.0 ha) and San Lorenzo Ruiz Subdivision (4.0 ha). Both sites were donated by Ayala Land as compensation for squatter families that were displaced by the company's commercial expansion in Metro Manila during the 1990s. Operation and maintenance of these sites has been turned over to the LGU. Some vacant areas are still available and may be secured for the PAFs of Bacoor, subject to negotiation with the LGU.

However, it would still be best if the LGU could provide one resettlement for all 160 PAFs from Bacoor. As discussed above, the 2.0 ha-prospective resettlement site in Toclong, Kawit would be an ideal site to provide this option. Barangay Toclong is only about 5.0 km away from Bacoor town proper.

(6) Noveleta

The Couples for Christ, a church-based NGO, also developed a resettlement site known as Camp David GK Village in Bgy. Sta. Rosa I in Noveleta. The area (1.4 ha) was acquired from Caritas Foundation, a church-based NGO, by the squatter-families from different places in Metro Manila who used to informally occupy the area after being displaced by priority national government projects, fire and natural calamities. Couples for Christ, another church-based NGO developed the area in partnership with the municipal LGU, private individuals

and such institutions such as the Rotary Club and Meralco Foundation, The site now hosts 33 families and construction is on-going to provide 34 additional row houses for the next batch of beneficiaries. The site, however, can still accommodate 60 or so more families. Negotiations with the GK will help to secure the remaining slots for the 55 resettling PAFs from Noveleta who may be displaced by the proposed river improvement.

(7) Rosario

The Philippine National Oil Company donated a 1.2 ha government lot in Bgy. Ligtong III, Rosario to squatter families who have informally occupied the land. It is now known as the PNOC GK Village after Couples for Christ partnered with PNOC and private individuals to develop the area into a Gawad Kalinga resettlement site. Only 10 families presently occupy the area. It has enough room for 110 more housing units for Cavite's poorest of the poor.

Possible arrangements with the NGO, PNOC and the concerned private entities should be explored early on during the detailed design stage of the project in order to earmark this site for the potential PAFs from Rosario who are likely to be displaced by proposed drainage structures.

(8) Naic

In addition, the province foresees a need to purchase a property located in the coastal area to accommodate the fisher folks who will be affected by the ongoing demolition drive among coastal communities. A possible area being considered is a coastal area in Bgy. Halang in the Municipality of Naic. The municipality lies outside of the study area. Nevertheless, if the this plan materializes, this resettlement site could possibly include as potential beneficiaries the fishing communities from the coastal areas of Bacoor, Kawit, Noveleta and Rosario who will likely be displaced by the proposed river improvement, drainage and coastal structures.

(9) Other Sites

There are other existing resettlement sites, which can be explored as an alternative option for the potential PAFs. These sites now host squatter families who were displaced during the implementation of priority national government projects such as the Pasig River Rehabilitation Project, railway improvement, reclamation projects of the Public Estates Authority (PEA), the Ninoy Aquino International Airport and some private commercial and residential development such as the Ayala Land in Metro Manila.

The National Housing Authority through its project offices in GMA, General Trias and Dasmariñas, introduced an innovative approach to resettlement of these displaced families in Cavite. Beginning in the early 90's, NHA acquired house and lot units in subdivisions owned and operated by private land developers. These subdivisions, listed below, now host some 1.000 to 4,000 resettlers per site.

- Sunny Brooke Subdivision, Gen. Trias
- Southville Subdivision, Trece Martires City
- Summerville Subdivision, Trece Martires City
- Country Meadows Subdivision, Gen. Trias
- Tropical Village, Gen. Trias
- Belmont Subdivision, Gen. Trias
- Belvidere Subdivision, Gen. Trias

On inspection, the Study Team found many housing units still unoccupied after many long years since these have been awarded to intended beneficiaries. Negotiations with the NHA may be initiated for possible cancellation of the original award in favor of qualified PAFs from neaby municipalities who may opt to assume residence in the absence of the original awardee.

11.5.7 Procedures, Strategies and Measures for Resettlement

It will be necessary during the detailed design stages of the priority projects to formulate a full-scale resettlement action plan (RAP) to address the involuntary displacement of affected families. Consistent with the JICA's and other bilateral agencies' policy on involuntary resettlement, the over-arching goal is to ensure that the social and economic base of PAFs is improved or, at the very least, restored to pre-project levels. The attached Fig. 11.6 is a strategic framework that would serve as a procedural guide for the preparation and implementation of the RAP during the subsequent stages of project development.

Resettlement is a process consisting of three stages: the preparatory or pre-relocation stage, the actual relocation stage and the post-relocation stage. Emphasis must be given to involving the PAFs during the RAP formulation and implementation processes. The pre-relocation stage is the preparation aimed at adequately preparing the PAPs physically, materially and psychologically for the impending relocation. During the relocation proper, the objective is to physically remove the PAPs from the project's right-of-way to preclude impediments to project implementation. Transport and movement of PAFs should be done in a step-wise manner, preferably in parallel with project time frames. During the post-relocation stage, the PAPs are assisted so that they can re-establish their social and economic base and not be worse off after relocation.

A detailed description of the activities and strategies/measures that would be involved in each stage of resettlement planning and implementation is found below.

(1) Pre-Relocation Stage

(a) Social Preparation

(i) Consultations and IEC Campaigns

Community consultation meetings and IEC activities are aimed at disseminating information and clarifying issues, particularly on the project context, ROW acquisition, clearing/demolition activities, entitlement, resettlement options, eligibility and target implementation, among others.
More importantly, reiterative consultation process is necessary to allow room for PAFs to meaningfully participate in consensus building and decision-making concerning the resettlement concerns and the options available to them.

(ii) Organization of Resettlement Task Force

The organization of an inter-agency resettlement task force (IRTAF) or RAP Implementation Committees (RIC), will ensure meaningful collaboration not only by concerned agencies but by the affected communities in all phases of resettlement planning and implementation.
The Provincial Housing Development and Management Office may be the lead agency of the RTAF/RIC. Membership of the IRTAF or RIC should be expanded to encourage close coordination with and active participation of the project implementing agency (DPWH), other supporting agencies (NHA, DSWD, TESDA, etc.), concerned municipal and barangay LGU representatives, non-government organizations (NGOs) and people's organizations (POs). In particular, the PAFs should be adequately represented and accorded the right to be heard and to decide on resettlement issues affecting them.

(iii) Grievance Redress and Arbitration

The PAFs' right to equal protection of the law shall be guaranteed through grievance redress procedures and mechanisms by which legitimate complaints could be heard and, particularly, conflicts over compensation and entitlements could be resolved.
The Provincial Housing Board is inherently mandated by virtue of local issuances to handle grievances related to the province's shelter program. The existing mechanism may be augmented with the creation of a Grievance Redress Sub-

Committee of the IRTAF or RIC, where PAFs would be represented with full voting powers.

(b) ROW Acquisition

(i) ROW Survey and Parcellary Mapping

The ROW survey will delineate the actual limits of the ROW based on the project design. Parcellary survey/mapping will delineate the actual extent of, and segregate from the adjacent lands, such private real property that would be acquired to secure the project's ROW. Where relocation site(s) need to be acquired under the project, the proposed relocation site(s) will also be subject to survey and parcellary mapping.

In the Philippines, conflicting land claims is not uncommon. This is because alienable and disposable (A&D) lands may be covered by tenurial instruments other than a Torrens title. A Torrens title is considered as the best evidence of ownership because "it is binding and indefeasible to the whole world." It takes the form of Original Certificate of Title (OCT), if it has not been conveyed to another party through sale, donation, inheritance and other legal means. Otherwise it is in the form of a Transfer Certificate Title (TCT).

However, "title" is a generic word meaning proof, evidence or monument of ownership. Thus, in lieu of a perfected Torrens title, privately owned real properties may be covered by other tenurial instruments such as Tax Declarations (TD), Real Property Tax Receipts (RPTR) and Deeds of Sale (DOS), Deeds of Donation (DOD) or, in case of agrarian lands, Certificate of Land Ownership Award (CLOA).

The following agencies are involved in the registration and validation of the tenurial status of private real properties that are subject to land acquisition, namely:

Department of Environment and Natural Resources (DENR) – Through its line agencies, namely: the Community/Provincial Environment and Natural Resource Office (CENRO/PENRO) at the local or provincial level and the Land Management Bureau/Services (LMB/LMS) at the regional level, these agencies, through channels, examine and approve the survey plans and issue the patents to land claimants for eventual registration with the local Registry of Deeds.

Provincial/Municipal Assessor's Office- The respective local offices issues a Tax Declaration (TD) on subject land after approval of survey plans and patents, for purposes of collection of real property tax, gains tax, transfer tax, inheritance tax and other related taxes by the local government units and the Bureau of Internal Revenue (BIR).

Land Registration Authority - The LRA, an agency attached to the Department of Justice (DOJ), through the provincial/city Registry of Deeds issues certificates of title (Ownership Certificates of Title (OCT) or Transfer Certificates of Title (TCT) and register documents, patents and other land transaction for the benefit of landowners. The LRA also resolves conflicting land claim cases elevated *en consulta* by or on appeal from decisions of Registrars of Deeds.

Department of Agriculture (DA) – The DA certifies as to the actual land use of agricultural lands, especially for purposes of conversion to other uses.

Department of Agrarian Reform (DAR) – In case of lands that are covered by the Comprehensive Agrarian Reform Program (CARP), the DAR issues certifications for agrarian reform beneficiaries. The claimant is issued an emancipation patent or a Certificate of Land Ownership Award (CLOA), which is also registered with the local Registry of Deeds.

Regional Trial Courts (RTC) and Municipal Trial Courts (MTC) – Determines the of validity of ownership claims in applications for original registration, judicial reconstitution of titles, and amendments to certificates.

(ii) Inventory and Appraisal of Affected Properties/Improvements

As soon as the limits of ROW have been delineated and the tenurial status and ownership of affected lands are ascertained, inventory will be conducted to identify the structures and improvements on affected lands, including trees, perennials and crops that may have to be removed from the ROW easement during project implementation. The objective is to determine the extent and effect of loss of property, identify the legitimate owners, occupants or cultivators, assess the present market value or replacement cost of the affected assets and determine the corresponding compensation and/or entitlement that will accrue to the PAPs.

An Appraisal Committee is usually created by the implementing agency (the DPWH). If no such body exists, the Provincial or Municipal Appraisal Committee (or a commissioned private appraiser) will undertake the inventory and appraisal of the market value of affected properties and improvements.

To determine the fair market value of properties, appraisers usually employ BIR zonal values, taxation ordinances, surrogate pricing and replacement cost techniques, considering such parameters as the following:

- Classification and use for which the property is suited;
- Development costs for improving the land;
- Value declared by the owner;
- Current selling price of similar lands in the vicinity;
- Reasonable disturbance compensation for the removal and/or demolition of certain improvements on the land and for the value of such improvements;
- Size, shape, location and zonal classification of the land;
- Price of land as manifested in the ocular findings, oral as well as documentary evidence presented; and
- Facts and events so as to enable the affected property owners to have sufficient funds to acquire similarly situated lands or lands of approximate areas as those required from them by the government, and thereby rehabilitate themselves as early as possible.

(iii) Compensation and Entitlement

Payment of compensation is agreed by negotiation between the Appraisal Committee and the owners as to the fair market value of affected properties and improvements. If negotiation fails, expropriation proceedings may be initiated. Where acquisition of relocation site(s) under the project is considered necessary, the lot owner of the proposed relocation site will also be entitled to compensation for land and improvements thereon.

The modes of compensation and eligibility criteria are to be described in a Compensation Matrix based on the impact on PAFs and their assets. Such compensation matrix will be subject to negotiation with and acceptable to PAFs. Table 11.9 shows the compensation matrix that governs land acquisition in DPWH projects in accordance with the LARRIP Policy. Among other things, it holds that PAFs are entitled to full compensation for the entire affected assets at replacement cost if they will lose all of their fixed assets or incur partial loss but the remaining assets are determined by competent authorities as no longer viable anymore for continued use. On the other hand, where the remaining affected assets are still viable for continued use, the PAFs will be compensated only for the affected portion of the assets.

The DPWH LARRIP Policy holds that only those PAPs residing, doing business, cultivating land or having rights over resources within the project area will be

eligible for compensation and/or other entitlement. As will be explained subsequently, the C/T survey date is usually set as the cut-off date by which eligibility of the PAPs is determined. On the other hand, the UDHA provides that owners of illegal structures built after the effectivity of RA 7279 are not eligible for resettlement assistance. Notwithstanding this provision, agencies tasked with resettlement are inclined to allow concessions on these policies for humanitarian reasons. The province of Cavite, for example, does not necessarily disqualify squatter families whose structures were built after 1992, unless identified as professional squatters or squatting syndicates. The number of houses/structures that are likely to be affected by the flood mitigation projects under the Master Plan is estimated at 470 (see Table R 11.24). There are no confirmed professional squatters or squatting syndicates among the potential PAFs; therefore, all of them would be eligible for resettlement assistance.

Other entitlements besides compensation are also subject of negotiations with PAPs who do not own the land. These include financial assistance to tenants and settlers, disturbance compensation to agricultural lessees, resettlement lot, inconvenience allowance, transportation, relocation assistance and rehabilitation package. Pursuant to Sec. 7 of Republic Act 6389 of 1971 (Code of Agrarian Reform), agricultural lessees are entitled to the payment of disturbance compensation equivalent to five times the average gross harvest in the last five years. Moreover, Sec. 18 of Executive Order 1035 of 1985 entitles displaced tenants/occupants of agricultural lands to financial assistance equivalent to the value of the gross harvest for one year, based on the average annual gross harvest for the last three preceding crop years, but in no case less that Php 15,000/ha.

(c) Census Survey and Tagging

(i) Census Survey and Tagging (C/T) Operation

The census survey will include 100% of the PAPs, both formal and informal settlers, who occupy the project's right of way. The census survey is a complete enumeration of all affected households and inventory of their affected assets and the tenurial status. The C/T results will: (1) establish the eligibility for entitlement; (2) determine the categories of entitlement; and (3) provide a basis for valuation and compensation. A simple survey instrument such as the one being used by the NHA would suffice for this purpose. NHA could provide technical assistance to conduct the C/T operations.

Structural mapping and tagging will be done simultaneously with the C/T operations. Tagging involves marking the affected structures and improvements to establish the identity of the eligible households. This will help prevent fraudulent claims by opportunists who may take advantage of the perceived benefits from resettlement.

The master list of PAPs will be prepared from the C/T survey results and will be validated by the LGU concerned in coordination with the PCUP to eliminate from the list "professional squatters," "squatting syndicates." Also excluded are non-eligible families who are already beneficiaries of CARP and other government housing programs. The final master list will serve as the basis for determining PAP category and their eligibility for compensation and entitlement.

(ii) Socio-Economic Survey

The socio-economic survey (SES) will be done to solicit a much wider range of information that was not captured during the Census Survey. In contrast to the census survey, it is usually done on a sample population, normally 20-25% of the PAFs who are included in the validated master list. Socio-economic survey should also include the host community. The SES results will be used to: (1) determine the demographic, economic and tenurial characteristics of PAPs; (2) assess their

incomes and productive base; (3) establish the use and value of affected assets; (4) identify particularly vulnerable groups (e.g., women-headed households, senior citizens living alone, poorest of the poor, etc.) who will require special rehabilitation assistance; and (5) craft appropriate plans for resettlement and socio-economic rehabilitation. A local consulting group, an NGO or an academic research institution may be commissioned to conduct the SES.

(d) Resettlement Site Development

In principle, the location of resettlement site should be acceptable to PAPs. Therefore, selection of sites should be discussed with them, with due consideration to: (1) proximity to origin; (2) proximity to employment and livelihood opportunities; (3) accessibility; (4) carrying capacity, in terms of population, services and environmental resources; (5) proximity to social infrastructure, especially schools and health clinics. As already mentioned, on-site resettlement within the respective LGUs is still the best option to avoid the impoverishment of vulnerable PAFs.

If acquired, new relocation sites should be equipped with basic infrastructure such as roads, water supply, power supply and drainage. These amenities shall conform to standards and criteria set forth in Batas Pambansa 220 for socialized and economic housing. An initial environmental examination (IEE) is necessary in order to secure the Environmental Compliance Certificate (ECC) before construction of resettlement sites with areas not exceeding 10.0 ha. Moreover, social facilities may need to be installed such as schools, health centers, day care centers, basketball courts and worship places.

As explained earlier, use of existing resettlement sites is a feasible alternative to acquiring new resettlement sites. Most of the existing resettlement sites in Cavite that were visited by the Study Team have adequate access to water supply (through the respective water districts) and power supply (through Meralco). Social facilities such as day care centers, primary and secondary schools, chapels, covered courts, wet markets, health centers and recreation halls are available. Invariably, LGUs have improved the main access roads and provided street lights to the relocation sites. In view of the anticipated influx of incoming resettlers, some facilities may need upgrading and improvement.

(e) Linkaging and Partnerships

DPWH, the PHDMO and municipal LGUs will benefit from technical and financial assistance from external institutions to ease the burden of providing livable resettlement sites and undertaking restoration activities. In Cavite's experience, the following linkages and partnership mechanisms have proved effective in addressing involuntary resettlement:

(i) Community Mortgage Program

The CMP is a low-income home financing program conceived by the National Housing Authority (NHA). It gives homeless low-income earners and informal settlers in blighted and priority development areas a chance to own homesteads. Under this program, several beneficiaries will organize themselves into a community association to be able to acquire an undivided privately owned tract of land through community mortgage or micro-financing scheme. A crucial requirement is the willingness of the owner/s of the proposed CMP site to put up the property for sale and the willingness of beneficiaries to corporately acquire the resettlement land.

The LGUs, the NHA, a private developer or an NGO may act as initiator of a CMP project on behalf of interested beneficiaries. A model CMP is a now a GK village called Barangay Aguado Neighborhood Association in Bgy. Aguado II, Trece Martires City. The site is a 1.63 ha privately owned property, which now hosts single detached economic housing units for 183 families who were

displaced by the Ninoy Aquino International Airport Project (NAIA) in 1995. The beneficiaries collectively pooled their financial compensation package in order to pay the down payment on the land. The municipal LGU assisted in securing guarantee for loan to pay the balance, which the homeowner's association continues to collect from the members until the full amount is paid. It also helped with land development and provision of good roads, individual water supply and electricity connections. The Gawad Kalinga adopted the association in 2000 and improved the community by donating materials for housing improvement, construction of alley pathways, street lights, a multi-purpose hall, a worship center, and a pre-school called "Sibol."Values formation education is at the core of the community's success.

A similar scheme was introduced in another relocation site called the Isaiah Village in Maragodon, Cavite. This time, the community partner is Habitat for Humanity, an international NGO through its local partner, the Naic Shoreline Kabalikat sa Kaunlaran Foundation The experience in these two sites may be worth replicating in addressing the involuntary resettlement of the PAFs identified in this Study.

(ii) Private Developers

Private land developers play an active role in the provision of shelter for the Cavitenos. Land development firms have the technical expertise and material, manpower and financial resources that may not be readily available to their government counterparts. The success of partnership with this interest group has been proven over time by the experience of NHA in their various housing projects in Cavite, as already explained. The provincial government plans to harness the strength of such partnership by inviting private developers to participate by way of socialized housing credits.

(iii) NGOs

Aside from model resettlement projects such as the GK and Habitat for Humanity, there are other interventions by international NGOs in partnership with local government and private entities to empower the poor Caviteños and uplif their social and economic conditions. World Vision works with two local NGOs, namely Children's Helper Project, Inc. and Community Economic Venture. CHPI has been helping poor communities in Noveleta, Cavite City, and Trece Martires City through environmental advocacy, children's sponsorship, education, livelihood development, micro-finance and provision of water supply facilities. CEV is involved primarily in providing micro-finance for livelihood and entrepreneurial development among the poorest of the poor in Cavite.

(iv) Private Financial Institutions

Some private financial institutions such as the Cavite City Rural Bank partners with church-based organizations and people's organizations to make credit windows available for micro-enterprise. CCRB loans out a 6-mo recyclable amount of Php 5,000 to Php 25,000 at very affordable interest rates. The loans support small-scale businesses involving buy and sell, direct selling, variety stores, backyard production and multi-purpose cooperatives, among others.

(2) Relocation Stage

(a) Demolition

The UDHA prescribes the guidelines and procedures by which demolition, eviction and physical movement should be done in a humane manner, starting with the proper planning and communication to PAFs of the relevant details before deployment of demolition and relocation teams. As far as possible, PAFs should be allowed to voluntarily dismantle their structures to ensure minimum damage and reuse of

salvageable materials.

Summary eviction proceedings may be initiated against “professional squatters” or members of “squatting syndicates” without benefit of any resettlement assistance.

The RAP should incorporate measures to preclude future encroachment and re-occupation of cleared areas. In some cases, supporting ordinances and police powers may be needed at the municipal and barangay levels to strengthening their enforcement.

(b) Physical Relocation

(i) Transport and Movement of PAFs

Movement of PAFs should only be made when resettlement sites and basic amenities are ready. Details of the movement should be planned well ahead including schedules, logistics, identification and transportation of people and belongings, and arrangements for temporary services (food, water, emergency medical care, waste management, and other provisions) en route to, upon arrival and during transition period at the new site.

A contingency plan should be prepared, in anticipation of possible resistance to demolition and relocation by certain PAPs and nuisance groups. This should be closely coordinated with social workers, the local police force, and stand-by medical teams.

(ii) Beneficiary Selection and Lot Disposition

In accordance with the housing ordinance, the LGUs usually prescribe the manner and criteria by which beneficiaries of housing programs are selected and prioritized for distribution or assignment of lots, either by lottery or on a first-come-first-served basis.

(3) Post-Relocation Stage

Project-induced displacement affects the social support systems and income earning capacities of PAFs. Often, financial compensation and resettlement assistance alone are not sufficient to re-establish them. Post-relocation strategies and measures are therefore meant to allow PAFs to share in project benefits through income and livelihood restoration and social re-integration programs.

In Cavite, most of the success stories in post-relocation restoration are often due to effective partnership and linkaging between theLGUs, national social support agencies, NGOs and the people’s organizations. The implementation of the Master Plan projects will benefit by replicating or supporting these efforts. .

(a) Social Rehabilitation

(i) Community Organization and Development

In most of the resettlements sites visited by the Study Team, the NGO programs such as the GK, Habitat for Humanity and World Vision stand worthy of emulation as models of holistic community shelter development work. Besides assisting communities in building houses and neighborhood facilities through sweat equity, resettling families are organized so they can re-build their lives with dignity around self-help initiatives and community-based undertakings. Once organized, homeowners’ associations are encouraged to participate in neighborhood and civic activities such as values formation, women’s/gender concerns, environmental advocacy, church activities, mother-and-child health care, parenting seminars, savings mobilization, ecological solid waste management, adult education programs, etc.

(ii) Social Integration

The holistic shelter development models just described all help to re-establish the

resettlers' sense of belonging and hasten the process of integrating the newcomers into the life of the community. However, the receiving LGUs/communities also have a role to play in faciliting this social rehabilitation process. Host barangays/municipal LGUs must be prepared to extend the social services to meet the added burden for health care, schools, sport/recreational activities as well as maintainance of peace and order, harmony and livability in the resettlement sites.

(b) Income Restoration

(i) Livelihood Development

Windows of economic and income-earning opportunities should be readily available and accessible such that the economic rehabilitation of PAFs will be hastened. Based on the initial profile, the extremely vulnerable PAFs include more than 50% of households that belong to the poorest of the poor; a third of the families that belong to the female-headed households, and more than 15% that are headed by senior citizens who are 60 years old and above and are beyond their economically productive years.

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), the academe, financial institutions, industries and NGOs. Agri-aqua production, coined as Maliksing ISDA (Integrated Sustainable Development Aquaculture) are among these flagship programs, which introduces rice-and-tilapia culture, backyard fish farming, fresh and marine water fish caging. A variation of this program, "ISDABest" trains and loans out fishing boats, fishnets and other paraphernalia, and fish/prawn fingerlings to beneficiaries, which include poor farmers and 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 governments. Known as the "Pangkabuhayang Pagsasanay sa Pamayanan",the caravan serves as a convergence for cooperative, livelihood and entrepreneurial development. It showcases income-earning options available and the home-made products that low-income families can produce commercially in their backyards. The products include food items (chocolate, cold cuts, boneless bangus, tinapa, fish/squid balls, spicy dried anchovies, fish nuggets, *siomai, tahong chicharon,* crispy crustaceans and seaweeds snacks, fruit preserves, coated candies, etc.) and handicrafts or novelty items (decorative balloons, fashion accessories, flower arrangement, candle-making, liquid soap and conditioner, perfume, disinfectant, etc.).

Part of the Gender and Development Plan of the province for 2005-2010 is ensuring equal access by women to labor and employment opportunities through the promotion of self-employment and home-based entrepreneurial activities. Hands-on trainings are now being provided to organized women's groups through the initiative of the PCLEDO. There are also special livelihood and vocational programs for physically abused and battered women and children.

The menu of livelihood options presently available to female-headed households include micro-enterprise such as buy and sell, direct selling, sari-sari stores, and backyard production. More and more women are now earning through commercial production food products, handicrafts and novelty items, thanks to PCLEDO. NGO-supported livelihood in dried fish production, backyard gardening and vending are also potential sources of income for women. More women are also being equipped for employment in garment factories, microchips and IT industries that now abound in the industrial estates of Cavite.

There is a senior citizens' office established in each municipality as well as a

provincial office where the concerns of the elderly are addressed. Still in its infancy, the programs include health and medical assistance, discounts on fare, food, medicines and medical services, and adult literacy. Appropriate livelihood program for the elderly still need to be explored.

Moreover, there is still a need to conduct a more focused socio-economic survey among the identified PAFs to tailor-suit the livelihood options to their present occupations and skills, training and preference. At the same time, an environmental scanning of the host communities will give particular consideration to: (1) resources available in the resettlement area; (2) other relevant programs and projects of the different government and private institutions; (3) for land-based economic activities, availability and size of agricultural area; (4) population carrying capacity; and (5) proximity to urban centers and places of work, among others.

(ii) Cooperative Development

Through the PCLEDO, LGUs, DTI and partner NGOs, the cooperatives in Cavite can be further strengthened to provide more opportunities and capital for livelihood development. While much effort has been devoted to organizing and registering cooperatives, access by the poorest and women sectors to capital, livelihood and market opportunities should be improved.

(iii) Access to Micro-Finance

Similarly, access of the poor and women-headed households to public and private financing windows should be improved for capital generation and build-up. More financial institutions, through improved NGO-LGU partnerships, should invest in micro-credit financing, savings mobilization and other self-help, community-based fund-sourcing and capital build-up activities.

(iv) Skills Development

A more thorough skills inventory among PAFs could provide the basis for a more focused planning of skills development program to enhance the capability of PAFs to find employment and income-earning opportunities. In particular, there is a need to know the PAPs' specific conditions as to: (1) present livelihood activities and other income sources; (2) special skills, (3) livelihood skills/vocational trainings attended, (4) suitable additional livelihood skills/vocational trainings preferred, (5) natural resources (e.g., tenable land, fisheries and other environmental resources) and institutional support (e.g., micro-credit, training facilities, social networks, etc.) available in the relocation site.

(c) Estate Management

(i) Housing Development

Low-cost housing is an incentive that would entice PAFs to relocate or move away from the project areas. To ease the financial burden that house construction entails, the LGU should tap all possible sources of funds for low-cost housing assistance and provide housing beneficiaries easier access to both individual and community-based arrangements to finance shelter development, as discussed earlier.

Shelter development plans should also consider PAF's preferences, affordability and willingness to pay. While it may be easier to provide a uniform package, some PAFs may prefer economic housing while the low-income groups may be able to afford the cheaper options such as socialized housing, lots only, lot/house rental, rent-to-own schemes, etc.

(ii) Lot Award and Disposition

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 LGUs responsibility will also include securing the tenurial status of PAFs by way of delivery of titles and legal documents to prove ownership. At present, the shelter program in the province needs more teeth to address the vicious cycle of squatting. The practice by beneficiaries of selling their rights or titles to resettlement units only to end up squatting again continues to be a challenge even to experienced agencies such as the NHA.

(iii) Cost Recovery

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.

At present, shelter agencies have to grapple with the issue of sustainability owing to the difficulty in guaranteeing loan repayment by PAFs and the recoupment of cost of land/housing development. Such is the experience with the Bgy. Langkaan CMP. Poor repayment is also a problem in many NHA resettlement sites within private subdivisions.

(iv) Conservancy and Maintenance

The RAP should clarify agency responsibility for conservancy and maintenance of physical structures. As observed during the Study Team's site visits, basic infrastructure in many resettlement sites are in dire need of repair and maintenance. In contrast, sites under GK and Habitat for Humanity programs fare a lot better. This is because the communities themselves take responsibility for conservancy and maintenance, including beautification activities. This model approach should be replicated in future communities of PAFs to ensure the livability of the resettlement site and its surrounding environment.

(4) Monitoring and Evaluation

A Monitoring and Evaluation plan will be prepared as part of the RAP to ensure regular and periodic collection, analysis and reporting on the progress throughout the resettlement cycle. Monitoring will take place against the activities, entitlements, time frames, budget and target benefits. Specific indicators will be identified, which will be useful in assessing the extent to which resettlement objectives as set out in the RAP are achieved and making appropriate management decisions.

Tables

Table 2.1 Estimated Channel Flow Capacities of the Main Rivers in Lowland Area

Name of Rivers	Sections		Flow Capacity	
	Sra. No.	Description	Discharge	Flood Scale
Imus	Sta.0+000~ Sta.3+400	River mouth to Confluence Point with Julian River in town proper of Imus	100~500 m^3/s	Less than 2-year
	Sta.3+400~Sta.6+000	Downstream of Aguinaldo Highway	600~800 m^3/s	5-year
	Sta.6+000~Sta.12+100	Aguinaldo Highway ~ Anabu Dam	400~1000 m^3/s	5-year
	Sta.12+100~Sta.13+000	Anabu Dam to NIA Irrigation Canal	600 m^3/s	More than 20-year
Bacoor	Sta.0+000~ Sta.3+000	Fishpond area	50 m^3/s	Less than 2-year
	Sta.3+000~	Town proper of Bacoor	20 m^3/s	Less than 2-year
Julian	Sta.0+000~ Sta.4+800	Confluence with Imus to Julian Dam	50~200 m^3/s	Less than 2-year
	Sta.0+000~ Sta.10+000	Julian Dam to NIA Irrigation Canal	30~400 m^3/s	Less than 2-year
Left Tributry of Julian R.	Sta.0+000~ Sta.4+500	Confluence with Julian to Irrigation Drainage Beginning Point	0~30 m^3/s*1	Less than 2-year
San Juan	Rivermouth~Sta.2+000	Fishpond area	200 m^3/s	Less than 2-year
	Sta.2+000~Sta.4+800	Branching point to Confluence with Ylang-Ylang	300 m^3/s	2-year
	Sta.4+800 ~ Sta.10+500	Confluence Point to Bayan Dam	300~400 m^3/s	5-year
	Sta.10+500.~Sta.12+000	Upstream of Bayan Dam	300 m^3/s	5-year
	Sta.12+000~Sta.14+400	Downstream of NIA Irrigation Canal	400 m^3/s	20-year
Ylang-Ylang	Sta.4+800 ~ Sta.8+000	Upstream from confluence with San Juan	400 m^3/s	10-year
	Sta.8+000 ~ Sta.12+600	Downstream of NIA Irrigation Canal	600 m^3/s	More than 20-year
Canas	Sta.0+000~Sta.9+150	River Mouth to NIA Irrigation Canal	More than 1000 m^3/s	More than 20-year

Note: Flow capacity depends on Backwater Stage from Imus and Julian Rivers.

Table2.2 Estimated Flow Capacities of the Main Drainage Channels in Lowland Area

Name of Drainage Channel	ID No. of Channel	Sections (Length)	Flow Capacity		Main Problem on Channel Flow
			Discharge (m3/s)	Flood Scale	
Malamok	Dr-1	Sta.0+000 - Sta. 1+000	26 to 56	Less than 2-year	Low land level
		Sta.1+000 - Sta. 1+650	60 too 68	3-year	Gentle Slope
		Sta.1+650 - Sta. 2+000	Less than 10	Less than 2-year	Low land level
	Dr-2	Sta.0+000 - Sta. 1+500	Less than 15	Less than 2-year	Low land level
Tirona	Dr-3	Sta.0+000 - Sta. 0+800	Less than 60	Less than 2-year	Low land level
		Sta.0+800 - Sta. 1+400	30 to 65	5-year	Low land level
		Sta.1+400 - Sta. 2+000	0 to 60	Less than 2-year	Low land level
		Sta.2+000 - Sta. 2+800	nil	Less than 2-year	Low land level
Branch Channel of San Juan River	Dr-4	Sta.0+000 - Sta. 2+600	Less than 65	Less than 2-year	Gentle Slope
		Sta.2+600 - Sta. 4+000	35 to 80	Less than 2-year	Gentle Slope
Panamitan	Dr-5	Sta.0+000 - Sta. 1+200	25 to 50	Less than 2-year	Gentle Slope
		Sta.1+200 - Sta. 2+200	10 to 20	3-year	Gentle Slope
	Dr-6	Sta.0+000 - Sta. 2+100	Less than 20	Less than 2-year	Low land level
Branch Canal of San Juan River	Dr-7	Sta.0+000 - Sta. 0+800	Nil	Less than 2-year	Low land level
		Sta.0+800 - Sta. 1+400	20 to 45	100-year	-
		Sta.1+400 - Sta. 1+600	2	Less than 2-year	Low land level
-	Dr-8	Sta.0+000 - Sta. 1+000	Less than 5	Less than 2-year	Gentle Slope
Malimango (EPZA)	Dr-9	Sta.0+000 - Sta.1+200	10 to 30	Less than 2-year	Gentle Slope
		Sta.1+200 - Sta.1+800	10 to 15	Less than 2-year	Gentle Slope
		Sta.1+800 - Sta.3+500	20 to 45	Less than 2-year	
		Sta.3+500 - Sta.4+200	10 to 20	5-year	Low land level
Tributaries of Bacoor River	Bacoor-2	Sta.0+000 - Sta.1+800	0 to 25	Less than 2-year	Low land level
	Bacoor-3	Sta.0+000 - Sta.1+700	0 to 55	Less than 2-year	Low land level
Tanza	CT-1	Sta.0+000 - Sta.1+550	160 to 880	100-year	-
		Sta.1+550 - Sta.1+950	35 to 60	3-year	Low land level

Table 3.1 Existing Land Use in the Study Area

(Unit: ha)

City/ Municipality	Residential	Industrial	Institutional	Commercial	Built-up/ Mix Use	Agricultural	Grassland/ Open Area	Tree Plantation	Water Bodies	Unclassified	Total
Amadeo	234	7	5	11	0	3,416	156	459	0	0	4,287
Bacoor	950	10	5	53	9	214	323	64	182	0	1,809
Dasmarinas	2,147	175	111	159	2	1,195	1,982	1,239	1	0	7,012
Gen. Trias	1,394	290	13	15	13	4,143	1,697	907	10	0	8,482
Imus	1,573	77	12	37	11	2,175	730	532	12	0	5,160
Indang	40	5	0	12	0	1,135	12	0	0	0	1,204
Kawit	361	0	1	13	0	585	15	85	488	0	1,548
Noveleta	239	1	6	0	1	115	27	14	182	0	585
Rosario	250	240	5	4	0	80	52	26	21	0	677
Silang	490	67	32	8	11	3,757	329	414	0	0	5,108
Tagaytay	75	0	1	100	0	696	61	77	0	20	1,029
Tanza	315	0	12	3	7	1,089	16	80	8	0	1,530
Trece Martires	353	42	6	8	3	436	878	586	0	0	2,313
Total	8,420	914	208	422	57	19,037	6,278	4,484	903	21	40,743
Share	20.7%	2.2%	0.5%	1.0%	0.1%	46.7%	15.4%	11.0%	2.2%	0.1%	100.0%

Table 4.1 Land Use Plan Projected by Cities/Municipalities in Study Area

(Unit: ha)

City/ Municipality	Residential	Industrial	Institutional	Commercial	Built-up/ Mix Use	Agricultural	Grassland/ Open Area	Tree Plantation	Water Bodies	Unclassified	Total
Amadeo	858	0	0	372	0	2,809	0	249	0	0	4,287
Bacoor	1,657	8	2	143	0	0	0	0	0	0	1,809
Dasmarinas	2,648	33	37	110	2,908	1,174	102	0	0	0	7,012
Gen. Trias	0	0	0	375	4,201	3,225	680	0	0	0	8,482
Imus	0	1,043	0	119	2,965	1,004	29	0	0	0	5,160
Indang	0	0	0	0	123	1,082	0	0	0	0	1,204
Kawit	0	0	0	0	1,436	0	111	0	0	0	1,548
Noveleta	381	4	14	81	0	0	36	0	68	0	585
Rosario	393	233	11	34	0	0	6	0	0	0	677
Silang	0	562	0	0	2,374	2,172	0	0	0	0	5,108
Tagaytay	0	0	0	162	500	328	38	0	0	0	1,029
Tanza	22	0	0	0	442	1,066	0	0	0	0	1,530
Trece Martires	335	0	0	0	1,978	0	0	0	0	0	2,313
Total	6,294	1,883	64	1,395	16,926	12,861	1,004	249	68	1	40,743
Share	15.4%	4.6%	0.2%	3.4%	41.5%	31.6%	2.5%	0.6%	0.2%	0.0%	100.0%

Table 4.2 Population Projection for Each City/Municipality in the Study Area

(Unit: Thousand)

City/ Municipality	Group[*1]	Total Population in the Whole City/Municipality Area									Study Area		
		Number of Population					Adjustment to Control Total				Share[*2]	2020 Population	
		2000	2005	2010	2015	2020	2005	2010	2015	2020		Distribution	Adjustment[*3]
Amadeo	L	26	29	32	34	36	29	30	31	33	100%	33	33
Bacoor	H	306	449	601	749	884	445	570	686	802	45%	359	351
Dasmarinas	H	380	558	746	930	1,098	552	708	852	996	93%	922	901
Gen Trias	M	108	140	172	200	224	139	163	183	203	100%	203	203
Imus	H	195	287	384	479	565	284	365	439	513	100%	513	513
Indang	L	51	58	64	68	72	57	60	63	65	13%	9	8
Kawit	L	63	71	78	84	88	70	74	77	80	100%	80	80
Noveleta	L	32	36	40	43	45	36	38	39	41	100%	41	41
Rosario	L	74	83	91	98	103	83	87	90	94	100%	94	94
Silang	M	156	204	249	289	324	202	236	265	294	38%	113	110
Tagaytay City	M	45	59	72	84	94	58	68	77	85	9%	7	7
Tanza	M	111	144	176	205	229	143	167	188	208	29%	60	59
Trece Martines	M	42	54	66	77	86	54	63	71	78	58%	45	44
Total	-	1,587	2,173	2,771	3,339	3,849	2,152	2,630	3,059	3,491	70%	2,479	2,444

Note:

*1: The following increase ratios are applied

[*1)] Increase Ratio Group	2000-05	2005-10	2010-15	2015-20
High (H)	8.00%	6.00%	4.50%	3.38%
Mid (M)	5.45%	4.09%	3.07%	2.30%
Low (L)	2.50%	1.88%	1.41%	1.05%

*2: [*2)] Share is the % of the population of the Study Area in the total population of each city/municipality in 2000

*3: Apply 0.977x number of population of Bacoor, Trece Martires, Dasmarinas, Tanza, Tagaytay, Indang, Silang for adjustment

Table 4.3 Land Use Plan Proposed in the Study (Year 2020)

(unit: ha)

Land Use	Residential	Industrial	Institutional	Commercial	Built-up/ Mix Use	Agricultural	Grassland/ Open Area	Tree Plantation	Water Bodies	Unclassified	Total
Amadeo	263	11	10	26	0	3,371	154	453	0	0	4,287
Bacoor	1,181	16	9	127	0	130	196	39	110	0	1,809
Dasmarinas	3,842	274	202	442	0	609	1,011	632	0	0	7,012
Gen. Trias	3,011	440	25	37	0	3,047	1,248	667	7	0	8,482
Imus	2,759	120	23	90	0	1,367	458	334	8	0	5,160
Indang	28	8	5	28	0	1,123	12	0	0	0	1,204
Kawit	464	8	1	30	0	521	13	76	435	0	1,548
Noveleta	277	6	11	6	0	97	23	11	154	0	585
Rosario	173	360	11	10	0	55	36	18	14	0	677
Silang	1,151	104	63	19	0	3,148	276	347	0	0	5,108
Tagaytay	12	0	11	177	0	802	4	3	0	20	1,029
Tanza	716	15	24	7	0	701	11	51	5	0	1,530
Trece Martires	683	65	11	20	0	352	708	473	0	0	2,313
Total	14,561	1,426	407	1,019	0	15,323	4,149	3,105	733	21	40,743
Share	35.7%	3.5%	1.0%	2.5%	0.0%	37.6%	10.2%	7.6%	1.8%	0.1%	100.0%

Table 4.4 Built-up Area and Population Projected in the Study (Year 2020)

City/ Municipality	Land Use			Built-up Area Ratio		Population Density		Population		
	Total Area	Built-up Area(existin	Built-up Area(2020)	Existing	2020	Existing	2020	2000	2020	Incremental population
	(ha)	(ha)	(ha)	(%)	(%)	(per/ha)	(per/ha)	(person)	(person)	(person)
Amadeo	4,287	257	310	6.0%	7.2%	6.0	7.6	25,737	32,751	7,014
Bacoor	1,809	1,027	1,333	56.7%	73.7%	75.7	125.6	136,933	227,170	90,236
Dasmarinas	7,012	2,595	4,760	37.0%	67.9%	50.1	116.5	351,585	816,551	464,966
Gen. Trias	8,482	1,725	3,513	20.3%	41.4%	12.7	40.8	107,691	346,180	238,489
Imus	5,160	1,710	2,993	33.1%	58.0%	37.9	91.6	195,481	472,425	276,944
Indang	1,204	57	69	4.7%	5.7%	5.6	6.9	6,684	8,310	1,627
Kawit	1,548	375	503	24.2%	32.5%	40.5	51.6	62,751	79,852	17,101
Noveleta	585	247	300	42.2%	51.4%	54.7	69.6	31,959	40,668	8,709
Rosario	677	499	554	73.7%	81.7%	108.8	138.4	73,665	93,740	20,075
Silang	5,108	607	1,337	11.9%	26.2%	11.7	30.8	60,015	157,310	97,295
Tagaytay	1,029	175	200	17.0%	19.4%	3.9	7.1	3,981	7,323	3,342
Tanza	1,530	337	761	22.0%	49.8%	20.9	57.9	31,928	88,554	56,626
Trece Martires	2,313	412	780	17.8%	33.7%	10.4	31.6	24,032	73,102	49,070
Total	40,743	10,021	17,413	24.6%	42.7%	27.3	60.0	1,112,442	2,443,936	1,331,494

Table 5.1 Availability of Rainfall Data in and around the Study Area

Data item	6-hourly rainfall	Daily rainfall						
		Within study area				Adjacent area		
Year	Sangley Point	Sangley Point	Mabolo	Amadeo	Tagaytay	Port Area	San Pedro	Ambulong
1951								A
1952								A
1953								A
1954								A
1955								A
1956								A
1957								A
1958								A
1959								A
1960								A
1961						A		A
1962						A		A
1963						A		A
1964						A		A
1965						A		A
1966						A		A
1967						A		A
1968						A		A
1969						A		A
1970						P		A
1971						A	P	P
1972						A	A	A
1973						A	A	A
1974		P				A	A	P
1975		A	P			A	A	P
1976		A	A			P	A	A
1977		A	A			P	P	A
1978	A	A	P			P	A	A
1979	P	P	P			P	A	A
1980	P	P	A				A	A
1981	A	A	A			P	A	A
1982	A	A	A			A	A	A
1983	A	A	A			P	A	A
1984	A	A	A			A	A	A
1985	A	A	A	A		P	A	A
1986	A	A	A	A		A	A	A
1987	P	A	P	P		A	A	A
1988	A	A	A	A		P	A	A
1989	A	A	A	A		A	A	A
1990	A	A	A	A		A	P	A
1991	A	A	A	A		A		A
1992	A	A	A	A		A		A
1993	A	A	A	A		A	P	A
1994	A	A	A	A	P	A	A	A
1995	A	A	A	A	P	A	P	A
1996	A	A	A	A	P	A	P	A
1997	A	A	A	P	P	A	A	A
1998	A	A	A	P	A	A	P	A
1999	A	A	A	A	P	A	P	A
2000	A	A	P	A	P	A		A
2001	A	A	A	A	P	A		A
2002	A	A	A	P	A	A		A
2003	A	A	A	P	A	A		A
2004	A	A	A	P	P	A		P
2005	A	A	A	A	A	A		A
2006	A	A	P	A	A	A		A

A: Fully available
P: Partially available

Table 5.2 Design Storm of Long Duration Rainfall for Each Return Period

T (hr)	2-year mm/hr	3-year mm/hr	5-year mm/hr	10-year mm/hr	20-year mm/hr	30-year mm/hr	50-year mm/hr	100-year mm/hr
0								
1	1.1	1.4	1.7	2.0	2.3	2.4	2.6	2.8
2	1.2	1.5	1.7	2.1	2.3	2.5	2.7	2.9
3	1.2	1.5	1.8	2.2	2.4	2.6	2.7	3.0
4	1.3	1.6	1.9	2.2	2.5	2.7	2.8	3.1
5	1.3	1.6	1.9	2.3	2.6	2.8	3.0	3.2
6	1.4	1.7	2.0	2.4	2.7	2.9	3.1	3.3
7	1.5	1.7	2.1	2.5	2.8	3.0	3.2	3.4
8	1.5	1.8	2.2	2.6	2.9	3.1	3.3	3.6
9	1.6	1.9	2.3	2.7	3.1	3.3	3.5	3.8
10	1.7	2.0	2.4	2.9	3.2	3.5	3.6	3.9
11	1.8	2.2	2.6	3.0	3.4	3.6	3.8	4.2
12	1.9	2.3	2.7	3.2	3.6	3.8	4.0	4.4
13	2.0	2.4	2.9	3.4	3.8	4.1	4.3	4.7
14	2.2	2.6	3.1	3.7	4.1	4.3	4.6	5.0
15	2.3	2.8	3.3	4.0	4.4	4.6	4.9	5.3
16	2.5	3.1	3.6	4.3	4.8	5.1	5.3	5.8
17	2.8	3.4	4.0	4.7	5.2	5.5	5.9	6.3
18	3.2	3.8	4.4	5.2	5.8	6.2	6.5	7.0
19	3.6	4.3	5.1	5.9	6.6	7.0	7.4	7.9
20	4.3	5.1	5.9	6.9	7.7	8.1	8.6	9.2
21	5.3	6.3	7.3	8.4	9.4	9.8	10.4	11.1
22	7.0	8.3	9.7	11.0	12.3	12.8	13.6	14.4
23	11.3	13.3	15.3	17.1	19.0	19.7	20.8	21.9
24	51.7	57.9	63.7	68.3	74.4	75.9	79.4	81.9
25	17.3	20.1	22.8	25.2	27.9	28.8	30.4	31.7
26	8.6	10.2	11.7	13.3	14.8	15.4	16.3	17.2
27	6.0	7.1	8.3	9.5	10.6	11.1	11.7	12.5
28	4.7	5.6	6.5	7.6	8.4	8.9	9.4	10.0
29	3.9	4.7	5.5	6.4	7.1	7.5	7.9	8.5
30	3.4	4.0	4.7	5.5	6.2	6.5	6.9	7.4
31	3.0	3.6	4.2	5.0	5.5	5.8	6.2	6.6
32	2.7	3.2	3.8	4.5	5.0	5.3	5.6	6.0
33	2.4	2.9	3.5	4.1	4.6	4.9	5.1	5.6
34	2.2	2.7	3.2	3.8	4.2	4.5	4.8	5.1
35	2.1	2.5	3.0	3.5	3.9	4.2	4.4	4.8
36	1.9	2.4	2.8	3.3	3.7	3.9	4.2	4.5
37	1.8	2.2	2.6	3.1	3.5	3.7	3.9	4.3
38	1.7	2.1	2.5	3.0	3.3	3.5	3.7	4.1
39	1.6	2.0	2.3	2.8	3.1	3.4	3.6	3.9
40	1.5	1.9	2.2	2.7	3.0	3.2	3.4	3.7
41	1.5	1.8	2.1	2.6	2.9	3.1	3.2	3.5
42	1.4	1.7	2.0	2.5	2.7	3.0	3.1	3.4
43	1.4	1.7	2.0	2.4	2.6	2.8	3.0	3.3
44	1.3	1.6	1.9	2.3	2.5	2.7	2.9	3.2
45	1.3	1.5	1.8	2.2	2.4	2.7	2.8	3.1
46	1.2	1.5	1.8	2.2	2.4	2.6	2.7	3.0
47	1.2	1.4	1.7	2.1	2.3	2.5	2.6	2.9
48	1.1	1.4	1.6	2.0	2.2	2.4	2.6	2.8
49								
Total (mm)	191	224	258	295	326	342	360	383

Table 5.3 Design Storm of Short Duration Rainfall for Each Return Period

Time	Rainfall (mm)							
T (minute)	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
0								
5	1.2	1.5	1.8	2.1	2.4	2.6	2.9	3.2
10	1.3	1.6	1.9	2.2	2.6	2.8	3.0	3.4
15	1.4	1.7	2.0	2.4	2.8	3.0	3.3	3.6
20	1.6	1.9	2.2	2.6	3.0	3.3	3.5	3.9
25	1.8	2.1	2.5	2.9	3.3	3.6	3.9	4.3
30	2.0	2.3	2.7	3.2	3.7	3.9	4.3	4.7
35	2.2	2.7	3.1	3.6	4.2	4.4	4.8	5.3
40	2.6	3.1	3.6	4.2	4.8	5.1	5.6	6.1
45	3.2	3.8	4.4	5.0	5.8	6.1	6.6	7.2
50	4.1	4.8	5.5	6.3	7.3	7.7	8.3	9.0
55	6.0	6.9	7.8	8.9	10.1	10.7	11.6	12.5
60	12.3	13.8	15.5	17.8	19.8	21.1	22.6	24.7
65	7.9	8.9	10.1	11.5	13.0	13.7	14.8	16.1
70	4.9	5.6	6.5	7.4	8.4	8.9	9.6	10.5
75	3.6	4.2	4.9	5.6	6.4	6.8	7.4	8.0
80	2.9	3.4	4.0	4.6	5.3	5.6	6.1	6.6
85	2.4	2.9	3.3	3.9	4.5	4.8	5.2	5.7
90	2.1	2.5	2.9	3.4	3.9	4.2	4.6	5.0
95	1.9	2.2	2.6	3.0	3.5	3.7	4.1	4.5
100	1.7	2.0	2.3	2.7	3.2	3.4	3.7	4.1
105	1.5	1.8	2.1	2.5	2.9	3.1	3.4	3.8
110	1.4	1.7	2.0	2.3	2.7	2.9	3.2	3.5
115	1.3	1.5	1.8	2.2	2.5	2.7	2.9	3.3
120	1.2	1.4	1.7	2.0	2.4	2.5	2.8	3.1
125								
Total	72.5	84.3	97.2	112.3	128.5	136.6	148.2	162.1

Table 5.4 Land Use Items for Runoff Analysis

Item	Re-classified from Original Plan	Official Land Use Plan
Fishpond/Rice Field	Agricultural (Rice Field)*	Agricultural
	Water Bodies/Fishpond	Fishpond, Water Body
Forest	Tree Plantation	Forest/Trees/Brush, Reserved Forest, Tree Plantation
Farm Land/Grassland/ Open Area	Agricultural (Farm Land)*	Agricultural
	Grassland/Open Area	Ecological Development Zone
		Grassland, Open Area
		Park and Recreational
		Religious and Cemetery
	Unclassified	Tourism Strip, Unclassified
Urban Area	Industrial	Industrial Area
	Built-up/Mix Use	Roads
	Commercial	Commercial and Business
		General Development Area, Primary Urban Core
		Health and Welfare
		Transport and Service Facility
	Institutional	Educational and Cultural
		Government and Quasi-Public
	Residential	Residential Area

Note: *:Agricultural area is further classified into "Rice Field" and "Farm Land" in each municipality.

Table 5.5 Present Land Use Condition in Sub-basin

Unit: %

Basin	Sub-Basin	Area (km2)	Fishpond/ Rice Field	Tree Plantation	Farm Land	Open Area/ Grassland	Urban Area	Total
Imus	IM-01	13.96	0.14	14.14	65.10	3.94	16.68	100
	IM-02	18.60	5.13	12.13	12.35	20.34	50.06	100
	IM-03	19.74	5.42	13.88	17.88	33.58	29.24	100
	IM-04	8.68	43.44	13.03	10.10	14.81	18.62	100
	IM-05	10.74	10.55	18.42	3.91	44.23	22.89	100
	IM-06	3.09	6.84	5.64	1.04	9.04	77.44	100
	IM-07	9.43	3.90	7.99	6.05	26.89	55.16	100
	IM-08	7.22	12.61	7.29	2.77	12.36	64.97	100
	IM-09	3.13	38.82	5.75	8.52	8.17	38.74	100
	IM-10	0.60	16.15	4.90	0.00	9.62	69.32	100
	IM-11	0.71	34.99	1.41	0.00	5.76	57.84	100
	BC-01	7.45	10.05	8.17	1.04	23.03	57.71	100
	BC-02	8.21	15.31	2.66	0.76	22.86	58.40	100
	BC-03	1.14	49.45	0.00	0.00	2.20	48.35	100
	BC-04	2.33	32.48	1.87	1.53	6.01	58.11	100
	BC-05	0.47	57.94	0.00	0.00	0.00	42.06	100
Imus Sub-Total		115.49	11.77	10.93	15.11	21.49	40.70	100
San Juan	SJ-01	30.90	1.81	10.75	75.88	5.83	5.74	100
	SJ-02	9.27	5.33	17.37	18.17	24.69	34.43	100
	SJ-03	9.04	44.29	6.45	11.07	9.00	29.19	100
	SJ-04	9.07	65.23	9.09	16.31	0.72	8.64	100
	SJ-05	10.22	45.52	8.90	11.35	10.42	23.82	100
	SJ-06	4.89	56.37	8.83	14.07	0.21	20.52	100
	SJ-07	0.88	9.25	4.31	9.82	2.72	73.90	100
	SJ-08	11.32	41.26	4.37	39.72	0.21	14.44	100
	SJ-09	1.02	55.36	0.00	9.47	1.86	33.32	100
	SJ-10	1.51	72.48	1.24	1.18	4.37	20.74	100
San Juan Sub-Total		88.13	28.14	9.34	38.76	7.01	16.75	100
Ylang-Ylang	YY-01	32.63	2.38	16.35	39.96	20.97	20.34	100
	YY-02	15.10	3.66	18.48	43.72	9.36	24.78	100
	YY-03	3.19	35.51	13.17	10.14	13.33	27.86	100
	YY-04	2.52	61.78	21.77	14.23	0.00	2.21	100
	YY-05	4.93	72.92	7.48	18.23	0.00	1.37	100
	YY-06	0.20	44.55	16.15	19.05	0.00	20.24	100
Ylang-Ylang Sub-Total		58.56	13.15	16.21	36.30	14.82	19.52	100
Canas	CN-01	15.12	0.00	1.90	71.95	17.17	8.98	100
	CN-02	11.83	0.83	18.01	38.58	16.46	26.11	100
	CN-03	14.20	0.00	5.92	63.87	24.85	5.36	100
	CN-04	10.43	1.32	26.16	16.52	45.89	10.12	100
	CN-05	2.84	27.54	3.54	24.57	31.50	12.85	100
	CN-06	6.57	19.01	14.04	22.56	32.13	12.26	100
	CN-07	15.05	0.20	5.08	64.88	17.24	12.60	100
	CN-08	16.72	11.96	14.77	5.11	39.94	28.21	100
	CN-09	0.54	40.24	16.01	23.73	15.83	4.19	100
	CN-10	10.53	40.53	8.83	35.21	0.69	14.75	100
	CN-11	5.97	26.81	2.70	47.60	0.62	22.26	100
	CN-12	2.51	10.34	6.19	13.11	2.85	67.52	100
Canas Sub-Total		112.31	9.47	10.31	40.99	22.62	16.60	100
Drainage Area	XX-01	2.23	2.81	5.96	0.00	14.91	76.32	100
	XX-02	6.42	26.86	1.04	11.98	2.23	57.88	100
	XX-03	0.17	10.93	0.00	0.00	0.00	89.07	100
	XX-04	3.15	50.33	0.96	30.38	2.24	16.10	100
	XX-05	1.65	50.64	4.53	0.00	6.54	38.29	100
	XX-06	1.07	99.96	0.00	0.00	0.00	0.04	100
	XX-07	0.40	100.00	0.00	0.00	0.00	0.00	100
	XX-08	1.03	32.72	1.79	0.00	2.31	63.18	100
	XX-09	0.98	16.31	1.27	0.00	40.44	41.98	100
	XX-10	0.54	100.00	0.00	0.00	0.00	0.00	100
	XX-11	2.24	20.73	5.69	30.31	2.03	41.24	100
	XX-12	0.31	99.96	0.00	0.00	0.00	0.04	100
	XX-13	6.64	43.10	12.56	24.26	1.15	18.93	100
	XX-14	5.73	46.75	9.03	9.56	1.58	33.08	100
	XX-15	0.15	62.46	0.00	0.00	0.00	37.54	100
	XX-16	0.21	100.00	0.00	0.00	0.00	0.00	100
Drainage Area Sub-Total		32.92	40.55	5.51	13.86	3.91	36.16	100
Total		407.42	17.20	10.74	30.31	16.29	25.47	100

Source: JICA Study Team

Table 5.6 Present Land Use Condition in Sub-drainage Area

Unit: %

SubDrainage	Area (ha)	Fishpond/ Rice Field	Tree Plantation	Farm Land	Open Area/ Grassland	Urban Area	Total
XX-01-S1	78.8	0.32	1.79	0.00	26.00	71.89	100
XX-01-S2	70.3	8.41	1.04	0.00	15.08	75.47	100
XX-01-S3	74.2	0.13	15.06	0.00	2.99	81.82	100
XX-02-S1	134.3	70.54	0.00	17.64	0.98	10.85	100
XX-02-S2	58.3	59.25	0.00	14.81	0.00	25.94	100
XX-02-S3	255.0	0.31	0.00	3.76	1.69	94.23	100
XX-02-S4	114.3	33.54	0.00	21.10	0.05	45.31	100
XX-02-S5	79.9	5.00	8.39	13.57	10.79	62.25	100
XX-04-S1	148.6	76.32	1.10	19.16	0.00	3.43	100
XX-04-S2	121.2	11.44	1.14	55.49	5.82	26.10	100
XX-04-S3	45.3	69.06	0.00	0.00	0.00	30.94	100
XX-11-S1	85.7	14.92	10.03	67.95	0.00	7.10	100
XX-11-S2	42.2	11.62	3.27	7.81	0.00	77.31	100
XX-11-S3	59.1	22.46	4.62	10.43	6.48	56.01	100
XX-11-S4	18.6	33.02	0.00	0.00	0.00	66.98	100
XX-11-S5	17.8	51.67	0.00	0.00	3.97	44.36	100
XX-13-S1	71.1	60.80	9.53	17.26	0.00	12.41	100
XX-13-S2	238.5	67.42	12.99	14.80	0.19	4.59	100
XX-13-S3	67.0	17.70	0.49	3.89	6.77	71.16	100
XX-13-S4	258.1	22.99	17.31	42.96	0.00	16.74	100
XX-13-S5	29.1	37.12	2.11	0.00	9.13	51.63	100
XX-14-S1	43.3	49.31	8.01	10.82	0.00	31.86	100
XX-14-S2	230.8	55.51	10.52	12.18	0.03	21.76	100
XX-14-S3	254.3	38.95	7.87	7.33	2.20	43.64	100
XX-14-S4	44.6	43.47	8.89	7.48	7.61	32.54	100
SJ-08L2	107.1	7.42	1.12	49.30	0.00	42.16	100
SJ-08R2	68.4	30.86	16.36	15.20	3.42	34.15	100
SJ-10L	86.7	59.44	2.16	0.00	7.64	30.76	100

Source: JICA Study Team

Table 5.7 Future Land Use Condition in Sub-basin

Unit: %

Basin	Sub-Basin	Area (km2)	Fishpond/ Rice Field	Tree Plantation	Farm Land	Open Area/ Grassland	Urban Area	Total
Imus	IM-01	13.96	0.13	12.73	53.64	3.65	29.85	100
	IM-02	18.60	1.29	3.72	4.14	3.03	87.82	100
	IM-03	19.74	3.03	7.54	11.42	20.23	57.79	100
	IM-04	8.68	30.65	8.29	7.23	9.29	44.54	100
	IM-05	10.74	0.91	15.00	0.49	36.39	47.21	100
	IM-06	3.09	0.42	0.00	0.00	0.00	99.58	100
	IM-07	9.43	0.47	1.04	1.50	1.51	95.47	100
	IM-08	7.22	0.96	1.88	0.21	0.00	96.95	100
	IM-09	3.13	12.21	0.06	2.68	0.00	85.05	100
	IM-10	0.60	11.10	0.05	0.00	8.47	80.38	100
	IM-11	0.71	29.94	1.41	0.00	5.76	62.89	100
	BC-01	7.45	1.77	4.75	0.13	14.70	78.64	100
	BC-02	8.21	8.81	1.70	0.41	14.88	74.20	100
	BC-03	1.14	44.40	0.00	0.00	2.20	53.40	100
	BC-04	2.33	7.86	0.50	0.03	3.25	88.35	100
	BC-05	0.47	52.89	0.00	0.00	0.00	47.11	100
Imus Sub-Total		115.49	5.36	6.09	9.94	10.76	67.84	100
San Juan	SJ-01	30.90	1.69	10.75	70.95	5.37	11.24	100
	SJ-02	9.27	4.17	9.47	14.26	3.47	68.63	100
	SJ-03	9.04	40.16	6.39	10.04	1.85	41.56	100
	SJ-04	9.07	59.80	7.14	14.95	0.48	17.63	100
	SJ-05	10.22	39.59	8.03	9.87	0.60	41.91	100
	SJ-06	4.89	52.32	8.82	13.07	0.03	25.76	100
	SJ-07	0.88	5.87	4.31	4.43	2.72	82.67	100
	SJ-08	11.32	36.71	3.61	31.62	0.02	28.04	100
	SJ-09	1.02	26.23	0.00	0.00	0.00	73.77	100
	SJ-10	1.51	67.50	1.24	1.10	4.37	25.79	100
San Juan Sub-Total		88.13	25.04	8.10	34.94	2.66	29.25	100
Ylang-Ylang	YY-01	32.63	2.09	13.76	34.51	14.91	34.73	100
	YY-02	15.10	3.04	13.53	26.30	1.17	55.97	100
	YY-03	3.19	30.97	13.17	7.61	13.33	34.91	100
	YY-04	2.52	57.67	21.77	13.29	0.00	7.26	100
	YY-05	4.93	68.87	7.48	17.22	0.00	6.42	100
	YY-06	0.20	41.01	16.15	17.54	0.00	25.30	100
Ylang-Ylang Sub-Total		58.56	12.05	13.49	28.50	9.34	36.62	100
Canas	CN-01	15.12	0.00	1.90	70.07	17.02	11.01	100
	CN-02	11.83	0.69	9.66	37.12	7.97	44.56	100
	CN-03	14.20	0.00	5.69	61.56	24.02	8.72	100
	CN-04	10.43	1.31	20.60	16.48	34.84	26.76	100
	CN-05	2.84	24.21	3.54	18.64	31.50	22.12	100
	CN-06	6.57	18.99	11.04	21.30	25.26	23.41	100
	CN-07	15.05	0.20	5.07	64.75	17.24	12.74	100
	CN-08	16.72	8.62	6.72	4.09	15.68	64.88	100
	CN-09	0.54	40.24	16.01	23.73	15.83	4.19	100
	CN-10	10.53	35.84	8.21	27.02	0.52	28.40	100
	CN-11	5.97	20.38	1.45	36.17	0.00	42.00	100
	CN-12	2.51	2.96	0.29	0.00	0.30	96.45	100
Canas Sub-Total		112.31	7.93	7.25	38.23	16.46	30.13	100
Drainage Area	XX-01	2.23	2.76	4.66	0.00	5.46	87.12	100
	XX-02	6.42	26.86	1.04	11.65	0.00	60.44	100
	XX-03	0.17	10.93	0.00	0.00	0.00	89.07	100
	XX-04	3.15	50.33	0.96	30.38	2.24	16.10	100
	XX-05	1.65	50.64	4.53	0.00	6.54	38.29	100
	XX-06	1.07	99.96	0.00	0.00	0.00	0.04	100
	XX-07	0.40	100.00	0.00	0.00	0.00	0.00	100
	XX-08	1.03	32.72	0.00	0.00	0.73	66.55	100
	XX-09	0.98	16.31	1.27	0.00	40.44	41.98	100
	XX-10	0.54	100.00	0.00	0.00	0.00	0.00	100
	XX-11	2.24	11.53	4.94	29.13	0.00	54.40	100
	XX-12	0.31	99.96	0.00	0.00	0.00	0.04	100
	XX-13	6.64	39.36	10.06	20.25	0.07	30.27	100
	XX-14	5.73	33.90	5.76	7.00	0.13	53.21	100
	XX-15	0.15	62.37	0.00	0.00	0.00	37.63	100
	XX-16	0.21	100.00	0.00	0.00	0.00	0.00	100
Drainage Area Sub-Total		32.92	36.93	4.25	12.46	2.18	44.18	100
Total		407.42	13.84	7.76	26.02	9.68	42.70	100

Source: JICA Study Team

Table 5.8 Future Land Use Condition in Sub-drainage Area

Unit: %

SubDrainage	Area (ha)	Fishpond/ Rice Field	Tree Plantation	Farm Land	Open Area/ Grassland	Urban Area	Total
XX-01-S1	78.8	0.32	1.79	0.00	4.96	92.93	100
XX-01-S2	70.3	8.28	0.00	0.00	11.77	79.95	100
XX-01-S3	74.2	0.13	12.12	0.00	0.00	87.75	100
XX-02-S1	134.3	70.54	0.00	17.63	0.00	11.83	100
XX-02-S2	58.3	59.25	0.00	14.81	0.00	25.94	100
XX-02-S3	255.0	0.31	0.00	3.76	0.00	95.92	100
XX-02-S4	114.3	33.54	0.00	21.10	0.00	45.36	100
XX-02-S5	79.9	5.00	8.39	10.95	0.00	75.67	100
XX-04-S1	148.6	76.32	1.10	19.16	0.00	3.43	100
XX-04-S2	121.2	11.44	1.14	55.49	5.82	26.10	100
XX-04-S3	45.3	69.06	0.00	0.00	0.00	30.94	100
XX-11-S1	85.7	14.56	9.09	66.31	0.00	10.04	100
XX-11-S2	42.2	1.10	1.39	5.00	0.00	92.51	100
XX-11-S3	59.1	7.04	4.50	10.35	0.00	78.11	100
XX-11-S4	18.6	25.42	0.00	0.00	0.00	74.58	100
XX-11-S5	17.8	21.99	0.00	0.00	0.00	78.01	100
XX-13-S1	71.1	59.47	9.53	13.05	0.00	17.96	100
XX-13-S2	238.5	67.42	12.99	14.80	0.19	4.59	100
XX-13-S3	67.0	5.63	0.03	1.23	0.00	93.11	100
XX-13-S4	258.1	21.06	11.24	34.48	0.00	33.22	100
XX-13-S5	29.1	0.00	0.00	0.00	0.00	100.00	100
XX-14-S1	43.3	49.30	8.01	10.82	0.00	31.87	100
XX-14-S2	230.8	55.51	10.52	12.18	0.00	21.79	100
XX-14-S3	254.3	14.49	2.08	2.19	0.29	80.95	100
XX-14-S4	44.6	17.88	0.00	3.92	0.00	78.20	100
SJ-08L2	107.1	4.12	0.00	27.41	0.00	68.47	100
SJ-08R2	68.4	14.33	6.87	1.82	0.30	76.68	100
SJ-10L	86.7	59.44	2.16	0.00	7.64	30.76	100

Source: JICA Study Team

Table 5.9 Observed Rainfall during the Typhoon Milenyo in 2006

Unit: mm

No.	Time	Sangley Point	Tagaytay*
1	2006/9/27 09:00		0.00
2	2006/9/27 10:00		0.00
3	2006/9/27 11:00		0.55
4	2006/9/27 12:00		0.00
5	2006/9/27 13:00		2.73
6	2006/9/27 14:00	12.0	3.27
7	2006/9/27 15:00		0.55
8	2006/9/27 16:00		1.64
9	2006/9/27 17:00	4.6	4.91
10	2006/9/27 18:00		1.64
11	2006/9/27 19:00		0.00
12	2006/9/27 20:00	7.2	0.00
13	2006/9/27 21:00		0.00
14	2006/9/27 22:00		0.00
15	2006/9/27 23:00	3.8	4.36
16	2006/9/28 00:00		3.27
17	2006/9/28 01:00		6.00
18	2006/9/28 02:00	0.0	8.72
19	2006/9/28 03:00		2.73
20	2006/9/28 04:00		3.27
21	2006/9/28 05:00		3.27
22	2006/9/28 06:00		2.18
23	2006/9/28 07:00		14.18
24	2006/9/28 08:00	42.0	0.55
	Sub-Total (Daily)	69.6	63.8

No.	Time	Sangley Point	Tagaytay*
25	2006/9/28 09:00		15.04
26	2006/9/28 10:00		38.59
27	2006/9/28 11:00	9.7	77.17
28	2006/9/28 12:00		53.63
29	2006/9/28 13:00		28.78
30	2006/9/28 14:00	14.3	3.27
31	2006/9/28 15:00		1.96
32	2006/9/28 16:00		7.85
33	2006/9/28 17:00	45.8	0.00
34	2006/9/28 18:00		0.00
35	2006/9/28 19:00		0.00
36	2006/9/28 20:00	0.0	0.00
37	2006/9/28 21:00		0.00
38	2006/9/28 22:00		0.00
39	2006/9/28 23:00		0.65
40	2006/9/29 00:00		0.00
41	2006/9/29 01:00		0.00
42	2006/9/29 02:00	0.0	0.00
43	2006/9/29 03:00		0.65
44	2006/9/29 04:00		0.00
45	2006/9/29 05:00		0.00
46	2006/9/29 06:00		0.00
47	2006/9/29 07:00		0.00
48	2006/9/29 08:00	0.0	0.00
	Sub-Total (Daily)	69.8	227.6
	Total (2-day)	139.4	291.4

*Note: Values are based on daily rainfall observation records and temporal distribution of strip chart collected from PAGASA.

Table 5.10 Observed Tide Level during the Typhoon Milenyo in 2006

No.	Time	Manila South Harbor [A] in meters above MLLW	Cavite Harbor [B]* El.m
1	2006/9/27 09:00	0.38	-0.19
2	2006/9/27 10:00	0.44	-0.13
3	2006/9/27 11:00	0.52	-0.05
4	2006/9/27 12:00	0.61	0.04
5	2006/9/27 13:00	0.65	0.08
6	2006/9/27 14:00	0.67	0.10
7	2006/9/27 15:00	0.64	0.07
8	2006/9/27 16:00	0.60	0.03
9	2006/9/27 17:00	0.59	0.02
10	2006/9/27 18:00	0.63	0.06
11	2006/9/27 19:00	0.71	0.14
12	2006/9/27 20:00	0.86	0.29
13	2006/9/27 21:00	1.01	0.44
14	2006/9/27 22:00	1.14	0.57
15	2006/9/27 23:00	1.25	0.68
16	2006/9/28 00:00	1.27	0.70
17	2006/9/28 01:00	1.24	0.67
18	2006/9/28 02:00	1.16	0.59
19	2006/9/28 03:00	1.00	0.43
20	2006/9/28 04:00	0.83	0.26
21	2006/9/28 05:00	0.65	0.08
22	2006/9/28 06:00	0.50	-0.07
23	2006/9/28 07:00	0.44	-0.13
24	2006/9/28 08:00	0.38	-0.19
25	2006/9/28 09:00	0.37	-0.20
26	2006/9/28 10:00	0.44	-0.13
27	2006/9/28 11:00	0.51	-0.06
28	2006/9/28 12:00	0.56	-0.01
29	2006/9/28 13:00	0.55	-0.02
30	2006/9/28 14:00	0.66	0.09
31	2006/9/28 15:00	0.88	0.31
32	2006/9/28 16:00	0.99	0.42
33	2006/9/28 17:00	0.89	0.32
34	2006/9/28 18:00	0.56	-0.01
35	2006/9/28 19:00	0.51	-0.06
36	2006/9/28 20:00	0.78	0.21
37	2006/9/28 21:00	1.19	0.62
38	2006/9/28 22:00	1.35	0.78
39	2006/9/28 23:00	1.28	0.71
40	2006/9/29 00:00	1.19	0.62
41	2006/9/29 01:00	1.19	0.62
42	2006/9/29 02:00	1.29	0.72
43	2006/9/29 03:00	1.29	0.72
44	2006/9/29 04:00	1.09	0.52
45	2006/9/29 05:00	0.80	0.23
46	2006/9/29 06:00	0.55	-0.02
47	2006/9/29 07:00	0.41	-0.16
48	2006/9/29 08:00	0.41	-0.16
49	2006/9/29 09:00	0.36	-0.21
50	2006/9/29 10:00	0.28	-0.29
51	2006/9/29 11:00	0.25	-0.32
52	2006/9/29 12:00	0.28	-0.29
53	2006/9/29 13:00	0.41	-0.16
54	2006/9/29 14:00	0.54	-0.03
55	2006/9/29 15:00	0.60	0.03
56	2006/9/29 16:00	0.58	0.01
57	2006/9/29 17:00	0.56	-0.01
58	2006/9/29 18:00	0.62	0.05
59	2006/9/29 19:00	0.76	0.19
60	2006/9/29 20:00	0.89	0.32
61	2006/9/29 21:00	0.97	0.40
62	2006/9/29 22:00	1.06	0.49
63	2006/9/29 23:00	1.17	0.60
64	2006/9/30 00:00	1.30	0.73
65	2006/9/30 01:00	1.39	0.82
66	2006/9/30 02:00	1.40	0.83
67	2006/9/30 03:00	1.30	0.73
68	2006/9/30 04:00	1.14	0.57
69	2006/9/30 05:00	0.94	0.37
70	2006/9/30 06:00	0.78	0.21
71	2006/9/30 07:00	0.63	0.06
72	2006/9/30 08:00	0.48	-0.09
73	2006/9/30 09:00	0.29	-0.28
74	2006/9/30 10:00	0.17	-0.40
75	2006/9/30 11:00	0.13	-0.44
76	2006/9/30 12:00	0.16	-0.41
77	2006/9/30 13:00	0.23	-0.34
78	2006/9/30 14:00	0.30	-0.27
79	2006/9/30 15:00	0.33	-0.24
80	2006/9/30 16:00	0.43	-0.14
81	2006/9/30 17:00	0.51	-0.06
82	2006/9/30 18:00	0.60	0.03
83	2006/9/30 19:00	0.71	0.14
84	2006/9/30 20:00	0.77	0.20
85	2006/9/30 21:00	0.85	0.28
86	2006/9/30 22:00	0.97	0.40
87	2006/9/30 23:00	1.10	0.53
88	2006/10/1 00:00	1.21	0.64
89	2006/10/1 01:00	1.32	0.75
90	2006/10/1 02:00	1.36	0.79
91	2006/10/1 03:00	1.38	0.81
92	2006/10/1 04:00	1.31	0.74
93	2006/10/1 05:00	1.18	0.61
94	2006/10/1 06:00	1.03	0.46
95	2006/10/1 07:00	0.75	0.18
96	2006/10/1 08:00	0.58	0.01

Source: NAMRIA

*Note: [B] = [A] - 0.48 m (MSL) - 0.09 m (tidal difference between Manila South Harbor and Cavite Harbor)

Table 5.11 Probable Peak Discharge for Drainage Area (Present Land Use)

Code	Drainage Area Name	Channel ID	Sub-Drainage	Drainage Area (ha)	Peak Discharge (m3/s)							
					2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	Sapa	-	-	74.2	9.0	10.1	11.3	12.8	14.4	14.9	15.8	16.4
2	Rosario -Poblacion	-	-	70.3	8.1	9.1	10.2	11.7	13.3	13.7	14.5	15.0
3	Silangan	-	-	78.8	8.5	9.6	10.8	13.1	15.3	15.8	16.9	17.5
4	Malimango Drainage	Dr-9	S1	134.3	6.6	8.0	9.7	12.3	14.8	15.6	16.8	17.7
			S2	58.3	4.1	4.9	5.6	6.8	7.9	8.2	8.8	9.1
			S3	254.9	34.1	38.4	42.5	46.4	51.2	52.5	55.2	57.1
			S4	114.3	9.5	10.9	12.5	15.2	17.7	18.4	19.7	20.6
			S5	79.9	7.8	8.8	10.1	12.5	14.7	15.4	16.4	17.1
			outlet	641.7	50.9	59.2	66.7	76.0	88.7	91.7	99.5	101.4
5	Ligtong	-		16.6	2.3	2.6	2.9	3.1	3.4	3.4	3.6	3.7
6	Bacao	Dr-8	S1	148.6	6.0	7.6	9.4	12.3	15.0	15.9	17.2	18.3
			S2	121.2	6.3	7.3	9.1	14.7	19.3	20.7	22.8	24.1
			S3	45.3	3.7	4.4	5.0	5.5	6.1	6.2	6.6	6.8
			outlet	315.1	9.5	11.0	13.0	17.3	22.4	23.7	26.1	27.3
7	San Rafael	-	-	165.4	12.8	14.9	17.1	19.6	22.4	23.2	24.7	25.8
8	Sta. Isabel	-	-	106.9	5.0	6.2	7.4	8.4	9.5	9.8	10.4	11.0
9	Wakas	-	-	39.5	2.3	2.8	3.3	3.7	4.2	4.3	4.6	4.8
10	Kawit -Poblacion	Dr-4	-	54.0	2.9	3.6	4.2	4.8	5.4	5.5	5.9	6.2
11	Tirona River	Dr-3	S1	85.8	2.6	3.1	5.2	9.3	13.0	14.1	15.7	16.7
			S2	42.1	5.0	5.7	6.3	7.1	8.0	8.2	8.7	9.0
			S3	59.2	5.7	6.5	7.4	8.8	10.2	10.6	11.2	11.7
			S4	18.6	2.3	2.6	2.8	3.1	3.4	3.4	3.6	3.7
			S5	17.8	1.8	2.1	2.3	2.6	2.9	3.0	3.1	3.2
			S6	30.7	1.9	2.3	2.7	3.0	3.4	3.5	3.7	3.9
			outlet	254.2	16.1	17.3	21.0	26.8	33.0	34.5	37.0	39.8
12	Malamok River	Dr-2	S1	71.2	3.8	4.6	5.5	7.3	8.9	9.3	10.1	10.6
			S2	238.5	8.8	11.0	14.0	18.7	23.3	24.8	27.3	29.2
			S3	66.8	7.6	8.6	9.6	10.9	12.2	12.6	13.3	13.7
			S4	258.1	10.7	12.8	16.1	25.7	34.0	36.8	41.0	44.1
			S5	29.1	2.9	3.3	3.7	4.3	4.9	5.0	5.3	5.5
		Dr-1	S6	43.3	3.3	3.9	4.5	5.5	6.3	6.6	7.0	7.3
			S7	230.8	12.9	15.4	18.2	22.7	27.1	28.4	30.8	32.6
			S8	254.5	20.1	23.3	26.6	31.2	35.9	37.3	39.9	41.9
			S9	44.6	3.4	4.0	4.6	5.8	6.8	7.1	7.6	7.9
			S10	15.3	1.5	1.7	1.9	2.1	2.3	2.4	2.5	2.6
			S11	21.4	1.4	1.7	1.9	2.2	2.4	2.5	2.6	2.8
			outlet	1,273.6	36.3	45.1	55.1	70.2	86.3	93.4	105.3	116.5
13	Binakayan	-	-	102.6	10.9	12.5	14.0	15.4	17.0	17.5	18.4	19.1
14	Sineguelasan	-	-	98.1	7.3	8.3	9.8	13.3	16.3	17.2	18.6	19.5
15	Calero River	Dr-7	-	86.6	6.5	7.6	8.8	10.2	11.6	12.0	12.7	13.3
16	Panamitan	Dr-5	S1	725.0	25.1	30.9	38.7	58.1	76.0	82.2	91.7	99.3
			S2	68.4	5.4	6.2	7.2	9.1	10.8	11.3	12.1	12.7
		Dr-6	S3	231.9	7.0	9.1	13.5	18.4	24.2	26.1	29.1	31.2
			S4	107.1	8.2	9.3	11.0	15.1	18.7	19.7	21.3	22.4
			outlet	1132.4	30.1	39.9	56.0	73.5	96.0	104.0	114.0	124.3
17	Daan Bukid Creek	Bacoor-2	-	114.4	10.5	12.1	13.7	15.0	16.7	17.1	18.1	18.7
18	Salinas	Bacoor-3	-	233.0	22.4	25.6	28.9	32.5	36.6	37.7	39.9	41.6

Peak discharges are calculated Peak discharges are calculated by Quasi-Linear Storage Type Model.
Baseflow is assumed as 0.01m. Baseflow is assumed as 0.01m3/s/ha.

Table 5.12 Probable Peak Discharge for Drainage Area (Future Land Use)

Code	Drainage Area Name	Channel ID	Sub-Drainage	Drainage Area (ha)	Peak Discharge (m3/s)							
					2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	Sapa	-	-	74.2	9.5	10.7	11.9	13.2	14.7	15.1	15.9	16.5
2	Rosario -Poblacion	-	-	70.3	8.4	9.5	10.6	12.0	13.5	13.8	14.6	15.1
3	Silangan	-	-	78.8	10.6	11.9	13.2	14.5	16.0	16.4	17.2	17.8
4	Malimango Drainage	Dr-9	S1	134.3	6.7	8.2	9.8	12.5	14.9	15.6	16.8	17.7
			S2	58.3	4.1	4.9	5.6	6.8	7.9	8.2	8.8	9.1
			S3	254.9	34.7	39.0	43.1	46.9	51.5	52.7	55.3	57.2
			S4	114.3	9.5	10.9	12.6	15.2	17.7	18.4	19.7	20.6
			S5	79.9	9.2	10.3	11.6	13.4	15.2	15.7	16.7	17.3
			outlet	641.7	52.6	61.0	69.1	77.8	90.6	92.7	100.5	102.5
5	Ligtong	-		16.6	2.3	2.6	2.9	3.1	3.4	3.4	3.6	3.7
6	Bacao	Dr-8	S1	148.6	6.0	7.6	9.4	12.3	15.0	15.9	17.2	18.3
			S2	121.2	6.3	7.3	9.1	14.7	19.3	20.7	22.8	24.1
			S3	45.3	3.7	4.4	5.0	5.5	6.1	6.2	6.6	6.8
			outlet	315.1	9.5	11.0	13.0	17.3	22.4	23.7	26.1	27.3
7	San Rafael	-	-	165.4	12.8	14.9	17.1	19.6	22.4	23.2	24.7	25.8
8	Sta. Isabel	-	-	106.9	5.0	6.2	7.4	8.4	9.5	9.8	10.4	11.0
9	Wakas	-	-	39.5	2.3	2.8	3.3	3.7	4.2	4.3	4.6	4.8
10	Kawit -Poblacion	Dr-4	-	54.0	2.9	3.6	4.2	4.8	5.4	5.5	5.9	6.2
11	Tirona River	Dr-3	S1	85.8	2.9	3.5	5.2	9.5	13.1	14.2	15.8	16.7
			S2	42.1	5.7	6.3	7.0	7.7	8.5	8.7	9.2	9.5
			S3	59.2	7.0	7.9	8.8	10.1	11.3	11.7	12.3	12.8
			S4	18.6	2.4	2.7	3.0	3.2	3.5	3.6	3.7	3.9
			S5	17.8	2.3	2.6	2.9	3.1	3.4	3.4	3.6	3.7
			S6	30.7	1.9	2.3	2.7	3.0	3.4	3.5	3.7	3.9
			outlet	254.2	18.0	19.1	22.5	28.1	34.3	35.5	37.8	40.3
12	Malamok River	Dr-2	S1	71.2	4.3	5.1	6.0	7.7	9.1	9.5	10.3	10.8
			S2	238.5	8.8	11.0	14.0	18.7	23.3	24.8	27.3	29.2
			S3	66.8	9.1	10.3	11.3	12.2	13.4	13.7	14.3	14.8
			S4	258.1	15.9	18.5	22.0	30.1	37.4	39.8	43.6	46.4
			S5	29.1	4.2	4.7	5.1	5.5	6.0	6.1	6.4	6.6
		Dr-1	S6	43.3	3.3	3.9	4.5	5.5	6.3	6.6	7.0	7.3
			S7	230.8	12.9	15.4	18.2	22.7	27.1	28.5	30.8	32.6
			S8	254.5	30.6	34.6	38.5	42.1	46.4	47.6	50.0	51.8
			S9	44.6	5.5	6.3	7.0	7.6	8.4	8.6	9.0	9.3
			S10	15.3	1.5	1.7	1.9	2.1	2.3	2.4	2.5	2.6
			S11	21.4	1.4	1.7	1.9	2.2	2.4	2.5	2.6	2.8
			outlet	1,273.6	70.0	84.4	99.5	117.1	138.8	146.5	161.4	169.8
13	Binakayan	-	-	102.6	11.4	13.0	14.5	15.7	17.3	17.7	18.5	19.2
14	Sineguelasan	-	-	98.1	7.3	8.3	9.8	13.3	16.3	17.2	18.6	19.5
15	Calero River	Dr-7	-	86.6	6.5	7.6	8.8	10.2	11.6	12.0	12.7	13.3
16	Panamitan	Dr-5	S1	725.0	34.6	41.3	49.6	67.2	83.9	89.6	98.6	105.7
			S2	68.4	8.1	9.2	10.2	11.3	12.6	12.9	13.6	14.1
		Dr-6	S3	231.9	9.0	11.1	13.9	20.5	26.2	28.1	31.1	33.2
			S4	107.1	11.1	12.6	14.2	17.2	20.1	20.9	22.3	23.2
			outlet	1132.4	42.8	52.8	64.2	82.2	105.2	113.2	123.9	132.6
17	Daan Bukid Creek	Bacoor-2	-	114.4	10.5	12.1	13.7	15.0	16.7	17.1	18.1	18.7
18	Salinas	Bacoor-3	-	233.0	28.7	32.5	36.0	39.3	43.3	44.4	46.7	48.3

Peak discharges are calculated Peak discharges are calculated by Quasi-Linear Storage Type Model.
Baseflow is assumed as 0.01m Baseflow is assumed as 0.01m3/s/ha.

Table 5.13 Simulation Result of Typhoon Milenyo in 2006

Under Present Land Use

Inundation Depth (m)	Number of Inundated Houses & Buildings			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.15 - 0.49	645	10,950	6,765	18,360
0.50 - 0.99	304	7,720	5,201	13,225
1.00 - 1.99	239	3,186	1,180	4,605
2.00 - 2.99	109	22	105	236
>= 3.00	34	0	28	62
Total	1,331	21,878	13,279	36,488

Under Present Land Use

Unit: km^2

Inundation Depth (m)	Extent of Inundation Area			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.01 - 0.24	2.15	12.32	12.58	27.04
0.25 - 0.49	0.28	5.03	6.21	11.52
0.50 - 0.99	0.43	4.62	5.65	10.70
1.00 - 1.99	0.37	1.71	1.88	3.96
2.00 - 2.99	0.13	0.02	0.17	0.32
>= 3.00	0.03	0.00	0.03	0.06
Total	3.38	23.71	26.51	53.60

Table 5.14 (1/2) Simulation Result with Each Return Period

Under Present Land Use

Unit: km^2

Inundation Depth (m)	Inundation Area (2-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.53	6.46	7.09	14.09
0.25 - 0.49	0.06	1.60	1.34	2.99
0.50 - 0.99	0.03	1.47	0.57	2.07
1.00 - 1.99	0.00	0.09	0.03	0.12
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.62	9.62	9.03	19.27

Inundation Depth (m)	Inundation Area (5-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	1.18	7.95	10.34	19.47
0.25 - 0.49	0.09	2.73	2.53	5.35
0.50 - 0.99	0.05	2.22	1.53	3.79
1.00 - 1.99	0.02	0.41	0.23	0.66
2.00 - 2.99	0.00	0.00	0.01	0.01
>= 3.00	0.00	0.00	0.00	0.00
Total	1.34	13.31	14.63	29.28

Inundation Depth (m)	Inundation Area (10-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	1.36	9.09	12.61	23.07
0.25 - 0.49	0.14	3.16	3.14	6.44
0.50 - 0.99	0.07	2.65	2.42	5.14
1.00 - 1.99	0.02	0.68	0.39	1.09
2.00 - 2.99	0.00	0.00	0.03	0.03
>= 3.00	0.00	0.00	0.00	0.00
Total	1.59	15.59	18.60	35.78

Inundation Depth (m)	Inundation Area (20-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	1.76	10.31	14.18	26.25
0.25 - 0.49	0.27	3.59	4.04	7.90
0.50 - 0.99	0.22	3.16	3.43	6.81
1.00 - 1.99	0.05	0.98	0.79	1.82
2.00 - 2.99	0.00	0.00	0.05	0.05
>= 3.00	0.00	0.00	0.02	0.02
Total	2.30	18.05	22.51	42.85

Inundation Depth (m)	Inundation Area (30-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	1.81	10.66	13.97	26.44
0.25 - 0.49	0.26	3.84	4.51	8.61
0.50 - 0.99	0.27	3.30	3.79	7.36
1.00 - 1.99	0.11	1.21	0.87	2.19
2.00 - 2.99	0.02	0.00	0.05	0.07
>= 3.00	0.00	0.00	0.02	0.02
Total	2.47	19.02	23.20	44.68

Inundation Depth (m)	Inundation Area (50-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	1.76	11.27	13.85	26.88
0.25 - 0.49	0.36	4.03	4.99	9.38
0.50 - 0.99	0.28	3.64	4.27	8.19
1.00 - 1.99	0.27	1.38	1.15	2.80
2.00 - 2.99	0.04	0.02	0.05	0.11
>= 3.00	0.00	0.00	0.02	0.02
Total	2.71	20.36	24.32	47.38

Inundation Depth (m)	Inundation Area (100-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	1.74	12.27	13.20	27.22
0.25 - 0.49	0.36	4.57	5.72	10.65
0.50 - 0.99	0.29	3.94	5.02	9.25
1.00 - 1.99	0.32	1.45	1.56	3.33
2.00 - 2.99	0.10	0.02	0.13	0.25
>= 3.00	0.03	0.00	0.03	0.06
Total	2.84	22.25	25.66	50.75

Table 5.14 (2/2) Simulation Result with Each Return Period

Under Present Land Use

Inundation Depth (m)	No. of Inundated Houses and Buildings (2-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	119	5,407	1,547	7,073
0.50 - 0.99	17	2,962	256	3,235
1.00 - 1.99	0	149	11	160
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	136	8,518	1,814	10,468

Inundation Depth (m)	No. of Inundated Houses and Buildings (5-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	195	6,797	3,769	10,761
0.50 - 0.99	42	4,170	1,124	5,336
1.00 - 1.99	1	955	144	1,100
2.00 - 2.99	0	0	16	16
>= 3.00	0	0	0	0
Total	238	11,922	5,053	17,213

Inundation Depth (m)	No. of Inundated Houses and Buildings (10-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	372	7,572	5,277	13,221
0.50 - 0.99	45	5,061	1,827	6,933
1.00 - 1.99	1	1,429	234	1,664
2.00 - 2.99	0	0	45	45
>= 3.00	0	0	0	0
Total	418	14,062	7,383	21,863

Inundation Depth (m)	No. of Inundated Houses and Buildings (20-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	439	8,728	6,147	15,314
0.50 - 0.99	74	5,773	3,064	8,911
1.00 - 1.99	4	2,107	416	2,527
2.00 - 2.99	0	0	47	47
>= 3.00	0	0	2	2
Total	517	16,608	9,676	26,801

Inundation Depth (m)	No. of Inundated Houses and Buildings (30-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	431	9,171	6,662	16,264
0.50 - 0.99	106	6,040	3,404	9,550
1.00 - 1.99	9	2,389	455	2,853
2.00 - 2.99	3	0	47	50
>= 3.00	0	0	2	2
Total	549	17,600	10,570	28,719

Inundation Depth (m)	No. of Inundated Houses and Buildings (50-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	566	9,501	6,662	16,729
0.50 - 0.99	94	6,728	3,940	10,762
1.00 - 1.99	81	2,585	608	3,274
2.00 - 2.99	46	22	47	115
>= 3.00	0	0	2	2
Total	787	18,836	11,259	30,882

Inundation Depth (m)	No. of Inundated Houses and Buildings (100-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	555	10,125	6,719	17,399
0.50 - 0.99	182	7,003	4,698	11,883
1.00 - 1.99	54	2,741	1,069	3,864
2.00 - 2.99	79	22	84	185
>= 3.00	34	0	28	62
Total	904	19,891	12,598	33,393

Table 5.15 (1/4) Simulation Result of the Flood Caused by River Overflow

Under Present Land Use — Unit: Km2

Inundation Depth (m)	Inundation Area (2-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.00	5.60	0.50	6.10
0.25 - 0.49	0.00	1.46	0.32	1.77
0.50 - 0.99	0.00	1.25	0.11	1.36
1.00 - 1.99	0.00	0.09	0.00	0.09
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.00	8.39	0.93	9.32

Inundation Depth (m)	Inundation Area (5-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.02	6.73	2.38	9.12
0.25 - 0.49	0.00	2.53	1.28	3.82
0.50 - 0.99	0.00	2.14	0.95	3.09
1.00 - 1.99	0.00	0.36	0.15	0.51
2.00 - 2.99	0.00	0.00	0.01	0.01
>= 3.00	0.00	0.00	0.00	0.00
Total	0.02	11.75	4.77	16.54

Inundation Depth (m)	Inundation Area (10-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.07	7.24	4.73	12.04
0.25 - 0.49	0.04	3.08	2.15	5.26
0.50 - 0.99	0.01	2.74	1.48	4.23
1.00 - 1.99	0.00	0.71	0.28	0.99
2.00 - 2.99	0.00	0.01	0.03	0.04
>= 3.00	0.00	0.00	0.00	0.00
Total	0.12	13.78	8.67	22.56

Inundation Depth (m)	Inundation Area (20-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.15	7.87	7.51	15.53
0.25 - 0.49	0.18	3.54	2.93	6.65
0.50 - 0.99	0.15	3.17	2.33	5.65
1.00 - 1.99	0.03	1.01	0.59	1.63
2.00 - 2.99	0.00	0.00	0.05	0.05
>= 3.00	0.00	0.00	0.02	0.02
Total	0.51	15.59	13.43	29.53

Inundation Depth (m)	Inundation Area (30-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.17	8.15	8.25	16.57
0.25 - 0.49	0.17	3.70	3.27	7.13
0.50 - 0.99	0.20	3.37	2.59	6.16
1.00 - 1.99	0.09	1.22	0.70	2.01
2.00 - 2.99	0.02	0.00	0.05	0.07
>= 3.00	0.00	0.00	0.02	0.02
Total	0.66	16.43	14.88	31.97

Inundation Depth (m)	Inundation Area (50-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.14	8.50	8.45	17.09
0.25 - 0.49	0.18	3.89	3.87	7.94
0.50 - 0.99	0.25	3.76	3.02	7.04
1.00 - 1.99	0.23	1.28	0.94	2.46
2.00 - 2.99	0.04	0.02	0.05	0.11
>= 3.00	0.01	0.00	0.02	0.03
Total	0.84	17.46	16.36	34.66

Inundation Depth (m)	Inundation Area (100-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.14	9.67	8.67	18.47
0.25 - 0.49	0.19	4.34	4.59	9.13
0.50 - 0.99	0.24	4.13	3.50	7.87
1.00 - 1.99	0.30	1.49	1.02	2.80
2.00 - 2.99	0.10	0.02	0.12	0.24
>= 3.00	0.03	0.00	0.03	0.06
Total	0.99	19.64	17.93	38.57

Table 5.15 (2/4) Simulation Result of the Flood Caused by River Overflow

Under Present Land Use

Inundation Depth (m)	No. of Inundated Houses and Buildings (2-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	0	4,706	88	4,794
0.50 - 0.99	0	2,138	11	2,149
1.00 - 1.99	0	67	0	67
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	0	6,911	99	7,010

Inundation Depth (m)	No. of Inundated Houses and Buildings (5-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	23	6,777	2,352	9,152
0.50 - 0.99	0	3,943	680	4,623
1.00 - 1.99	0	739	98	837
2.00 - 2.99	0	0	16	16
>= 3.00	0	0	0	0
Total	23	11,459	3,146	14,628

Inundation Depth (m)	No. of Inundated Houses and Buildings (10-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	36	7,691	3,657	11,384
0.50 - 0.99	0	5,151	1,130	6,281
1.00 - 1.99	0	1,659	131	1,790
2.00 - 2.99	0	33	45	78
>= 3.00	0	0	0	0
Total	36	14,534	4,963	19,533

Inundation Depth (m)	No. of Inundated Houses and Buildings (20-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	78	8,339	4,421	12,838
0.50 - 0.99	29	5,777	1,861	7,667
1.00 - 1.99	3	2,257	337	2,597
2.00 - 2.99	0	0	47	47
>= 3.00	0	0	2	2
Total	110	16,373	6,668	23,151

Inundation Depth (m)	No. of Inundated Houses and Buildings (30-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	70	8,573	4,634	13,277
0.50 - 0.99	61	5,852	2,148	8,061
1.00 - 1.99	8	2,588	397	2,993
2.00 - 2.99	3	0	47	50
>= 3.00	0	0	2	2
Total	142	17,013	7,228	24,383

Inundation Depth (m)	No. of Inundated Houses and Buildings (50-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	171	8,643	5,702	14,516
0.50 - 0.99	49	6,721	2,386	9,156
1.00 - 1.99	80	2,621	542	3,243
2.00 - 2.99	46	22	47	115
>= 3.00	0	0	2	2
Total	346	18,007	8,679	27,032

Inundation Depth (m)	No. of Inundated Houses and Buildings (100-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	116	9,289	6,190	15,595
0.50 - 0.99	135	7,137	2,678	9,950
1.00 - 1.99	53	3,016	638	3,707
2.00 - 2.99	79	22	84	185
>= 3.00	34	0	28	62
Total	417	19,464	9,618	29,499

Table 5.15 (3/4) Simulation Result of the Flood Caused by River Overflow

Under 2020 Land Use Unit: Km2

Inundation Depth (m)	Inundation Area (2-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.01	7.18	1.03	8.21
0.25 - 0.49	0.00	2.29	0.70	2.99
0.50 - 0.99	0.00	1.82	0.35	2.17
1.00 - 1.99	0.00	0.22	0.03	0.25
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.01	11.50	2.11	13.62

Inundation Depth (m)	Inundation Area (5-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.04	7.84	3.15	11.03
0.25 - 0.49	0.00	3.42	1.54	4.96
0.50 - 0.99	0.00	2.66	1.10	3.76
1.00 - 1.99	0.00	0.76	0.14	0.90
2.00 - 2.99	0.00	0.00	0.02	0.02
>= 3.00	0.00	0.00	0.00	0.00
Total	0.04	14.67	5.95	20.66

Inundation Depth (m)	Inundation Area (10-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.08	8.58	5.06	13.72
0.25 - 0.49	0.04	3.88	2.32	6.24
0.50 - 0.99	0.01	3.09	1.69	4.79
1.00 - 1.99	0.00	0.99	0.30	1.29
2.00 - 2.99	0.00	0.02	0.05	0.07
>= 3.00	0.00	0.00	0.02	0.02
Total	0.13	16.57	9.44	26.13

Inundation Depth (m)	Inundation Area (20-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.17	8.59	8.34	17.09
0.25 - 0.49	0.16	4.47	3.13	7.77
0.50 - 0.99	0.15	3.70	2.45	6.30
1.00 - 1.99	0.03	1.26	0.64	1.93
2.00 - 2.99	0.00	0.03	0.05	0.08
>= 3.00	0.00	0.00	0.02	0.02
Total	0.51	18.05	14.63	33.19

Inundation Depth (m)	Inundation Area (30-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.18	8.70	8.46	17.34
0.25 - 0.49	0.16	4.33	3.43	7.92
0.50 - 0.99	0.21	4.04	2.71	6.96
1.00 - 1.99	0.08	1.36	0.83	2.28
2.00 - 2.99	0.02	0.03	0.05	0.10
>= 3.00	0.00	0.00	0.02	0.02
Total	0.66	18.46	15.50	34.62

Inundation Depth (m)	Inundation Area (50-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.17	9.59	8.74	18.49
0.25 - 0.49	0.17	4.62	4.06	8.85
0.50 - 0.99	0.24	4.31	3.21	7.76
1.00 - 1.99	0.04	1.44	0.92	2.41
2.00 - 2.99	0.02	0.03	0.08	0.13
>= 3.00	0.00	0.00	0.02	0.02
Total	0.65	19.98	17.03	37.66

Inundation Depth (m)	Inundation Area (100-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.01 - 0.24	0.17	9.67	9.23	19.06
0.25 - 0.49	0.18	4.94	4.81	9.93
0.50 - 0.99	0.25	4.56	3.67	8.49
1.00 - 1.99	0.30	1.74	1.02	3.05
2.00 - 2.99	0.10	0.03	0.14	0.27
>= 3.00	0.03	0.00	0.03	0.06
Total	1.02	20.93	18.90	40.86

Table 5.15 (4/4) Simulation Result of the Flood Caused by River Overflow

Under 2020 Land Use

Inundation Depth (m)	No. of Inundated Houses and Buildings (2-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	0	12,574	742	13,316
0.50 - 0.99	0	6,572	184	6,756
1.00 - 1.99	0	554	53	607
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	0	19,701	979	20,680

Inundation Depth (m)	No. of Inundated Houses and Buildings (5-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	33	17,271	3,730	21,034
0.50 - 0.99	0	9,344	1,050	10,394
1.00 - 1.99	0	2,962	92	3,054
2.00 - 2.99	0	0	53	53
>= 3.00	0	0	0	0
Total	33	29,577	4,925	34,536

Inundation Depth (m)	No. of Inundated Houses and Buildings (10-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	50	18,194	6,136	24,380
0.50 - 0.99	0	10,477	1,770	12,247
1.00 - 1.99	0	4,144	238	4,382
2.00 - 2.99	0	50	63	113
>= 3.00	0	0	6	6
Total	50	32,866	8,211	41,127

Inundation Depth (m)	No. of Inundated Houses and Buildings (20-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	125	19,545	7,254	26,924
0.50 - 0.99	54	12,136	3,299	15,488
1.00 - 1.99	8	4,817	582	5,407
2.00 - 2.99	0	91	63	154
>= 3.00	0	0	6	6
Total	187	36,588	11,203	47,978

Inundation Depth (m)	No. of Inundated Houses and Buildings (30-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	188	19,599	8,076	27,863
0.50 - 0.99	99	13,080	3,443	16,621
1.00 - 1.99	16	5,174	782	5,972
2.00 - 2.99	8	91	63	161
>= 3.00	0	0	6	6
Total	311	37,943	12,369	50,623

Inundation Depth (m)	No. of Inundated Houses and Buildings (50-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	111	20,043	8,719	28,873
0.50 - 0.99	110	13,738	4,007	17,854
1.00 - 1.99	5	5,568	1,078	6,651
2.00 - 2.99	8	91	70	169
>= 3.00	0	0	6	6
Total	234	39,439	13,879	53,552

Inundation Depth (m)	No. of Inundated Houses and Buildings (100-year return preriod)			
	Canas	Imus	San Juan - Ylang-Ylang	Total
0.15 - 0.49	216	20,673	9,547	30,436
0.50 - 0.99	237	14,906	4,633	19,776
1.00 - 1.99	112	6,113	1,340	7,564
2.00 - 2.99	202	91	168	461
>= 3.00	85	0	83	167
Total	851	41,782	15,771	58,403

Table 5.16 (1/2) Simulation Result of Inland Flood

Without Project under Present Land Use

Inundation Depth (m)	Number of Inundated Houses & Buildings			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.15 - 0.49	102	2,054	1,470	3,626
0.50 - 0.99	16	919	232	1,167
1.00 - 1.99	0	74	17	91
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	118	3,047	1,719	4,884

Unit: km^2

Inundation Depth (m)	Extent of Inundation Area			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.01 - 0.24	0.31	1.02	4.16	5.49
0.25 - 0.49	0.04	0.59	0.48	1.11
0.50 - 0.99	0.02	0.27	0.17	0.45
1.00 - 1.99	0.00	0.02	0.01	0.03
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.37	1.90	4.82	7.09

Partial Protection under Present Land Use

Inundation Depth (m)	Number of Inundated Houses & Buildings			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.15 - 0.49	102	265	1,292	1,659
0.50 - 0.99	16	0	251	267
1.00 - 1.99	0	0	0	0
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	118	265	1,543	1,926

Unit: km^2

Inundation Depth (m)	Extent of Inundation Area			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.01 - 0.24	0.31	0.42	1.47	2.21
0.25 - 0.49	0.04	0.07	0.40	0.50
0.50 - 0.99	0.02	0.00	0.18	0.20
1.00 - 1.99	0.00	0.00	0.00	0.00
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.37	0.49	2.05	2.91

Table 5.16 (2/2) Simulation Result of Inland Flood

Without Project under 2020 Land Use

Inundation Depth (m)	Number of Inundated Houses & Buildings			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.15 - 0.49	185	4,501	2,094	6,780
0.50 - 0.99	53	1,786	339	2,178
1.00 - 1.99	0	235	22	257
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	238	6,523	2,454	9,215

Unit: km^2

Inundation Depth (m)	Extent of Inundation Area			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.01 - 0.24	0.48	1.67	4.69	6.84
0.25 - 0.49	0.04	0.84	0.55	1.43
0.50 - 0.99	0.04	0.35	0.20	0.58
1.00 - 1.99	0.00	0.04	0.01	0.05
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.56	2.89	5.45	8.90

Partial Protection under 2020 Land Use

Inundation Depth (m)	Number of Inundated Houses & Buildings			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.15 - 0.49	127	369	1,913	2,409
0.50 - 0.99	20	102	303	425
1.00 - 1.99	0	0	32	32
2.00 - 2.99	0	0	0	0
>= 3.00	0	0	0	0
Total	147	471	2,247	2,865

Unit: km^2

Inundation Depth (m)	Extent of Inundation Area			
	Canas	Imus	San Juan & Ylang-Ylang	Total
0.01 - 0.24	0.31	0.44	1.44	2.20
0.25 - 0.49	0.04	0.05	0.42	0.50
0.50 - 0.99	0.02	0.02	0.17	0.21
1.00 - 1.99	0.00	0.00	0.01	0.01
2.00 - 2.99	0.00	0.00	0.00	0.00
>= 3.00	0.00	0.00	0.00	0.00
Total	0.37	0.51	2.04	2.92

Table 6.1 Flood Mitigation Works undertaken by DPWH Cavite District Office

Year	Project Title (Target)	Work Quantity	Cost (pesos)
2000-2001	Regular Infra Program	5 projects, 2.122km	9,200,000
	Flood Control and Drainage under APP2000	14 projects, 3.17km	13,750,000
	Flood Control and Drainage under APP 2001	1 project 1,850.3m	10,000,000
	Regular Maintenance	17 projects, 2,058.32m	5,625,000
	Total		**38,575,000**
2002	Regular Infra Program	2 projects, 81.20m	1,250,000
	Upper House Funded Project (Improvement of river/drainage channel)	3 projects, 3,467.97m	21,200,000
	PDAF (Improvement of drainage channel)	2 projects, 1,243.27m	7,600,000
	EL Nino Prpject (Desilting and cleaning of drainage channel)	1 project	4,000,000
	Regular Maintenance	10 projects, 2,236.44m	5,306,000
	Total		**39,356,000**
2003	Regular Infra Program for Flood Control	1 project	1,000,000
	Upper House Funded Project (Widening/construction of drainage channel)	1 project	7,500,000
	Project under VILP CY2003 (Const//Rehab of drainage system)	4 projects	5,250,000
	Project under VILP CY2003 (Const//Rehab of drainage system)	10 projects	5,725,000
	Regular Maintenance (Flood Control)	1 project	667,000
	Total		**20,142,000**
2004	Upper House Funded Project (River Side Riprap)	1 project	1,000,000
	Lower House Funded Project (River Side Ripalap)	3 projects	6,000,000
	Total		**7,000,000**
2005	Earmark for this Year (To help address the problem of flooding, DPWH Cavite District Office has pinpointed high risk areas. Earmarked for flood control and drainage this year is P16.70 Million for construction of flood control and dredging works.)		**16,700,000**
2006	Office of the President Funded Project (Cleaning Canal Activity along National Road)	1 project	13,800,000
	Upper House Funded Project (River Dredging)	3 projects	40,000,000
	Total		**53,800,000**

Table 8.1 Proposed Tidal Gates, Improvement of Existing Drainage Main and Construction of New Drainage and Interceptors

Objective Drainage Area (Municipality)	Structure	Name of Structure*	Number of House Relocation	
			2-year	5-year
Bacoor	Channel Improvement	Bacoor-3 (L=0.3km)	10	10
	Drainage Main	BM-1. (L=0.5km, Box Culvert)	2	**20**
	Tidal Gate	Outlet of BM-1	-	-
Imus	Channel Improvement	Dr-1 (Malamok Drainage Canal, L=1.2km)	80	105
	Interceptor	I-IT-2 (L=0.25km, Box Culvert)	-	**25**
Kawit	Channel Improvement	Dr-5 (Panamitan Drainage Canal) (L=2.3km)	35	55
	Drainage Main	KDM-1 (L=0.7km) KDM-2 (L=1.5km)	2	2
	Tidal Gate	Outlet of Tirona Drainage Canal Outlet of Dr-5 Inlet Point of Branch of San Juan, Outlet of KDM-1	-	-
	Interceptor	I-Dr-5 (L=0.7km) I-Dr-6-1 (L=1.5km, Box Culvert) I-Dr-6-2 (L=1.2km, Box Culvert)	4	10
Noveleta	Channel Improvement	Dr-8 (L=1.0km)	1	3
	Drainage Main	NDM-1 (L=1.1km, Box Culvert)	10	20
	Tidal Gate	Outlets of Dr-8 Outlet of NDM-1	-	-
Rosario	Channel Improvement	Dr-9 (Malimango Drainage Canal. L=1.4km)	30	65
	Drainage Main	RDM-1,2,3 and 4 (L=3.5km in total, Box Culvert)	-	**140**
	Tidal Gate	Outlet of RDM-1,2 and 3	-	-
Gen. Trias	Interceptor	I-Dr-9 (L=1.9km, B.C.)	10	20
Tanza	Drainage Main	TDM-1 (L=0.4km)	-	-
Total			184	**475**

Note: *: Refer to Fig. 8.11 (Alternative_D-1)

Table 8.2 Structural Features for Inland Drainage with On-site (2-year return period / Full Protection)

Item					House Relocation		Land Acquisition	
Area	Measure	Target	Description		D-1	D-2	D-1	D-2
	Exist. Drainage Imp.	Bacoor-3	P.W L=0.3km		10	10	0.1	0.1
	Drainage Main	BM-1	B.C: L=0.5km, BxH=3.0x2.5m		2	2	0.0	0.0
	Flap Gate		8 places					
	Subtotal				12	12	0.1	0.1
Bacoor	Total							
	Exist. Drainage Imp.	Dr-1	Widening/Dike L=1.2km with T.G		80	80	0.5	0.5
	Interceptor	I-IT-2	B.C: L=0.25km, BxH=2.7x2.4m		0	0	0	0
	Retention Pond	M2	A=11ha, V=0.27mcm		0	0	11	11
	Subtotal				80	80	11.5	11.5
Imus	Total							
		Dr-2	Widening/Dike L=1.4km		20	20	0.1	0.1
		Dr-3	Dredging T.G with Lock		10	10	0.6	0.6
		Dr-4	Dredging T.G with Lock		5	5	1.0	1.0
	Exist. Drainage Imp.	Dr-5	Widening/Dike L=2.3km		0	0	1.0	1.0
		KDM-1	B=6m, L=1.5km with T.G		2	2	0.8	0.8
	Drainage Main	KDM-2	B.C: L=0.65km, BxH=3.0x2.5m		0	0	0.0	0.0
		I-Dr-5	B.C: L=0.7km, BxH=3.0x2.5mx2		3	3	0.2	0.2
		I-Dr-6-1	B.C: L=1.5km, BxH=3.0x2.5mx2		0	0	0.5	0.5
	Interceptor	I-Dr-6-2	B.C: L=1.2km, BxH=3.0x2.5mx2		1	1	0.3	0.3
		M1	A=4ha, V=0.08mcm		0	0	4.0	4.0
		K1	A=4ha, V=0.20mcm		0	0	4.0	4.0
	Retention Pond	P1	A=16ha, V=0.45mcm		0	0	16.0	16.0
		CD-1	L=0.5km, Earth Dike Type		12	12	1.2	1.2
		CD-2	L=1.5km, Earth Dike Type		16	16	3.1	3.1
	Coastal Dike	CD-3	L=2.1km, Earth Dike Type		50	50	3.4	3.4
		RD-1	L=3.2km, Earth Dike Type		0	100	0.0	2.5
		RD-2	L=5.9km, Earth Dike Type		0	70	0.0	3.5
	Ring Dike	RD-3	L=4.0km, Earth Dike Type		0	50	0.0	2.6
	Flap Gate		D-1: 2 places D-2:8places					
	Subtotal				119	339	36.2	44.8
Kawit	Total							
	Exist. Drainage Imp.	Dr-8	Widening/Dike L=1.0km with T.G		1	1	0.8	0.8
	Drainage Main	NDM-1	B.C: L=1.1km, BxH=2.7x2.4m with T.G		10	10	0.1	0.1
	Coastal Dike	CD-4	L=3.2km, Concrete Dike Type		20	20	6.2	6.2
	Flap Gate		1 place					
	Subtotal				31	31	7.1	7.1
Noveleta	Total							
	Exist. Drainage Imp.	Dr-9	Widening/Dike L=1.2km with T.G		30	30	1.6	1.6
	Drainage Main	RDM-1-4	B.C: L=2.0km, BxH=3.0x2.5m B.C: L=1.3km, BxH=3.0x2.5mx2 P.C: L=0.15km 910mm dia. with 2-T.G		0	0	0.1	0.1
	Retention Pond	E1	A=3ha, V=0.1mcm		0	0	3.0	3.0
	Coastal Dike	CD-5&6	L=4.7km, Concrete Dike Type		40	40	4.9	4.9
	Flap Gate		5 places					
	Subtotal				70	70	9.6	9.6
Rosario	Total							
	Interceptor	I-Dr-9	B.C: L=2.9km, BxH=2.7x2.4m		10	10	0.5	0.5
	Retention Pond	E2	A=3ha, V=0.1mcm		1	1	14	14
	Subtotal				11	11	14.5	14.5
Gen. Trias	Total							
	Coastal Dike	CD-7	L=0.5km, Concrete Dike Type		0	0	0.7	0.7
	Flap Gate		2 places					
	Subtotal							
Tanza	Total							
	Measure		D1	D2	D1	D2	D1	D2
	Exist. Drainage Imp.		L=2.6km	L=2.6km	156	156	1.6	1.6
	Drainage Main		L=10.4km	L=10.4km	14	14	1.0	1.0
	Interceptor		L=6.3km	L=6.3km	14	14	1.5	1.5
	Retention Pond		A=52hectares	A=52hectares	1	1	52.0	52.0
	Coastal Dike		L=12.5km	L=12.5km	138	138	19.5	19.5
	Ring Dike		-	L=9.0km	0	220	0.0	8.6
	Tidal Gate		n : 11	n : 9				
	Flap G.		n : 18	n : 24				
Total	Total				323	543	75.6	84.2

Table 8.3 Structural Features for Inland Drainage with On-site (2-year return period / Partial Protection)

Item					House Relocation		Land Acquisition	
Area	Measure	Target	Description		D-1	D-2	D-1	D-2
	Exist. Drainage Imp.	Bacoor-3	P.W L=0.3km		10	10	0.1	0.1
	Flap Gate		8 places					
	Subtotal				10	10	0.1	0.1
Bacoor	Total							
	Exist. Drainage Imp.	Dr-1	Tidal Gate with Lock		10	10	0.2	0.2
	Interceptor	I-IT-2	B.C: L=0.25km, BxH=2.7x2.4m		0	0	0	0
	Retention Pond	M2	A=11ha, V=0.27mcm		0	0	11	11
	Subtotal				10	10	11.2	11.2
Imus	Total							
		Dr-3	Tidal Gate with Lock					
		Dr-4	Tidal Gate with Lock					
	Exist. Drainage Imp.	Dr-5	Widening/Dike L=2.3km		0	0	1.0	1.0
	Drainage Main	KDM-1	B=6m, L=1.5km with T.G		2	2	0.8	0.8
	Interceptor	I-Dr-6-1	B.C: L=1.5km, BxH=3.0x2.5mx2		0	0	0.5	0.5
		M1	A=4ha, V=0.08mcm		0	0	4.0	4.0
		K1	A=4ha, V=0.20mcm		0	0	4.0	4.0
	Retention Pond	P1	A=16ha, V=0.45mcm		0	0	16.0	16.0
		CD-1	L=0.5km, Earth Dike Type		12	12	1.2	1.2
		CD-2	L=1.5km, Earth Dike Type		16	16	3.1	3.1
	Coastal Dike	CD-3	L=2.1km, Earth Dike Type		50	50	3.4	3.4
		RD-1	L=3.2km, Earth Dike Type		0	100	0.0	2.5
		RD-2	L=5.9km, Earth Dike Type		0	70	0.0	3.5
	Ring Dike	RD-3	L=4.0km, Earth Dike Type		0	50	0.0	2.6
	Flap Gate		D-1: 2 places D-2:8places					
	Subtotal				80	300	34	42.6
Kawit	Total							
	Exist. Drainage Imp.	Dr-8	Tidal Gate					
	Drainage Main	NDM-1	Tidal Gate		0	0	0	0
	Flap Gate		1 place					
	Subtotal				0	0	0	0
Noveleta	Total							
	Exist. Drainage Imp.	Dr-9	Tidal Gate		10	10	0.5	0.5
		RDM-1-4	Tidal Gate					
	Retention Pond	E1	A=3ha, V=0.1mcm		0	0	3.0	3.0
	Flap Gate		5 places					
	Subtotal				10	10	3.5	3.5
Rosario	Total							
	Interceptor	I-Dr-9	Widening/Dike L=1.2km with T.G		10	10	0.5	0.5
	Retention Pond	E2	A=3ha, V=0.1mcm		1	1	14	14
	Subtotal				11	11	14.5	14.5
Gen. Trias	Total							
	Flap Gate		2 places					
Tanza	Total							
	Measure		D1	D2				
	Exist. Drainage Imp.		L=7.5km	L=7.5km	30	30	1.8	1.8
	Drainage Main		L=1.5km	L=1.5km	2	2	0.8	0.8
	Interceptor		L=2.7km	L=2.7km	10	10	1.0	1.0
	Retention Pond		A=52hectares	A=52hectares	1	1	52.0	52.0
	Coastal Dike		L=4.1km	L=4.1km	78	78	7.7	7.7
	Ring Dike		-	L=9.0km	0	220	0.0	8.6
	Tidal Gate		n : 9	n : 8				
	Flap G.		n : 18	n : 24				
Total	Total				121	341	63.3	71.9

Table 8.4 Structural Features for Inland Drainage without On-site (2-year return period / Full Protection)

Item				House Relocation		Land Acquisition	
Area	Measure	Target	Description	D-1	D-2	D-1	D-2
	Exist. Drainage Imp.	Bacoor-3	P.W L=0.3km	10	10	0.1	0.1
	Drainage Main	BM-1	B.C: L=0.5km, BxH=3.0x2.5m	2	2	0.0	0.0
	Flap Gate		8 places				
	Subtotal			12	12	0.1	0.1
Bacoor	Total						
	Exist. Drainage Imp.	Dr-1	Widening/Dike L=1.2km with T.G	80	80	0.5	0.5
	Interceptor	I-IT-2	B.C: L=0.25km, BxH=2.7x2.4m	0	0	0	0
	Retention Pond	M2	A=11ha, V=0.27mcm	0	0	11	11
	Subtotal			80	80	11.5	11.5
Imus	Total						
		Dr-2	Widening/Dike L=1.4km	20	20	0.1	0.1
		Dr-3	Dredging T.G with Lock	10	10	0.6	0.6
		Dr-4	Dredging T.G with Lock	5	5	1.0	1.0
	Exist. Drainage Imp.	Dr-5	Widening/Dike L=2.3km	0	0	1.0	1.0
		KDM-1	B=6m, L=1.5km with T.G	2	2	0.8	0.8
	Drainage Main	KDM-2	B.C: L=0.65km, BxH=3.0x2.5m	0	0	0.0	0.0
		I-Dr-5	B.C: L=0.7km, BxH=3.0x2.5mx2	3	3	0.2	0.2
		I-Dr-6-1	B.C: L=1.5km, BxH=3.0x2.5mx2	0	0	0.5	0.5
	Interceptor	I-Dr-6-2	B.C: L=1.2km, BxH=3.0x2.5mx2	1	1	0.3	0.3
		M1	A=6ha, V=0.12mcm	0	0	6.0	6.0
		K1	A=7ha, V=0.33mcm	0	0	7.0	7.0
	Retention Pond	P1	A=20ha, V=0.55mcm	0	0	20.0	20.0
		CD-1	L=0.5km, Earth Dike Type	12	12	1.2	1.2
		CD-2	L=1.5km, Earth Dike Type	16	16	3.1	3.1
	Coastal Dike	CD-3	L=2.1km, Earth Dike Type	50	50	3.4	3.4
		RD-1	L=3.2km, Earth Dike Type	0	100	0.0	2.5
		RD-2	L=5.9km, Earth Dike Type	0	70	0.0	3.5
	Ring Dike	RD-3	L=4.0km, Earth Dike Type	0	50	0.0	2.6
	Flap Gate		D-1: 2 places D-2:8places				
	Subtotal			119	339	45.2	53.8
Kawit	Total						
	Exist. Drainage Imp.	Dr-8	Widening/Dike L=1.0km with T.G	1	1	0.8	0.8
	Drainage Main	NDM-1	B.C: L=1.1km, BxH=2.7x2.4m with T.G	10	10	0.1	0.1
	Coastal Dike	CD-4	L=3.2km, Concrete Dike Type	20	20	6.2	6.2
	Flap Gate		1 place				
	Subtotal			31	31	7.1	7.1
Noveleta	Total						
	Exist. Drainage Imp.	Dr-9	Widening/Dike L=1.2km with T.G	30	30	1.6	1.6
	Drainage Main	RDM-1-4	B.C: L=2.0km, BxH=3.0x2.5m B.C: L=1.3km, BxH=3.0x2.5mx2 P.C: L=0.15km 910mm dia. with 2-T.G	0	0	0.1	0.1
	Retention Pond	E1	A=3ha, V=0.1mcm	0	0	3.0	3.0
	Coastal Dike	CD-5&6	L=4.7km, Concrete Dike Type	40	40	4.9	4.9
	Flap Gate		5 places				
	Subtotal			70	70	9.6	9.6
Rosario	Total						
	Interceptor	I-Dr-9	B.C: L=2.9km, BxH=2.7x2.4m	10	10	0.5	0.5
	Retention Pond	E2	A=3ha, V=0.1mcm	1	1	14	14
	Subtotal			11	11	14.5	14.5
Gen. Trias	Total						
	Coastal Dike	CD-7	L=0.5km, Concrete Dike Type	0	0	0.7	0.7
	Flap Gate		2 places				
	Subtotal						
Tanza	Total						
	Measure		D1	D2			
	Exist. Drainage Imp.		L=2.6km	L=2.6km	156	156	1.6	1.6
	Drainage Main		L=10.4km	L=10.4km	14	14	1.0	1.0
	Interceptor		L=6.3km	L=6.3km	14	14	1.5	1.5
	Retention Pond		A=61hectares	A=61hectares	1	1	61.0	61.0
	Coastal Dike		L=12.5km	L=12.5km	138	138	19.5	19.5
	Ring Dike		-	L=9.0km	0	220	0.0	8.6
	Tidal Gate		n : 11	n : 9				
	Flap G.		n : 18	n : 24				
Total	Total				323	543	84.6	93.2

Table 8.5 Structural Features for Inland Drainage without On-site (2-year return period / Partial Protection)

Item					House Relocation		Land Acquisition	
Area	Measure	Target	Description		D-1	D-2	D-1	D-2
	Exist. Drainage Imp.	Bacoor-3	P.W L=0.3km		10	10	0.1	0.1
	Flap Gate		8 places					
	Subtotal				10	10	0.1	0.1
Bacoor	Total							
	Exist. Drainage Imp.	Dr-1	Tidal Gate with Lock		10	10	0.2	0.2
	Interceptor	I-IT-2	B.C: L=0.25km, BxH=2.7x2.4m		0	0	0	0
	Retention Pond	M2	A=11ha, V=0.27mcm		0	0	11	11
	Subtotal				10	10	11.2	11.2
Imus	Total							
		Dr-3	Tidal Gate with Lock					
		Dr-4	Tidal Gate with Lock					
	Exist. Drainage Imp.	Dr-5	Widening/Dike L=2.3km		0	0	1.0	1.0
	Drainage Main	KDM-1	B=6m, L=1.5km with T.G		2	2	0.8	0.8
	Interceptor	I-Dr-6-1	B.C: L=1.5km, BxH=3.0x2.5mx2		0	0	0.5	0.5
		M1	A=6ha, V=0.12mcm		0	0	6.0	6.0
		K1	A=7ha, V=0.33mcm		0	0	7.0	7.0
	Retention Pond	P1	A=20ha, V=0.55mcm		0	0	20.0	20.0
		CD-1	L=0.5km, Earth Dike Type		12	12	1.2	1.2
		CD-2	L=1.5km, Earth Dike Type		16	16	3.1	3.1
	Coastal Dike	CD-3	L=2.1km, Earth Dike Type		50	50	3.4	3.4
		RD-1	L=3.2km, Earth Dike Type		0	100	0.0	2.5
		RD-2	L=5.9km, Earth Dike Type		0	70	0.0	3.5
	Ring Dike	RD-3	L=4.0km, Earth Dike Type		0	50	0.0	2.6
	Flap Gate		D-1: 2 places D-2:8places					
	Subtotal				80	300	43.0	51.6
Kawit	Total							
	Exist. Drainage Imp.	Dr-8	Tidal Gate					
	Drainage Main	NDM-1	Tidal Gate		0	0	0	0
	Flap Gate		1 place					
	Subtotal				0	0	0	0
Noveleta	Total							
	Exist. Drainage Imp.	Dr-9	Tidal Gate		10	10	0.5	0.5
		RDM-1-4	Tidal Gate					
	Retention Pond	E1	A=3ha, V=0.1mcm		0	0	3.0	3.0
	Flap Gate		5 places					
	Subtotal				10	10	3.5	3.5
Rosario	Total							
	Interceptor	I-Dr-9	Widening/Dike L=1.2km with T.G		10	10	0.5	0.5
	Retention Pond	E2	A=3ha, V=0.1mcm		1	1	14	14
	Subtotal				11	11	14.5	14.5
Gen. Trias	Total							
	Flap Gate		2 places					
Tanza	Total							
	Measure		D1	D2				
	Exist. Drainage Imp.		L=7.5km	L=7.5km	30	30	1.8	1.8
	Drainage Main		L=1.5km	L=1.5km	2	2	0.8	0.8
	Interceptor		L=2.7km	L=2.7km	10	10	1.0	1.0
	Retention Pond		A=61hectares	A=61hectares	1	1	61.0	61.0
	Coastal Dike		L=4.1km	L=4.1km	78	78	7.7	7.7
	Ring Dike		-	L=9.0km	0	220	0.0	8.6
	Tidal Gate		n : 9	n : 8				
	Flap G.		n : 18	n : 24				
Total	Total				121	341	72.3	80.9

Table 8.6 Cost Estimate for On-site Regulation Pond

(for 5 hectares)

Item	Unit	Equipment L/C	Equipment F/C	Material L/C	Material F/C	Labor L/C	Labor F/C	Quantity	Equipment L/C	Equipment F/C	Material L/C	Material F/C	Labor L/C	Labor F/C	Total	Remarks
Preparatory Work	L.S.	1	1	1	1	1	1	1	61,617	97,498	112,663	205,133	86,570	10,200	573,682	Mobilization and etc.
Excavation	m3	29	60	0	0	7	1	4,500	132,333	271,505	299	1,196	33,585	4,073	442,992	
Embakment	m3	43	88	0	0	7	1	925	39,643	81,362	26	103	6,730	816	128,679	
Retaining Wall	m3	531	688	2,195	2,339	1,257	151	254	134,761	174,871	557,590	594,107	319,153	38,330	1,818,813	
Fencing Work	m	219	263	470	1,568	1,920	226	120	26,333	31,564	56,351	188,200	230,359	27,097	559,904	incl. CHB Wall
Outlet Sluice	L.S.	1	1	1	1	1	1									
Concrete	m3	1,714	2,383	2,775	9,467	2,091	224	50	85,711	119,149	138,733	473,330	104,541	11,180	932,644	incl. Re-bar, Forming/False Works
Gate	nos	29,929	30,404	27,044	243,394	1,352	164	1	29,929	30,404	27,044	243,394	1,352	164	332,287	B x H : 1.0m x 1.0m
Spillway and Others	L.S.	111,443	177,494	244,169	364,518	91,283	11,069	1	111,443	177,494	244,169	364,518	91,283	11,069	999,975	
Temporary works	%	10%	10%	10%	10%	10%	10%	1	56,015	88,635	102,421	186,485	78,700	9,273	521,530	
Total									677,786	1,072,482	1,239,296	2,256,465	952,275	112,203	6,310,507	
								Say	678,000	1,073,000	1,240,000	2,257,000	953,000	113,000	7,000,000	
Perventage									10.7%	17.0%	19.6%	35.7%	15.1%	1.8%	100%	
								Say	10%	17%	20%	36%	15%	2%	100%	

(for 20 hectares)

Item	Unit	Equipment L/C	Equipment F/C	Material L/C	Material F/C	Labor L/C	Labor F/C	Quantity	Equipment L/C	Equipment F/C	Material L/C	Material F/C	Labor L/C	Labor F/C	Total	Remarks
Preparatory Work	L.S.	1	1	1	1	1	1	1	154,053	256,182	246,567	416,810	229,110	27,036	1,329,759	Mobilization and etc.
Excavation	m3	29	60	0	0	7	1	18,000	529,333	1,086,022	1,196	4,784	134,341	16,291	1,771,967	
Embakment	m3	43	88	0	0	7	1	2,500	107,143	219,896	69	277	18,190	2,206	347,781	
Retaining Wall	m3	531	688	2,195	2,339	1,257	151	685	363,431	471,601	1,503,738	1,602,219	860,709	103,369	4,905,067	
Fencing Work	m	219	263	470	1,568	1,920	226	400	87,777	105,213	187,837	627,332	767,864	90,325	1,866,348	incl. CHB Wall
Outlet Sluice	L.S.	1														
Concrete	m3	1,714	2,383	2,775	9,467	2,091	224	100	171,421	238,298	277,466	946,660	209,083	22,361	1,865,289	incl. Re-bar, Forming/False Works
Gate	nos	29,929	30,404	27,044	243,394	1,352	164	1	29,929	30,404	27,044	243,394	1,352	164	332,287	B x H : 1.0m x 1.0m
Other Facilities	L.S.	111,443	177,494	244,169	364,518	91,283	11,069	1	111,443	177,494	244,169	364,518	91,283	11,069	999,975	
Temporary works	%	10%	10%	10%	10%	10%	10%	1	140,048	232,893	224,152	378,918	208,282	24,578	1,208,871	
Total															14,627,345	
								Say							15,000,000	

Cost Estimation Formura:

$y = 600{,}000 \cdot x + 4{,}000{,}000$

Where,

x : *Area of Sub-division (hectares)*

y : *Construction base Cost of On-site Regulation Pond*

Average Area of New Sub-division Applied : 8 hectares

Hence,

Construction Base Cost of 8hectare-Sub-division

PHP 8,800,000

5 has	7,000,000
20 has	16,000,000
	7
	16

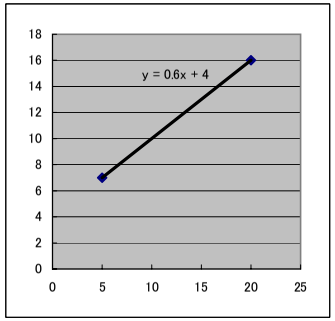


Table Cost Estimate of Compensation Cost for On-Site (for One Sub-division of 8 Hectares)

Item	Unit	Equipment L/C	Equipment F/C	Material L/C	Material F/C	Labor L/C	Labor F/C	Quantity	Equipment L/C	Equipment F/C	Material L/C	Material F/C	Labor L/C	Labor F/C	Total	Remarks
Land to be occupied	m2	0	0	3000	0	0	0	800	0	0	2,400,000	0	0	0	2,400,000	exclusive of Communal Area as park and ground in the Pond

Table 8.7 Cost Estimate of On-site Regulation Pond and the Collateral Cost in the Study Area

Consideration on On-site Retention Facilities

1. Comparative Calculation of the Costs between On-site Regulation Pond and Off-site Retarding Basin/Retention Pond

Average Area of New Sub-division Applied 8 hectares

Hence,

Construction Base Cost of 8hectare-Sub-division

PHP 8,800,000 /1sub-division(8has)

Built-up Area in the Study Area: Existing (2007) 29.49 % of Total Area 120.15 km^2

Future (2020) 42.7 % of Total Area 173.97 km^2

Expected Development Area during 2007-2020

53.82 km^2

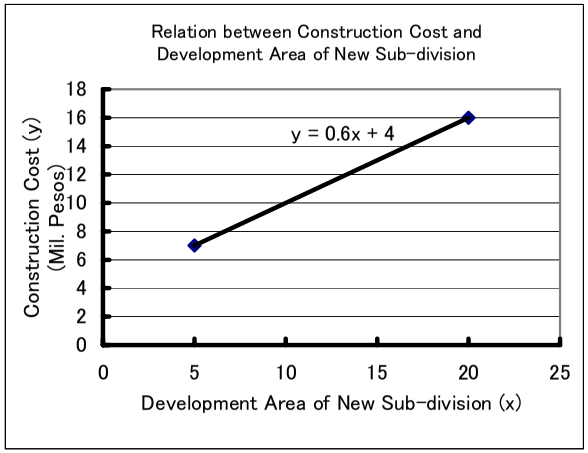
Cost of On-site Regulation Pond: Average Area of a new development Activity

8 hectares

The Cost that Developer should shoulder the burden for preparation of On-site Regulation Pond

53.82(km^2) x 100(ha/km^2) / 8(hectare/area x 8.8mil.P/area

= **5,920** mil.P



4,007 mil.P for Imus and San Juan

Collateral Cost of Off-site Retarding Basin corresponding to Construction of On-site Regulation Pond:

River	Area (km^2)	Existing 2003 %	Existing 2007 %	Future 2020 %	Difference %	Difference Area (has)	Assumed No. of Sub-div.	Collateral Volume for RB (m^3)	Related Retarding Basin / Retention Pond	Additional Cost (Mil.P) Retarding Basin Const.	Retarding Basin Land	Drainage Imp. *1	Total
Imus	115.50	40.7	44.69	67.96	23.27	2,358	295	2,121,940	I-1			200	200
San Juan	88.20	16.57	17.95	26.19	8.24	638	80	573,973	S-1			54	54
Ylang-Ylang	58.56	19.52	21.56	34.16	12.60	647	81	582,470	Y-1 and Y-2			55	55
Canas	112.32	16.60	18.27	32.61	14.34	1,413	177	1,271,672	C-1			120	120
Others	32.84	36.16	36.50	47.82	11.32	326	41	293,453	M-1&2, P-1, K-1, E-1			28	28
Total	407.42	24.6	29.49	42.7	13.21	5,382	674	4,843,816	-	0	0	457	**457**

Note : *1: It is assumed that drainage channel improvement of 200m in length would be required to connect with the rivers or main drainages.
In this connection, the additional costs of wet stone masonry works (700m^2) are added per a sub-division construction as an additional cost.

Table 8.8 Annual Disbursement Schedule for River Overflow Flood (10-year Protection) & Inland Drainage Improvement (2-year Partial Protection) (with On-site)

Cost Item	Amount			2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019	
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
A. Construction Base Cost																											
1. Construction Base Cost (CBC)	2,472	1,552	1,691	-	-	-	-	209	142	433	283	369	227	534	332	420	264	384	240	86	46	37	19	-	-	-	-
1.1 Package 1.1 (Imus R.)(10-year)	*259*	*167*	*425*	-	-	-	-	*73*	*51*	*73*	*51*	*23*	*13*	*90*	*52*	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Package 1.2 (Bacoor R.)(2-year)	*461*	*266*	*727*	-	-	-	-	*113*	*78*	*113*	*78*	*47*	*22*	*70*	*33*	*70*	*33*	*47*	*22*	-	-	-	-	-	-	-	-
1.3 Package 1.3 (Julian)(5-year)	*243*	*147*	*391*	-	-	-	-	-	-	-	-	*61*	*42*	*61*	*42*	-	-	*24*	*13*	*61*	*32*	*37*	*19*	-	-	-	-
1.4 Package 2 (San Juan) (10-year)	*474*	*315*	*790*	-	-	-	-	*23*	*13*	*57*	*32*	*34*	*19*	*108*	*75*	*144*	*100*	*108*	*75*	-	-	-	-	-	-	-	-
1.5 Package 3 (Inland Drainage)	*1,035*	*657*	*1,691*	-	-	-	-	-	-	*191*	*121*	*205*	*130*	*205*	*130*	*205*	*130*	*205*	*130*	*25*	*15*	-	-	-	-	-	-
3. Physical Contingency for CBC	124	78	201	-	-	-	-	10	7	22	14	18	11	27	17	21	13	19	12	4	2	2	1	-	-	-	-
Subtotal (1+2+3)	**2,595**	**1,630**	**1,892**	**0**	**0**	**0**	**0**	**219**	**149**	**455**	**297**	**387**	**238**	**561**	**349**	**441**	**277**	**404**	**252**	**90**	**49**	**39**	**20**	**0**	**0**	**0**	**0**
B. Compensation Cost																											
1.1 Compensation Cost (CC)	0	687	687	-	-	-	119	-	119	-	104	-	104	-	108	-	39	-	52	-	43	-	-	-	-	-	-
1.2 Compensation Cost (CC)	0	354	354	-	-	-	7	-	28	-	142	-	121	-	57	-	-	-	-	-	-	-	-	-	-	-	-
1.3 Compensation Cost (CC)	0	444	444	-	-	-	-	-	44	-	66	-	66	-	88	-	88	-	92	-	-	-	-	-	-	-	-
3. Physical Contingency for CC	0	74	74	-	-	-	6	-	10	-	16	-	15	-	13	-	6	-	7	-	2	-	-	-	-	-	-
Subtotal (1+3)	**0**	**518**	**518**	**0**	**0**	**0**	**6**	**0**	**54**	**0**	**82**	**0**	**81**	**0**	**101**	**0**	**94**	**0**	**99**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
C. Administration Cost Cost																											
1.1 Administration Cost (AC)	0	156	156	-	-	-	8	-	30	-	29	-	22	-	32	-	10	-	11	-	9	-	4	-	-	-	-
1.2 Administration Cost (AC)	0	80	80	-	-	-	0	-	4	-	16	-	12	-	17	-	17	-	13	-	-	-	-	-	-	-	-
1.3 Administration Cost (AC)	0	313	313		-		-		28		55		46		67		54		50		9		4		-		-
Subtotal (1)	**0**	**313**	**313**	**0**	**0**	**0**	**9**	**0**	**62**	**0**	**100**	**0**	**80**	**0**	**116**	**0**	**81**	**0**	**74**	**0**	**19**	**0**	**8**	**0**	**0**	**0**	**0**
D. Engineering Service Cost																											
1.1 Engineering Service Cost (ESC)	154	93	247	-	-	29	17	39	23	14	9	14	9	14	9	14	9	14	9	10	6	5	3	-	-	-	-
1.2 Engineering Service Cost (ESC)	76	50	126	-	-	14	9	19	13	7	5	9	6	9	6	7	5	7	5	2	2	-	-	-	-	-	-
1.3 Engineering Service Cost (ESC)	166	105	271	-	-	31	20	41	26	16	10	16	10	16	10	16	10	16	10	10	7	5	3	-	-	-	-
3. Physical Contingency for ESC	20	12	32	-	-	4	2	5	3	2	1	2	1	2	1	2	1	2	1	1	1	0	0	-	-	-	-
Subtotal (1+3)	**185**	**117**	**303**	**0**	**0**	**78**	**49**	**104**	**65**	**39**	**24**	**41**	**26**	**41**	**26**	**39**	**24**	**39**	**24**	**23**	**15**	**10**	**6**	**0**	**0**	**0**	**0**
Total (A+B+C+D)	**2,781**	**2,578**	**3,026**	**-**	**-**	**78**	**64**	**323**	**330**	**494**	**503**	**429**	**425**	**602**	**591**	**479**	**477**	**443**	**450**	**114**	**84**	**49**	**34**	**-**	**-**	**-**	**-**
E. Value added Tax for Components	0	588	588		-		15		64		98		83		117		94		86		21		9		-		-
Total (A+B+C+D+E)	**2,781**	**3,166**	**3,614**	**0**	**0**	**78**	**79**	**323**	**395**	**494**	**601**	**429**	**508**	**602**	**708**	**479**	**570**	**443**	**536**	**114**	**105**	**49**	**43**	**0**	**0**	**0**	**0**
F. Construction of On-site Reg. Pond																											
1.1 Construction Base Cost (Reg.P.)	1,322	1,082	2,404	0	0	106	87	106	87	132	108	132	108	132	108	132	108	132	108	132	108	106	87	106	87	106	87
1.2 Construction Base Cost (Reg.P.)	705	577	1,282	0	0	56	46	56	46	71	58	71	58	71	58	71	58	71	58	71	58	56	46	56	46	56	46
1.3 Construction Base Cost (Reg.P.)	176	144	321	0	0	14	12	14	12	18	14	18	14	18	14	18	14	18	14	18	14	14	12	14	12	14	12
3. Physical Contingency for Reg.P	126	128	255	-	-	9	8	9	8	12	11	12	12	12	12	13	13	13	13	13	14	11	12	11	12	11	13
Subtotal (1+3)	**303**	**273**	**575**	**0**	**0**	**23**	**20**	**23**	**20**	**30**	**25**	**30**	**26**	**30**	**27**	**30**	**27**	**30**	**28**	**31**	**28**	**25**	**23**	**25**	**24**	**25**	**25**
G. Value added Tax for Components	0	69	69		-		5		5		7		7		7		7		7		7		6		6		6
Grand Total (A+B+C+D+E+F+G)	**3,083**	**3,508**	**4,259**	**0**	**0**	**101**	**104**	**346**	**420**	**523**	**633**	**458**	**540**	**632**	**742**	**510**	**604**	**473**	**571**	**145**	**141**	**74**	**72**	**25**	**30**	**25**	**31**

Notes : *1 It is estimated based on the work quantities.
*2 1.95 % of all costs in foreign currency portion and 5.07 % of all costs in local currency portion
*3 Physical Contingency: 5 % of the sum of construction base cost, compensation cost and engineering service cost

*B Land acquisition and house evacuation cost
*C Project owner's expense for the management of the project, 7 % of the sum of construction cost and compensation cost
*D Cost for the construction supervision and etc. (D/D: 6% of CBC, S/V: 10% of CBC)
*E 12 % of the sum of construction base cost and engineering service cost

- Price Level as of October 31, 2007
- Conversion Rate US$ 1.00 = PhP. 43.95 = JpY. 114.67, JpY 1.00 = PhP. 0.3834

Table 8.9 Annual Disbursement Schedule including Price Contingency for River Overflow Flood (10-year Protection) & Inland Drainage Improvement (2-year Partial Protection) (with On-site)

Cost Item	Amount			2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019	
	F.C.	L.C.	Total	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
A. Construction Base Cost																											
1. Construction Base Cost (CBC)	2,472	1,552	1,691	-	-	-	-	209	142	433	283	369	227	534	332	420	264	384	240	86	46	37	19	-	-	-	-
1.1 Package 1.1 (Imus R.)(10-year)	*259*	*167*	*425*	-	-	-	-	*73*	*51*	*73*	*51*	*23*	*13*	*90*	*52*	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Package 1.2 (Bacoor R.)(2-year)	*461*	*266*	*727*	-	-	-	-	*113*	*78*	*113*	*78*	*47*	*22*	*70*	*33*	*70*	*33*	*47*	*22*	-	-	-	-	-	-	-	-
1.3 Package 1.3 (Julian)(5-year)	*243*	*147*	*391*	-	-	-	-	-	-	-	-	*61*	*42*	*61*	*42*	-	-	*24*	*13*	*61*	*32*	*37*	*19*	-	-	-	-
1.4 Package 2 (San Juan) (10-year)	*474*	*315*	*790*	-	-	-	-	*23*	*13*	*57*	*32*	*34*	*19*	*108*	*75*	*144*	*100*	*108*	*75*	-	-	-	-	-	-	-	-
1.5 Package 3 (Inland Drainage)	*1,035*	*657*	*1,691*	-	-	-	-	-	-	*191*	*121*	*205*	*130*	*205*	*130*	*205*	*130*	*205*	*130*	*25*	*15*	-	-	-	-	-	-
2. Price Escalation for CBC	299	526	826	-	-	-	-	12	23	35	62	37	64	66	115	61	109	64	117	16	26	8	12	-	-	-	-
Subtotal (1+2)	2,771	2,078	2,517	-	-	-	-	221	165	468	344	406	290	600	447	480	373	449	357	102	72	45	31	-	-	-	-
3. Physical Contingency for CBC	139	104	242	-	-	-	-	11	8	23	17	20	15	30	22	24	19	22	18	5	4	2	2	-	-	-	-
Subtotal (1+2+3)	**2,910**	**2,182**	**2,759**	**-**	**-**	**-**	**-**	**232**	**173**	**491**	**362**	**426**	**305**	**630**	**469**	**504**	**391**	**471**	**374**	**108**	**76**	**47**	**33**	**-**	**-**	**-**	**-**
B. Compensation Cost																											
1.1 Compensation Cost (CC)	0	687	687	-	-	-	119	-	119	-	104	-	104	-	108	-	39	-	52	-	43	-	-	-	-	-	-
1.2 Compensation Cost (CC)	0	354	354	-	-	-	7	-	28	-	142	-	121	-	57	-	-	-	-	-	-	-	-	-	-	-	-
1.3 Compensation Cost (CC)	0	444	444	-	-	-	-	-	44	-	66	-	66	-	88	-	88	-	92	-	-	-	-	-	-	-	-
2. Price Escalation for CC	0	427	427	-	-	-	13	-	31	-	68	-	82	-	87	-	53	-	70	-	24	-	-	-	-	-	-
Subtotal (1+2)	0	1,912	1,912	-	-	-	139	-	221	-	380	-	372	-	340	-	180	-	213	-	67	-	-	-	-	-	-
3. Physical Contingency for CC	0	96	96	-	-	-	7	-	11	-	19	-	19	-	17	-	9	-	11	-	3	-	-	-	-	-	-
Subtotal (1+2+3)	**0**	**2,008**	**2,008**	**-**	**-**	**-**	**146**	**-**	**232**	**-**	**399**	**-**	**391**	**-**	**357**	**-**	**189**	**-**	**224**	**-**	**70**	**-**	**-**	**-**	**-**	**-**	**-**
C. Administration Cost Cost																											
1.1 Administration Cost (AC)	0	156	156	-	-	-	8	-	30	-	29	-	22	-	32	-	10	-	11	-	9	-	4	-	-	-	-
1.2 Administration Cost (AC)	0	80	80	-	-	-	0	-	4	-	16	-	12	-	17	-	17	-	13	-	-	-	-	-	-	-	-
1.3 Administration Cost (AC)	0	313	313		-		-		28		55		46		67		54		50		9		4		-		-
2. Price Escalation for AC	0	180	180	-	-	-	1	-	10	-	22	-	23	-	40	-	34	-	36	-	11	-	5	-	-	-	-
Subtotal (1+2)	**0**	**729**	**729**	**-**	**-**	**-**	**10**	**-**	**72**	**-**	**122**	**-**	**103**	**-**	**155**	**-**	**115**	**-**	**110**	**-**	**29**	**-**	**13**	**-**	**-**	**-**	**-**
D. Engineering Service Cost																											
1.1 Engineering Service Cost (ESC)	154	93	247	-	-	29	17	39	23	14	9	14	9	14	9	14	9	14	9	10	6	5	3	-	-	-	-
1.2 Engineering Service Cost (ESC)	76	50	126	-	-	14	9	19	13	7	5	9	6	9	6	7	5	7	5	2	2	-	-	-	-	-	-
1.3 Engineering Service Cost (ESC)	166	105	271	-	-	31	20	41	26	16	10	16	10	16	10	16	10	16	10	10	7	5	3	-	-	-	-
2. Price Escalation for ESC	39	68	107	-	-	3	5	6	10	3	5	4	7	5	9	5	10	6	11	4	8	2	4	-	-	-	-
Subtotal (1+2)	434	316	751	-	-	77	51	105	72	40	28	43	32	44	33	42	33	43	35	27	22	12	10	-	-	-	-
3. Physical Contingency for ESC	22	16	38	-	-	4	3	5	4	2	1	2	2	2	2	2	2	2	2	1	1	1	1	-	-	-	-
Subtotal (1+2+3)	**456**	**332**	**788**	**-**	**-**	**81**	**54**	**110**	**76**	**42**	**30**	**46**	**33**	**47**	**35**	**45**	**35**	**45**	**36**	**28**	**23**	**13**	**11**	**-**	**-**	**-**	**-**
Total (A+B+C+D)	**3,366**	**5,251**	**6,284**	**-**	**-**	**81**	**210**	**342**	**553**	**534**	**912**	**472**	**832**	**676**	**1,016**	**549**	**729**	**517**	**745**	**136**	**198**	**59**	**56**	**-**	**-**	**-**	**-**
E. Value added Tax for Components	0	706	706		-		16		71		111		97		142		117		111		28		12		-		-
Total (A+B+C+D+E)	**3,366**	**5,957**	**6,990**	**-**	**-**	**81**	**226**	**342**	**624**	**534**	**1,023**	**472**	**929**	**676**	**1,158**	**549**	**846**	**517**	**856**	**136**	**226**	**59**	**68**	**-**	**-**	**-**	**-**
F. Construction of On-site Reg. Pond																											
1.1 Construction Base Cost (Reg.P.)	1,322	1,082	2,404	0	0	106	87	106	87	132	108	132	108	132	108	132	108	132	108	132	108	106	87	106	87	106	87
1.2 Construction Base Cost (Reg.P.)	705	577	1,282	0	0	56	46	56	46	71	58	71	58	71	58	71	58	71	58	71	58	56	46	56	46	56	46
1.3 Construction Base Cost (Reg.P.)	176	144	321	0	0	14	12	14	12	18	14	18	14	18	14	18	14	18	14	18	14	14	12	14	12	14	12
2. Price Escalation for CBC	320	767	1,087	0	0	7	15	11	23	18	39	22	51	27	62	32	75	37	88	42	101	38	92	42	104	46	117
Subtotal (1+2)	2,524	2,570	5,094	-	-	183	159	187	167	238	220	243	231	247	243	252	255	257	268	262	281	214	237	218	249	222	261
3. Physical Contingency for Reg.P	126	128	255	-	-	9	8	9	8	12	11	12	12	12	12	13	13	13	13	13	14	11	12	11	12	11	13
Subtotal (1+2+3)	**2,651**	**2,698**	**5,349**	**-**	**-**	**192**	**167**	**196**	**176**	**250**	**231**	**255**	**242**	**260**	**255**	**265**	**268**	**270**	**281**	**275**	**295**	**225**	**248**	**229**	**261**	**233**	**274**
G. Value added Tax for Components	0	642	642		-		43		45		58		60		62		64		66		68		57		59		61
Grand Total (A+B+C+D+E+F+G)	**6,016**	**9,297**	**12,981**	**0**	**0**	**273**	**436**	**538**	**844**	**784**	**1,312**	**727**	**1,231**	**936**	**1,475**	**814**	**1,178**	**787**	**1,203**	**411**	**590**	**284**	**374**	**229**	**320**	**233**	**335**

Notes : *1 It is estimated based on the work quantities.
*2 1.95 % of all costs in foreign currency portion and 5.07 % of all costs in local currency portion
*3 Physical Contingency: 5 % of the sum of construction base cost, compensation cost and engineering service cost

*B Land acquisition and house evacuation cost
*C Project owner's expense for the management of the project, 7 % of the sum of construction cost and compensation cost
*D Cost for the construction supervision and etc. (D/D: 6% of CBC, S/V: 10% of CBC)
*E 12 % of the sum of construction base cost and engineering service cost

- Price Level as of October 31, 2007
- Conversion Rate US$ 1.00 = PhP. 43.95 = JpY. 114.67, JpY 1.00 = PhP. 0.3834

Table 8.10 Estimated Damages to Buildings and Household Effects, Durable Assets and Inventories Caused by 2006-Flood

(million Pesos)

Type of Buildings	Damages to Buildings	Damages to Durable Assets	Damages to H.Effects/ Inv. Stocks	Total
A. Imus River Basin				
1. Residence	951		1,318	2,269
a. Residential Unit	951		1,318	2,269
2. Industrial, Educational and Medical Facilities	1,080	278	610	1,969
a. Manufacturing	4	39	30	73
b. Wholesale & Retail Trade	5	37	283	325
c. Hotels & Restaurants	660	1	98	758
d. Real Estate & Business Activities	151	0	155	307
e. Education	131	97	8	235
f. Health & Social Work	130	103	38	271
Total	2,031	278	1,929	4,238
B. San-Juan - Ylang-Ylang River Basins				
1. Residence	549		775	1,324
a. Residential Unit	549		775	1,324
2. Industrial, Educational and Medical Facilities	624	161	347	1,132
a. Manufacturing	2	23	17	42
b. Wholesale & Retail Trade	3	21	161	185
c. Hotels & Restaurants	381	1	56	437
d. Real Estate & Business Activities	87	0	88	176
e. Education	76	56	4	136
f. Health & Social Work	75	60	21	156
Total	1,174	161	1,122	2,457
C. Canas River Basin				
1. Residence	74		96	170
a. Residential Unit	74		96	170
2. Industrial, Educational and Medical Facilities	84	19	46	149
a. Manufacturing	0	3	2	5
b. Wholesale & Retail Trade	0	3	21	24
c. Hotels & Restaurants	51	0	7	59
d. Real Estate & Business Activities	12	0	12	23
e. Education	10	7	1	17
f. Health & Social Work	10	7	3	20
Total	158	19	142	319
D. Whole the River Basins				
1. Residence	1,574	0	2,189	3,763
a. Residential Unit	1,574	0	2,189	3,763
2. Industrial, Educational and Medical Facilities	1,789	458	1,004	3,250
a. Manufacturing	6	65	49	120
b. Wholesale & Retail Trade	8	61	465	534
c. Hotels & Restaurants	1,092	2	161	1,255
d. Real Estate & Business Activities	251	1	255	506
e. Education	216	159	12	388
f. Health & Social Work	215	170	62	448
Total	3,363	458	3,193	7,013

Table 8.11 Traffic Volume by Type of Vehicles and Estimated 24 Hour-Persons in Cavite Province

Location of Survey Point	Motor-cycle	Tricycle	Jeepney	Minibus	Standard Bus	Taxi/ HOV Taxi	Sedan/ Jeep	Utility Vehicle	Truck/ Trailer	Others	Total	Estimated 24 Hours-Persons
Manila-Cavite Highway: Boundary of Manila and Cavite	242	52	5,770	570	3,866	5,267	18,586	23,068	3,451	113	60,985	395,735
Aguinaldo Highway: Barangai Real, Bacoor	3,309	538	8,243	85	2,168	1,939	10,194	12,160	3,618	543	42,797	217,494
Aguinaldo Highway: Barangai Anabu 2, Imus	1,973	128	8,360	58	2,185	709	7,444	8,818	2,579	155	32,409	182,499
Governor Drive: Barangai San Francisco, General Trias	1,951	771	5,067	115	702	148	5,803	6,842	2,294	244	23,937	113,727
Governor Drive: Barangai Paliparan, Dasmarinas	2,070	3,854	3,454	38	301	289	5,641	9,696	2,986	524	28,853	100,236
Amadeo-General Trias Road: Barangai Tapia, General Trias	738	1,600	172	29	35	15	1,219	2,060	481	134	6,483	16,282
Aguinaldo Highway: Barangai Zapote II, Bacoor	4,531	1,514	10,950	1,768	67	985	3,380	4,122	1,198	2,849	31,364	128,496
Tirona Highway: Barangai Marulas, Kawit	1,492	1,351	942	2,510	344	239	2,605	2,733	284	566	13,066	92,508
Molino Road: Barangai Molino IV, Bacoor	2,501	981	4,506	16	30	1,017	4,663	7,731	1,153	567	23,165	92,764
Daan Hari Road: Barangai Molino IV, Bacoor	1,222	92	70	17	10	316	4,756	6,275	608	415	13,781	27,475
Salawag-Salitran Road: Barangai Jose Abad Santosa, Dasmarinas	982	3,921	220	10	16	136	3,100	4,306	578	222	13,491	27,110
Don P Campos Avenue: Dasmarinas (Provincial Road)	1,080	5,560	1,850	7	797	82	2,153	2,357	226	386	14,498	52,729
Tanza-Trece Martires Road-Indang Road: Barangai Sanja Mayor, Tanza	2,881	4,736	1,632	41	16	61	1,640	2,209	523	493	14,232	43,907
Noveleta-Tanza-Naic Road: Barangai Capipisa, Tanza	1,271	658	407	1,668	172	127	866	1,470	409	41	7,089	41,197
Governor Drive: Barangai Cabuco, Trece Martires	369	490	200	2	9	15	627	939	327	38	3,016	11,111
Aguinaldo Highway: Barangai Biga II, Silang	821	192	2,771	23	733	82	3,593	5,173	978	166	14,532	92,998
Carmona National Road: Barangai Madoya, Carmona	1,903	1,163	4,617	34	810	140	3,061	4,227	1,398	692	18,045	108,610
Manila South Road: Barangai Tunasan, Muntinlupa	3,956	1,531	7,148	38	1,318	570	3,703	5,448	1,376	1,294	26,382	187,732
Sta Rosa-Tagaytay Road: Barangai Sto Domingo, Sta Rosa	842	348	587	33	141	64	2,503	4,186	795	66	9,565	43,436
Total	34,134	29,480	66,966	7,062	13,720	12,201	85,537	113,820	25,262	9,508	397,690	1,976,046

Source: CALA Report.

Table 8.12(1/6) Total Damages in Imus River in Case of Works for 5-Year Flood Damage Mitigation under Present Land Use Status

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	1,046	66	1	1,113	114	68	182	1,296
5-year	1,945	128	1	2,074	208	127	335	2,408
10-year	2,698	156	2	2,856	284	174	458	3,314
20-year	3,128	190	2	3,319	327	203	530	3,849
30-year	3,305	216	2	3,523	345	215	560	4,083
50-year	3,521	262	2	3,785	367	231	598	4,383
100-year	3,845	263	3	4,111	400	251	651	4,762
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	33	0	0	33	4	2	6	39
10-year	219	0	0	220	25	13	38	258
20-year	484	0	1	486	54	30	83	569
30-year	828	68	1	897	91	55	145	1,043
50-year	1,371	83	1	1,455	149	89	238	1,693
100-year	1,957	100	2	2,058	209	126	335	2,393

Table 8.12(2/6) Total Damages in Imus River in Case of Works for 10-Year Flood Damage Mitigation under Present Land Use Status

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	1,046	66	1	1,113	114	68	182	1,296
5-year	1,945	128	1	2,074	208	127	335	2,408
10-year	2,698	156	2	2,856	284	174	458	3,314
20-year	3,128	190	2	3,319	327	203	530	3,849
30-year	3,305	216	2	3,523	345	215	560	4,083
50-year	3,521	262	2	3,785	367	231	598	4,383
100-year	3,845	263	3	4,111	400	251	651	4,762
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	33	0	0	33	4	2	6	39
10-year	218	0	0	218	24	13	38	256
20-year	441	0	1	442	49	27	76	518
30-year	776	54	1	831	85	51	136	967
50-year	1,355	83	1	1,439	147	88	235	1,674
100-year	1,951	100	2	2,053	208	125	334	2,386

Table 8.12(3/6) Total Damages in Imus River in Case of Works for 20-Year Flood Damage Mitigation under Present Land Use Status

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	1,046	66	1	1,113	114	68	182	1,296
5-year	1,945	128	1	2,074	208	127	335	2,408
10-year	2,698	156	2	2,856	284	174	458	3,314
20-year	3,128	190	2	3,319	327	203	530	3,849
30-year	3,305	216	2	3,523	345	215	560	4,083
50-year	3,521	262	2	3,785	367	231	598	4,383
100-year	3,845	263	3	4,111	400	251	651	4,762
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	33	0	0	33	4	2	6	39
10-year	218	0	0	218	24	13	38	256
20-year	441	0	1	442	49	27	76	518
30-year	776	54	1	831	85	51	136	967
50-year	1,355	83	1	1,439	147	88	235	1,674
100-year	1,951	100	2	2,053	208	125	334	2,386

Table 8.12(4/6) Total Damages in Imus River in Case of Works for 5-Year Flood Damage Mitigation under Future Land Use Status

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	3,125	469	1	3,594	339	219	558	4,153
5-year	5,245	904	1	6,150	556	375	931	7,081
10-year	6,101	1,124	1	7,225	642	441	1,082	8,308
20-year	6,906	1,316	1	8,223	725	502	1,226	9,450
30-year	7,252	1,393	1	8,645	759	527	1,287	9,932
50-year	7,601	1,486	1	9,088	795	554	1,349	10,437
100-year	8,140	1,642	1	9,783	850	597	1,446	11,230
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	135	18	0	153	15	9	25	178
10-year	540	48	0	588	60	36	96	684
20-year	1,231	209	1	1,440	136	88	224	1,664
30-year	3,043	659	1	3,703	331	226	556	4,260
50-year	4,220	948	1	5,169	453	315	768	5,937
100-year	5,375	1,129	1	6,505	569	397	966	7,471

Table 8.12(5/6) Total Damages in Imus River in Case of Works for 10-Year Flood Damage Mitigation under Future Land Use Status

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	3,125	469	1	3,594	339	219	558	4,153
5-year	5,245	904	1	6,150	556	375	931	7,081
10-year	6,101	1,124	1	7,225	642	441	1,082	8,308
20-year	6,906	1,316	1	8,223	725	502	1,226	9,450
30-year	7,252	1,393	1	8,645	759	527	1,287	9,932
50-year	7,601	1,486	1	9,088	795	554	1,349	10,437
100-year	8,140	1,642	1	9,783	850	597	1,446	11,230
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	135	18	0	153	15	9	25	178
10-year	540	48	0	588	60	36	96	684
20-year	1,231	209	1	1,440	136	88	224	1,664
30-year	3,043	659	1	3,703	331	226	556	4,260
50-year	4,220	948	1	5,169	453	315	768	5,937
100-year	5,375	1,129	1	6,505	569	397	966	7,471

Table 8.12(6/6) Total Damages in Imus River in Case of Works for 20-Year Flood Damage Mitigation under Future Land Use Status

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	3,125	469	1	3,594	339	219	558	4,153
5-year	5,245	904	1	6,150	556	375	931	7,081
10-year	6,101	1,124	1	7,225	642	441	1,082	8,308
20-year	6,906	1,316	1	8,223	725	502	1,226	9,450
30-year	7,252	1,393	1	8,645	759	527	1,287	9,932
50-year	7,601	1,486	1	9,088	795	554	1,349	10,437
100-year	8,140	1,642	1	9,783	850	597	1,446	11,230
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	135	18	0	153	15	9	25	178
10-year	540	48	0	588	60	36	96	684
20-year	1,231	209	1	1,440	136	88	224	1,664
30-year	3,043	659	1	3,703	331	226	556	4,260
50-year	4,220	948	1	5,169	453	315	768	5,937
100-year	5,375	1,129	1	6,505	569	397	966	7,471

Table 8.13(1/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Imus River in Case of Works for 5-Year Flood Damage Mitigation under Present Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	1,296	648	324	324
5-year	0.2000	0.3000	2,408	1,852	556	880
10-year	0.1000	0.1000	3,314	2,861	286	1,166
20-year	0.0500	0.0500	3,849	3,582	179	1,345
30-year	0.0333	0.0167	4,083	3,966	66	1,411
50-year	0.0200	0.0133	4,383	4,233	56	1,467
100-year	0.0100	0.0100	4,762	4,573	46	1,513

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	324
5-year	0.2000	0.3000	39	19	6	6	874
10-year	0.1000	0.1000	258	148	15	21	1,145
20-year	0.0500	0.0500	569	413	21	41	1,304
30-year	0.0333	0.0167	1,043	806	13	55	1,356
50-year	0.0200	0.0133	1,693	1,368	18	73	1,394
100-year	0.0100	0.0100	2,393	2,043	20	93	1,420

(= A - B)

Table 8.13(2/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Imus River in Case of Works for 10-Year Flood Damage Mitigation under Present Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	1,296	648	324	324
5-year	0.2000	0.3000	2,408	1,852	556	880
10-year	0.1000	0.1000	3,314	2,861	286	1,166
20-year	0.0500	0.0500	3,849	3,582	179	1,345
30-year	0.0333	0.0167	4,083	3,966	66	1,411
50-year	0.0200	0.0133	4,383	4,233	56	1,467
100-year	0.0100	0.0100	4,762	4,573	46	1,513

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	324
5-year	0.2000	0.3000	39	19	6	6	874
10-year	0.1000	0.1000	256	147	15	21	1,145
20-year	0.0500	0.0500	518	387	19	40	1,305
30-year	0.0333	0.0167	967	742	12	52	1,359
50-year	0.0200	0.0133	1,674	1,320	18	70	1,398
100-year	0.0100	0.0100	2,386	2,030	20	90	1,423

(= A - B)

Table 8.13(3/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Imus River in Case of Works for 20-Year Flood Damage Mitigation under Present Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	1,296	648	324	324
5-year	0.2000	0.3000	2,408	1,852	556	880
10-year	0.1000	0.1000	3,314	2,861	286	1,166
20-year	0.0500	0.0500	3,849	3,582	179	1,345
30-year	0.0333	0.0167	4,083	3,966	66	1,411
50-year	0.0200	0.0133	4,383	4,233	56	1,467
100-year	0.0100	0.0100	4,762	4,573	46	1,513

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	324
5-year	0.2000	0.3000	39	19	6	6	874
10-year	0.1000	0.1000	256	147	15	21	1,145
20-year	0.0500	0.0500	518	387	19	40	1,305
30-year	0.0333	0.0167	967	742	12	52	1,359
50-year	0.0200	0.0133	1,674	1,320	18	70	1,398
100-year	0.0100	0.0100	2,386	2,030	20	90	1,423

(= A - B)

Table 8.13(4/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Imus River in Case of Works for 5-Year Flood Damage Mitigation under Future Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	4,153	2,076	1,038	1,038
5-year	0.2000	0.3000	7,081	5,617	1,685	2,723
10-year	0.1000	0.1000	8,308	7,695	769	3,493
20-year	0.0500	0.0500	9,450	8,879	444	3,937
30-year	0.0333	0.0167	9,932	9,691	162	4,098
50-year	0.0200	0.0133	10,437	10,185	136	4,234
100-year	0.0100	0.0100	11,230	10,834	108	4,342

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	1,038
5-year	0.2000	0.3000	178	89	27	27	2,696
10-year	0.1000	0.1000	684	431	43	70	3,423
20-year	0.0500	0.0500	1,664	1,174	59	129	3,808
30-year	0.0333	0.0167	4,260	2,962	49	178	3,920
50-year	0.0200	0.0133	5,937	5,098	68	246	3,988
100-year	0.0100	0.0100	7,471	6,704	67	313	4,029

(= A - B)

Table 8.13(5/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Imus River in Case of Works for 10-Year Flood Damage Mitigation under Future Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	4,153	2,076	1,038	1,038
5-year	0.2000	0.3000	7,081	5,617	1,685	2,723
10-year	0.1000	0.1000	8,308	7,695	769	3,493
20-year	0.0500	0.0500	9,450	8,879	444	3,937
30-year	0.0333	0.0167	9,932	9,691	162	4,098
50-year	0.0200	0.0133	10,437	10,185	136	4,234
100-year	0.0100	0.0100	11,230	10,834	108	4,342

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	1,038
5-year	0.2000	0.3000	178	89	27	27	2,696
10-year	0.1000	0.1000	684	431	43	70	3,423
20-year	0.0500	0.0500	1,664	1,174	59	129	3,808
30-year	0.0333	0.0167	4,260	2,962	49	178	3,920
50-year	0.0200	0.0133	5,937	5,098	68	246	3,988
100-year	0.0100	0.0100	7,471	6,704	67	313	4,029

(= A - B)

Table 8.13(6/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Imus River in Case of Works for 20-Year Flood Damage Mitigation under Future Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	4,153	2,076	1,038	1,038
5-year	0.2000	0.3000	7,081	5,617	1,685	2,723
10-year	0.1000	0.1000	8,308	7,695	769	3,493
20-year	0.0500	0.0500	9,450	8,879	444	3,937
30-year	0.0333	0.0167	9,932	9,691	162	4,098
50-year	0.0200	0.0133	10,437	10,185	136	4,234
100-year	0.0100	0.0100	11,230	10,834	108	4,342

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	1,038
5-year	0.2000	0.3000	178	89	27	27	2,696
10-year	0.1000	0.1000	684	431	43	70	3,423
20-year	0.0500	0.0500	1,664	1,174	59	129	3,808
30-year	0.0333	0.0167	4,260	2,962	49	178	3,920
50-year	0.0200	0.0133	5,937	5,098	68	246	3,988
100-year	0.0100	0.0100	7,471	6,704	67	313	4,029

(= A - B)

Table 8.14(1/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Present Land Use Status – Diversion Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
						6.10%		
2-year	13	0	0	13	1	1	2	15
5-year	479	39	0	518	52	32	84	602
10-year	763	73	1	837	83	51	134	971
20-year	1,093	240	2	1,335	118	81	199	1,535
30-year	1,203	240	2	1,445	129	88	217	1,663
50-year	1,441	415	3	1,859	155	113	268	2,127
100-year	1,633	693	3	2,329	174	142	316	2,645
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	64	31	1	96	7	6	13	109
20-year	259	56	2	317	28	19	47	364
30-year	305	153	2	460	33	28	61	521
50-year	460	224	3	687	49	42	91	778
100-year	606	398	3	1,007	64	61	125	1,132

Table 8.14(2/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Present Land Use Status – Retarding Basin Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
						6.10%		
2-year	13	0	0	13	1	1	2	15
5-year	479	39	0	518	52	32	84	602
10-year	763	73	1	837	83	51	134	971
20-year	1,093	240	2	1,335	118	81	199	1,535
30-year	1,203	240	2	1,445	129	88	217	1,663
50-year	1,441	415	3	1,859	155	113	268	2,127
100-year	1,633	693	3	2,329	174	142	316	2,645
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	13	0	0	13	1	1	2	15
20-year	262	18	0	281	29	17	46	327
30-year	385	25	0	410	42	25	67	477
50-year	522	40	0	562	57	34	92	654
100-year	629	42	1	671	69	41	110	781

Table 8.14(3/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Present Land Use Status – Diversion Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
						6.10%		
2-year	13	0	0	13	1	1	2	15
5-year	479	39	0	518	52	32	84	602
10-year	763	73	1	837	83	51	134	971
20-year	1,093	240	2	1,335	118	81	199	1,535
30-year	1,203	240	2	1,445	129	88	217	1,663
50-year	1,441	415	3	1,859	155	113	268	2,127
100-year	1,633	693	3	2,329	174	142	316	2,645
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	178	33	2	213	19	13	32	244
30-year	241	34	2	277	25	17	42	319
50-year	361	120	2	484	38	30	68	552
100-year	460	224	3	687	49	42	91	778

Table 8.14(4/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Present Land Use Status – Retarding Basin Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension	Total	
						6.10%		
2-year	13	0	0	13	1	1	2	15
5-year	479	39	0	518	52	32	84	602
10-year	763	73	1	837	83	51	134	971
20-year	1,093	240	2	1,335	118	81	199	1,535
30-year	1,203	240	2	1,445	129	88	217	1,663
50-year	1,441	415	3	1,859	155	113	268	2,127
100-year	1,633	693	3	2,329	174	142	316	2,645
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	174	3	0	177	19	11	30	207
30-year	288	25	0	313	32	19	51	364
50-year	423	40	0	463	46	28	74	537
100-year	528	42	0	570	58	35	93	663

Table 8.14(5/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Present Land Use Status – Diversion Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	13	0	0	13	1	1	2	15
5-year	479	39	0	518	52	32	84	602
10-year	763	73	1	837	83	51	134	971
20-year	1,093	240	2	1,335	118	81	199	1,535
30-year	1,203	240	2	1,445	129	88	217	1,663
50-year	1,441	415	3	1,859	155	113	268	2,127
100-year	1,633	693	3	2,329	174	142	316	2,645
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	0	0	0	0	0	0	0	0
30-year	241	34	2	277	25	17	42	319
50-year	361	120	2	484	38	30	68	552
100-year	460	224	3	687	49	42	91	778

Table 8.14(6/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Present Land Use Status – Retarding Basin Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	13	0	0	13	1	1	2	15
5-year	479	39	0	518	52	32	84	602
10-year	763	73	1	837	83	51	134	971
20-year	1,093	240	2	1,335	118	81	199	1,535
30-year	1,203	240	2	1,445	129	88	217	1,663
50-year	1,441	415	3	1,859	155	113	268	2,127
100-year	1,633	693	3	2,329	174	142	316	2,645
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	0	0	0	0	0	0	0	0
30-year	288	25	0	313	32	19	51	364
50-year	423	40	0	463	46	28	74	537
100-year	528	42	0	570	58	35	93	663

Table 8.15(1/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Present Land Use Status – Diversion Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	15	8	4	4
5-year	0.2000	0.3000	602	308	93	96
10-year	0.1000	0.1000	971	786	79	175
20-year	0.0500	0.0500	1,535	1,253	63	238
30-year	0.0333	0.0167	1,663	1,599	27	264
50-year	0.0200	0.0133	2,127	1,895	25	290
100-year	0.0100	0.0100	2,645	2,386	24	313

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	4
5-year	0.2000	0.3000	0	0	0	0	96
10-year	0.1000	0.1000	109	54	5	5	170
20-year	0.0500	0.0500	364	236	12	17	220
30-year	0.0333	0.0167	521	442	7	25	240
50-year	0.0200	0.0133	778	650	9	33	256
100-year	0.0100	0.0100	1,132	955	10	43	271

(= A - B)

Table 8.15(2/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Present Land Use Status – Retarding Basin Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	15	8	4	4
5-year	0.2000	0.3000	602	308	93	96
10-year	0.1000	0.1000	971	786	79	175
20-year	0.0500	0.0500	1,535	1,253	63	238
30-year	0.0333	0.0167	1,663	1,599	27	264
50-year	0.0200	0.0133	2,127	1,895	25	290
100-year	0.0100	0.0100	2,645	2,386	24	313

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	4
5-year	0.2000	0.3000	0	0	0	0	96
10-year	0.1000	0.1000	15	8	1	1	174
20-year	0.0500	0.0500	327	171	9	9	228
30-year	0.0333	0.0167	477	402	7	16	248
50-year	0.0200	0.0133	654	566	8	24	266
100-year	0.0100	0.0100	781	718	7	31	283

(= A - B)

Table 8.15(3/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Present Land Use Status – Diversion Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	15	8	4	4
5-year	0.2000	0.3000	602	308	93	96
10-year	0.1000	0.1000	971	786	79	175
20-year	0.0500	0.0500	1,535	1,253	63	238
30-year	0.0333	0.0167	1,663	1,599	27	264
50-year	0.0200	0.0133	2,127	1,895	25	290
100-year	0.0100	0.0100	2,645	2,386	24	313

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	4
5-year	0.2000	0.3000	0	0	0	0	96
10-year	0.1000	0.1000	0	0	0	0	175
20-year	0.0500	0.0500	244	122	6	6	232
30-year	0.0333	0.0167	319	282	5	11	254
50-year	0.0200	0.0133	552	435	6	17	273
100-year	0.0100	0.0100	778	665	7	23	290

(= A - B)

Table 8.15(4/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Present Land Use Status – Retarding Basin Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	15	8	4	4
5-year	0.2000	0.3000	602	308	93	96
10-year	0.1000	0.1000	971	786	79	175
20-year	0.0500	0.0500	1,535	1,253	63	238
30-year	0.0333	0.0167	1,663	1,599	27	264
50-year	0.0200	0.0133	2,127	1,895	25	290
100-year	0.0100	0.0100	2,645	2,386	24	313

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	4
5-year	0.2000	0.3000	0	0	0	0	96
10-year	0.1000	0.1000	0	0	0	0	175
20-year	0.0500	0.0500	207	104	5	5	232
30-year	0.0333	0.0167	364	286	5	10	254
50-year	0.0200	0.0133	537	451	6	16	274
100-year	0.0100	0.0100	663	600	6	22	291

(= A - B)

Table 8.15(5/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Present Land Use Status – Diversion Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	15	8	4	4
5-year	0.2000	0.3000	602	308	93	96
10-year	0.1000	0.1000	971	786	79	175
20-year	0.0500	0.0500	1,535	1,253	63	238
30-year	0.0333	0.0167	1,663	1,599	27	264
50-year	0.0200	0.0133	2,127	1,895	25	290
100-year	0.0100	0.0100	2,645	2,386	24	313

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	4
5-year	0.2000	0.3000	0	0	0	0	96
10-year	0.1000	0.1000	0	0	0	0	175
20-year	0.0500	0.0500	0	0	0	0	238
30-year	0.0333	0.0167	319	160	3	3	262
50-year	0.0200	0.0133	552	435	6	8	281
100-year	0.0100	0.0100	778	665	7	15	298

(= A - B)

Table 8.15(6/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Present Land Use Status – Retarding Basin Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	15	8	4	4
5-year	0.2000	0.3000	602	308	93	96
10-year	0.1000	0.1000	971	786	79	175
20-year	0.0500	0.0500	1,535	1,253	63	238
30-year	0.0333	0.0167	1,663	1,599	27	264
50-year	0.0200	0.0133	2,127	1,895	25	290
100-year	0.0100	0.0100	2,645	2,386	24	313

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	4
5-year	0.2000	0.3000	0	0	0	0	96
10-year	0.1000	0.1000	0	0	0	0	175
20-year	0.0500	0.0500	0	0	0	0	238
30-year	0.0333	0.0167	364	182	3	3	261
50-year	0.0200	0.0133	537	451	6	9	281
100-year	0.0100	0.0100	663	600	6	15	298

(= A - B)

Table 8.16(1/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Future Land Use Status – Diversion Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	150	11	0	161	16	10	26	187
5-year	745	121	0	866	82	53	134	1,000
10-year	1,255	301	1	1,557	137	95	232	1,789
20-year	1,847	603	2	2,453	199	150	348	2,801
30-year	2,059	710	2	2,771	221	169	390	3,161
50-year	2,378	927	3	3,308	254	202	456	3,764
100-year	2,803	1,288	4	4,095	296	250	546	4,641
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	163	64	1	228	18	14	32	260
20-year	646	205	2	852	69	52	121	974
30-year	802	374	2	1,179	86	72	158	1,336
50-year	1,105	488	3	1,596	117	97	214	1,810
100-year	1,436	710	3	2,149	149	131	280	2,429

Table 8.16(2/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Future Land Use Status – Retarding Basin Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	150	11	0	161	16	10	26	187
5-year	745	121	0	866	82	53	134	1,000
10-year	1,255	301	1	1,557	137	95	232	1,789
20-year	1,847	603	2	2,453	199	150	348	2,801
30-year	2,059	710	2	2,771	221	169	390	3,161
50-year	2,378	927	3	3,308	254	202	456	3,764
100-year	2,803	1,288	4	4,095	296	250	546	4,641
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	16	7	0	24	2	1	3	27
20-year	342	53	0	395	38	24	62	458
30-year	508	83	0	591	56	36	92	684
50-year	689	131	0	820	76	50	126	946
100-year	835	202	1	1,038	91	63	155	1,192

Table 8.16(3/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Future Land Use Status – Diversion Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	150	11	0	161	16	10	26	187
5-year	745	121	0	866	82	53	134	1,000
10-year	1,255	301	1	1,557	137	95	232	1,789
20-year	1,847	603	2	2,453	199	150	348	2,801
30-year	2,059	710	2	2,771	221	169	390	3,161
50-year	2,378	927	3	3,308	254	202	456	3,764
100-year	2,803	1,288	4	4,095	296	250	546	4,641
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	462	147	2	611	48	37	85	696
30-year	648	209	2	859	68	52	120	979
50-year	924	361	2	1,288	97	79	175	1,463
100-year	1,151	497	3	1,651	121	101	222	1,873

Table 8.16(4/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Future Land Use Status – Retarding Basin Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	150	11	0	161	16	10	26	187
5-year	745	121	0	866	82	53	134	1,000
10-year	1,255	301	1	1,557	137	95	232	1,789
20-year	1,847	603	2	2,453	199	150	348	2,801
30-year	2,059	710	2	2,771	221	169	390	3,161
50-year	2,378	927	3	3,308	254	202	456	3,764
100-year	2,803	1,288	4	4,095	296	250	546	4,641
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	279	48	0	328	31	20	51	379
30-year	464	107	0	571	51	35	86	656
50-year	613	142	0	756	67	46	113	869
100-year	815	195	1	1,011	89	62	151	1,162

Table 8.16(5/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Future Land Use Status – Diversion Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	150	11	0	161	16	10	26	187
5-year	745	121	0	866	82	53	134	1,000
10-year	1,255	301	1	1,557	137	95	232	1,789
20-year	1,847	603	2	2,453	199	150	348	2,801
30-year	2,059	710	2	2,771	221	169	390	3,161
50-year	2,378	927	3	3,308	254	202	456	3,764
100-year	2,803	1,288	4	4,095	296	250	546	4,641
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	0	0	0	0	0	0	0	0
30-year	648	209	2	859	68	52	120	979
50-year	924	361	2	1,288	97	79	175	1,463
100-year	1,151	497	3	1,651	121	101	222	1,873

Table 8.16(6/6) Total Damages in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Future Land Use Status – Retarding Basin Plan

Without Project (million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
2-year	150	11	0	161	16	10	26	187
5-year	745	121	0	866	82	53	134	1,000
10-year	1,255	301	1	1,557	137	95	232	1,789
20-year	1,847	603	2	2,453	199	150	348	2,801
30-year	2,059	710	2	2,771	221	169	390	3,161
50-year	2,378	927	3	3,308	254	202	456	3,764
100-year	2,803	1,288	4	4,095	296	250	546	4,641
With Project								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	0	0	0	0	0	0	0	0
30-year	464	107	0	571	51	35	86	656
50-year	613	142	0	756	67	46	113	869
100-year	815	195	1	1,011	89	62	151	1,162

Table 8.17(1/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Future Land Use Status – Diversion Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	187	94	47	47
5-year	0.2000	0.3000	1,000	594	178	225
10-year	0.1000	0.1000	1,789	1,395	139	364
20-year	0.0500	0.0500	2,801	2,295	115	479
30-year	0.0333	0.0167	3,161	2,981	50	529
50-year	0.0200	0.0133	3,764	3,462	46	575
100-year	0.0100	0.0100	4,641	4,203	42	617

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	47
5-year	0.2000	0.3000	0	0	0	0	225
10-year	0.1000	0.1000	260	130	13	13	351
20-year	0.0500	0.0500	974	617	31	44	435
30-year	0.0333	0.0167	1,336	1,155	19	63	466
50-year	0.0200	0.0133	1,810	1,573	21	84	491
100-year	0.0100	0.0100	2,429	2,120	21	105	512

(= A - B)

Table 8.17(2/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 5-Year Flood Damage Mitigation under Future Land Use Status – Retarding Basin Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	187	94	47	47
5-year	0.2000	0.3000	1,000	594	178	225
10-year	0.1000	0.1000	1,789	1,395	139	364
20-year	0.0500	0.0500	2,801	2,295	115	479
30-year	0.0333	0.0167	3,161	2,981	50	529
50-year	0.0200	0.0133	3,764	3,462	46	575
100-year	0.0100	0.0100	4,641	4,203	42	617

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	47
5-year	0.2000	0.3000	0	0	0	0	225
10-year	0.1000	0.1000	27	13	1	1	363
20-year	0.0500	0.0500	458	242	12	13	466
30-year	0.0333	0.0167	684	571	10	23	506
50-year	0.0200	0.0133	946	815	11	34	541
100-year	0.0100	0.0100	1,192	1,069	11	45	572

(= A - B)

Table 8.17(3/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Future Land Use Status – Diversion Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	187	94	47	47
5-year	0.2000	0.3000	1,000	594	178	225
10-year	0.1000	0.1000	1,789	1,395	139	364
20-year	0.0500	0.0500	2,801	2,295	115	479
30-year	0.0333	0.0167	3,161	2,981	50	529
50-year	0.0200	0.0133	3,764	3,462	46	575
100-year	0.0100	0.0100	4,641	4,203	42	617

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	47
5-year	0.2000	0.3000	0	0	0	0	225
10-year	0.1000	0.1000	0	0	0	0	364
20-year	0.0500	0.0500	696	348	17	17	462
30-year	0.0333	0.0167	979	838	14	31	497
50-year	0.0200	0.0133	1,463	1,221	16	48	527
100-year	0.0100	0.0100	1,873	1,668	17	64	553

(= A - B)

Table 8.17(4/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 10-Year Flood Damage Mitigation under Future Land Use Status – Retarding Basin Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	187	94	47	47
5-year	0.2000	0.3000	1,000	594	178	225
10-year	0.1000	0.1000	1,789	1,395	139	364
20-year	0.0500	0.0500	2,801	2,295	115	479
30-year	0.0333	0.0167	3,161	2,981	50	529
50-year	0.0200	0.0133	3,764	3,462	46	575
100-year	0.0100	0.0100	4,641	4,203	42	617

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	47
5-year	0.2000	0.3000	0	0	0	0	225
10-year	0.1000	0.1000	0	0	0	0	364
20-year	0.0500	0.0500	379	189	9	9	470
30-year	0.0333	0.0167	656	518	9	18	511
50-year	0.0200	0.0133	869	763	10	28	547
100-year	0.0100	0.0100	1,162	1,015	10	38	579

(= A - B)

Table 8.17(5/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Future Land Use Status – Diversion Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	187	94	47	47
5-year	0.2000	0.3000	1,000	594	178	225
10-year	0.1000	0.1000	1,789	1,395	139	364
20-year	0.0500	0.0500	2,801	2,295	115	479
30-year	0.0333	0.0167	3,161	2,981	50	529
50-year	0.0200	0.0133	3,764	3,462	46	575
100-year	0.0100	0.0100	4,641	4,203	42	617

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	47
5-year	0.2000	0.3000	0	0	0	0	225
10-year	0.1000	0.1000	0	0	0	0	364
20-year	0.0500	0.0500	0	0	0	0	479
30-year	0.0333	0.0167	979	489	8	8	521
50-year	0.0200	0.0133	1,463	1,221	16	24	551
100-year	0.0100	0.0100	1,873	1,668	17	41	576

(= A - B)

Table 8.17(6/6) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in San-Juan and Ylang-Ylang Rivers in Case of Works for 20-Year Flood Damage Mitigation under Future Land Use Status – Retarding Basin Plan

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	187	94	47	47
5-year	0.2000	0.3000	1,000	594	178	225
10-year	0.1000	0.1000	1,789	1,395	139	364
20-year	0.0500	0.0500	2,801	2,295	115	479
30-year	0.0333	0.0167	3,161	2,981	50	529
50-year	0.0200	0.0133	3,764	3,462	46	575
100-year	0.0100	0.0100	4,641	4,203	42	617

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	47
5-year	0.2000	0.3000	0	0	0	0	225
10-year	0.1000	0.1000	0	0	0	0	364
20-year	0.0500	0.0500	0	0	0	0	479
30-year	0.0333	0.0167	656	328	5	5	523
50-year	0.0200	0.0133	869	763	10	16	559
100-year	0.0100	0.0100	1,162	1,015	10	26	591

(= A - B)

Table 8.18(1/4) Total Damages in Full Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Present Land Use Status

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
Without Project								
2-year	723	34	1	757	79	46	126	883
With Project								
2-year	0	0	0	0	0	0	0	0

Table 8.18(2/4) Total Damages in Full Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Future Land Use Status

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
Without Project								
2-year	723	34	1	757	79	46	126	883
With Project								
2-year	259	18	0	277	29	17	46	323

Table 8.18(3/4) Total Damages in Partial Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Present Land Use Status

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
Without Project								
2-year	1,265	176	1	1,442	139	88	227	1,668
With Project								
2-year	0	0	0	0	0	0	0	0

Table 8.18(4/4) Total Damages in Partial Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Future Land Use Status

(million Pesos)

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
Without Project								
2-year	1,265	176	1	1,442	139	88	227	1,668
With Project								
2-year	396	150	0	547	44	33	77	624

Table 8.19(1/4) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Full Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Present Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	883	441	221	221

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	221

(= A - B)

Table 8.19(2/4) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Full Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Present Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	883	441	221	221

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	323	161	81	81	140

(= A - B)

Table 8.19(3/4) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Partial Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Present Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	1,668	834	417	417

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	417

(= A - B)

Table 8.19(4/4) Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Partial Scale Case of Inland Drainage Improvement Works in Case of Works for 2-Year Flood Damage Mitigation under Future Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	1,668	834	417	417

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	624	312	156	156	261

(= A - B)

Table 8.20 Total Damages in Case of On-Site Flood Regulation Pond

Without Project

Return Period	Direct Damages				Indirect Damages			Damages in Grand Total
	Damages to Buildings together with HH Effects, Durable Assets and Inventory Goods	Damages to Industrial Estate	Damages to Agricultural Crops	Total	Income Losses Due to Cleaning of Buildings and of Business Suspension	Other Indirect Damages excl. Income Losses and Business Suspension 6.10%	Total	
Without On-Site Flood Regulation Pond								
2-year	807	197	0	1,005	86	61	147	1,152
5-year	1,183	380	0	1,563	125	95	220	1,783
10-year	1,033	385	0	1,418	107	87	193	1,611
20-year	743	281	0	1,025	78	63	140	1,166
With On-Site Flood Regulation Pond								
2-year	0	0	0	0	0	0	0	0
5-year	0	0	0	0	0	0	0	0
10-year	0	0	0	0	0	0	0	0
20-year	0	0	0	0	0	0	0	0

Table 8.21 Annual Average Damages and Annual Average Expected Damages to Be Mitigated in Case of On-Site Flood Regulation Pond

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumulated Amount of Probable Damages
2-year	0.5000	0.5000	1,152	576	288	288
5-year	0.2000	0.3000	1,783	1,468	440	728
10-year	0.1000	0.1000	1,611	1,697	170	898
20-year	0.0500	0.0500	1,166	1,389	69	967

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumulated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	0	0	0	0	288
5-year	0.2000	0.3000	0	0	0	0	728
10-year	0.1000	0.1000	0	0	0	0	898
20-year	0.0500	0.0500	0	0	0	0	967

(= A - B)

Table 8.22(1/3) Summary of Project Cost Disbursement in Financial Terms and Economic Terms for Imus River Channel Improvement

A.1.1 Imus River with On-Site Works on Measure for 5-Year Flood (million Pesos)

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	5,646	0	407	808	811	686	867	486	504	469	309	231	232	0
Economic Cost	4,307	0	278	605	605	504	651	364	374	348	236	172	172	0

A.1.2 Imus River without On-Site Works on Measure for 5-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	3,341	0	205	656	587	457	639	236	254	207	99	0	0	0
Economic Cost	2,474	0	124	491	439	335	482	179	189	154	81	0	0	0

A.2.1 Imus River with On-Site Works on Measure for 10-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	5,682	0	414	825	821	687	867	486	504	469	309	231	232	0
Economic Cost	4,331	0	282	616	613	504	651	364	374	348	236	172	172	0

A.2.2 Imus River without On-Site Works on Measure for 10-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	3,393	0	206	670	600	462	643	241	258	210	102	0	0	0
Economic Cost	2,516	0	125	503	450	338	485	183	193	156	83	0	0	0

A.3.1 Imus River with On-Site Works on Measure for 20-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	6,117	0	457	945	899	689	869	489	506	471	310	241	241	0
Economic Cost	4,528	0	305	702	676	506	652	366	376	349	236	180	180	0

A.3.2 Imus River without On-Site Works on Measure for 20-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	3,600	0	250	764	651	465	647	244	262	213	104	0	0	0
Economic Cost	2,661	0	148	567	491	341	488	186	196	158	85	0	0	0

Table 8.22(2/3) Summary of Project Cost Disbursement in Financial Terms and Economic Terms for San-Juan and Ylang-Ylang Rivers Channel Improvement

B.1.1 (1) San-Juan - Ylang-Ylang Rivers with On-Site Works on Measure for 5-Year Flood - Diversion Plan

(million Pesos)

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,441	0	145	218	376	311	269	332	264	156	123	123	124	0
Economic Cost	1,793	0	107	160	263	217	196	259	203	115	91	91	91	0

B.1.1 (2) San-Juan - Ylang-Ylang Rivers with On-Site Works on Measure for 5-Year Flood - Retarding Basin Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,691	0	151	227	378	310	369	389	333	161	127	123	124	0
Economic Cost	2,017	0	114	168	267	219	279	307	262	121	95	93	93	0

B.1.2 (1) San-Juan - Ylang-Ylang Rivers without On-Site Works on Measure for 5-Year Flood - Diversion Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	1,135	0	29	110	236	175	156	254	160	10	6	0	0	0
Economic Cost	844	0	22	81	159	117	115	207	131	8	5	0	0	0

B.1.2 (2) San-Juan - Ylang-Ylang Rivers without On-Site Works on Measure for 5-Year Flood - Retarding Basin Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	1,313	0	33	115	244	183	250	266	205	10	6	0	0	0
Economic Cost	983	0	25	85	164	122	191	216	167	8	5	0	0	0

B.2.1 (1) San-Juan - Ylang-Ylang Rivers with On-Site Works on Measure for 10-Year Flood - Diversion Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,823	0	155	265	473	376	311	407	310	157	123	123	124	0
Economic Cost	2,265	0	129	209	352	282	246	338	259	135	105	105	106	0

B.2.1 (2) San-Juan - Ylang-Ylang Rivers with On-Site Works on Measure for 10-Year Flood - Retarding Basin Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,951	0	157	234	435	372	463	472	396	158	123	123	124	0
Economic Cost	2,263	0	117	173	296	252	347	373	311	118	92	92	92	0

B.2.2 (1) San-Juan - Ylang-Ylang Rivers without On-Site Works on Measure for 10-Year Flood - Diversion Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	1,643	0	41	136	299	235	247	404	255	16	11	0	0	0
Economic Cost	1,215	0	30	99	194	151	182	329	208	13	9	0	0	0

B.2.2 (2) San-Juan - Ylang-Ylang Rivers without On-Site Works on Measure for 10-Year Flood - Retarding Basin Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	1,669	0	38	121	294	242	338	344	266	16	11	0	0	0
Economic Cost	1,239	0	29	92	191	154	255	280	217	13	9	0	0	0

B.3.1 (1) San-Juan - Ylang-Ylang Rivers with On-Site Works on Measure for 20-Year Flood - Diversion Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	3,593	0	196	322	530	624	542	488	362	160	123	123	124	0
Economic Cost	2,647	0	140	208	352	464	420	387	284	119	91	91	91	0

B.3.1 (2) San-Juan - Ylang-Ylang Rivers with On-Site Works on Measure for 20-Year Flood - Retarding Basin Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	3,248	0	159	193	403	451	576	511	425	158	123	123	124	0
Economic Cost	2,389	0	119	140	259	305	434	405	335	118	91	91	92	0

B.3.2 (1) San-Juan - Ylang-Ylang Rivers without On-Site Works on Measure for 20-Year Flood - Diversion Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,468	0	54	151	388	335	409	676	423	21	14	0	0	0
Economic Cost	1,830	0	42	114	242	206	301	551	345	17	11	0	0	0

B.3.2 (2) San-Juan - Ylang-Ylang Rivers without On-Site Works on Measure for 20-Year Flood - Retarding Basin Plan

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,357	0	54	151	343	290	513	549	423	21	14	0	0	0
Economic Cost	1,773	0	42	114	220	184	393	448	345	17	11	0	0	0

Table 8.22(3/3) Summary of Project Cost Disbursement in Financial Terms and Economic Terms for Inland Drainage Improvement

C.1.1 Full Scale Inland Drainage Improvement Works with On-Site Works on Measure for 2-Year Flood

(million Pesos)

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	6,718	0	172	272	839	1,168	1,195	1,195	1,200	515	54	54	54	0
Economic Cost	5,314	0	142	209	660	927	941	941	944	420	44	44	44	0

C.1.2 Full Scale Inland Drainage Improvement Works without On-Site Works on Measure for 2-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	6,359	0	142	251	809	1,141	1,168	1,167	1,172	481	27	0	0	0
Economic Cost	5,023	0	119	191	635	905	919	918	921	393	23	0	0	0

C.2.1 Partial Scale Inland Drainage Improvement Works with On-Site Works on Measure for 2-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,937	0	89	148	506	535	555	555	559	107	40	31	31	0
Economic Cost	2,435	0	72	108	393	416	426	426	429	86	32	24	24	0

C.2.2 Partial Scale Inland Drainage Improvement Works without On-Site Works on Measure for 2-Year Flood

Cost	Total	Annual Disbursement												
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Financial Cost	2,704	0	61	129	217	513	543	542	546	327	45	0	0	0
Economic Cost	2,255	0	51	93	158	398	417	416	418	267	37	0	0	0

Table 8.23 Summary of Economic Evaluation Result

Flood Damage Mitigation Measures		Imus River		San-Juan - Ylang-Ylang Rivers				Inland Drainage Improvement			
		With On-Site Works	Without On-Site Works	With On-Site Flood Regulation Pond		Without On-Site Flood Regulation Pond		Full Scale		Partial Scale	
				Diversion Plan	Retarding Basin Plan	Diversion Plan	Retarding Basin Plan	With On-Site Works	Without On-Site Works	With On-Site Works	Without On-Site Works
Alternative No.		F_I.3	F_I.2	F_S.5D	F_S.5R	F_S.3	F_S.2				
Measures for 2-Year Flood	NPV	-	-	-	-	-	-	-1,200	-1,190	-253	-429
	EIRR	-	-	-	-	-	-	5.43%	5.16%	8.13%	7.98%
	B/C	-	-	-	-	-	-	0.53	0.56	0.72	0.49
Measures for 5-Year Flood	NPV	11,437	7,829	1,035	922	305	1,101	-	-	-	-
	EIRR	28.57%	28.47%	19.37%	17.63%	14.15%	20.40%	-	-	-	-
	B/C	4.95	6.43	2.12	1.88	1.65	3.02	-	-	-	-
Measures for 10-Year Flood	NPV	12,110	10,303	1,535	1,547	591	578	-	-	-	-
	EIRR	32.38%	31.32%	20.24%	20.69%	15.51%	15.33%	-	-	-	-
	B/C	6.20	8.02	2.30	2.32	1.89	1.85	-	-	-	-
Measures for 20-Year Flood	NPV	13,512	11,533	1,822	1,998	668	696	-	-	-	-
	EIRR	32.84%	31.67%	19.87%	22.73%	14.47%	14.74%	-	-	-	-
	B/C	6.50	8.37	2.29	2.62	1.68	1.73	-	-	-	-

(Note) NPVs are expressed by million Pesos.

Table 8.24 Economic Evaluation in Case of Overall Project in Combination of Optimum Flood Mitigation Plans

(million Pesos)

		Economic Cost						Benefit to Be Derived							
		Construction Base Cost						Benefit to Be Derived from the Project			Benefit from On-Site Flood Regulation Pond				
Calendar Year	Year in Order	Imus-10 Year With On-Site	SJ-10 Year With On-Site, Retarding Basin Plan	Partial Scale Inland Drainage Plan With On-Site	Total	OM Cost	Total	Imus-10 Year With On-Site	SJ-10 Year With On-Site, Retarding Basin Plan	Partial Scale Inland Drainage Plan With On-Site	Imus-10 Year With On-Site	SJ-10 Year With On-Site, Retarding Basin Plan	Partial Scale Inland Drainage Plan With On-Site	Economic Benefit in Total	Cash Balance
2003	-4						0	0	0	0	0	0	0		0
2004	-3						0	0	0	0	0	0	0		0
2005	-2						0	0	0	0	0	0	0		0
2006	-1						0	0	0	0	0	0	0		0
2007	0						0	0	0	0	0	0	0	0	0
2008	1	0	0	0	0		0	0	0	0	0	0	0	0	0
2009	2	282	117	72	471		471	0	0	0	45	24	2	0	-471
2010	3	616	173	108	898		898	0	0	0	90	48	4	0	-898
2011	4	613	296	393	1,301		1,301	0	0	0	135	72	6	0	-1301
2012	5	504	252	416	1,172		1,172	0	0	0	180	96	8	0	-1172
2013	6	651	347	426	1,424		1,424	0	0	0	225	120	10	0	-1424
2014	7	364	373	426	1,163		1,163	0	0	0	269	144	12	0	-1163
2015	8	374	311	429	1,114		1,114	0	0	0	314	168	13	0	-1114
2016	9	348	118	86	552		552	0	0	0	359	192	15	0	-552
2017	10	236	92	32	359		359	0	0	232	404	216	17	869	510
2018	11	172	92	24	287	35	322	2,905	314	242	449	239	19	4,169	3847
2019	12	172	92	24	288	35	322	3,158	339	251	494	263	21	4,527	4205
2020	13	172	92	24	288	35	322	3,423	364	261	539	287	23	4,898	4575
2021	14					35	35	3,423	364	261	539	287	23	4,898	4863
2022	15					35	35	3,423	364	261	539	287	23	4,898	4863
2023	16					35	35	3,423	364	261	539	287	23	4,898	4863
2024	17					35	35	3,423	364	261	539	287	23	4,898	4863
2025	18					35	35	3,423	364	261	539	287	23	4,898	4863
2026	19					35	35	3,423	364	261	539	287	23	4,898	4863
2027	20					35	35	3,423	364	261	539	287	23	4,898	4863
2028	21					35	35	3,423	364	261	539	287	23	4,898	4863
2029	22					35	35	3,423	364	261	539	287	23	4,898	4863
2030	23					35	35	3,423	364	261	539	287	23	4,898	4863
2031	24					35	35	3,423	364	261	539	287	23	4,898	4863
2032	25					35	35	3,423	364	261	539	287	23	4,898	4863
2033	26					35	35	3,423	364	261	539	287	23	4,898	4863
2034	27					35	35	3,423	364	261	539	287	23	4,898	4863
2035	28					35	35	3,423	364	261	539	287	23	4,898	4863
2036	29					35	35	3,423	364	261	539	287	23	4,898	4863
2037	30					35	35	3,423	364	261	539	287	23	4,898	4863
2038	31					35	35	3,423	364	261	539	287	23	4,898	4863
2039	32					35	35	3,423	364	261	539	287	23	4,898	4863
2040	33					35	35	3,423	364	261	539	287	23	4,898	4863
2041	34					35	35	3,423	364	261	539	287	23	4,898	4863
2042	35					35	35	3,423	364	261	539	287	23	4,898	4863
2043	36					35	35	3,423	364	261	539	287	23	4,898	4863
2044	37					35	35	3,423	364	261	539	287	23	4,898	4863
2045	38					35	35	3,423	364	261	539	287	23	4,898	4863
2046	39					35	35	3,423	364	261	539	287	23	4,898	4863
2047	40					35	35	3,423	364	261	539	287	23	4,898	4863
2048	41					35	35	3,423	364	261	539	287	23	4,898	4863
2049	42					35	35	3,423	364	261	539	287	23	4,898	4863
2050	43					35	35	3,423	364	261	539	287	23	4,898	4863
2051	44					35	35	3,423	364	261	539	287	23	4,898	4863
2052	45					35	35	3,423	364	261	539	287	23	4,898	4863
2053	46					35	35	3,423	364	261	539	287	23	4,898	4863
2054	47					35	35	3,423	364	261	539	287	23	4,898	4863
2055	48					35	35	3,423	364	261	539	287	23	4,898	4863
2056	49					35	35	3,423	364	261	539	287	23	4,898	4863
2057	50					35	35	3,423	364	261	539	287	23	4,898	4863
2058	51					35	35	3,423	364	261	539	287	23	4,898	4863
2059	52					35	35	3,423	364	261	539	287	23	4,898	4863
2060	53					35	35	3,423	364	261	539	287	23	4,898	4863
2061	54					35	35	3,423	364	261	539	287	23	4,898	4863
2062	55					35	35	3,423	364	261	539	287	23	4,898	4863
2063	56					35	35	3,423	364	261	539	287	23	4,898	4863
2064	57					35	35	3,423	364	261	539	287	23	4,898	4863
2065	58					35	35	3,423	364	261	539	287	23	4,898	4863
2066	59					35	35	3,423	364	261	539	287	23	4,898	4863
2067	60					35	35	3,423	364	261	539	287	23	4,898	4863
2068	61					35	35	3,423	364	261	539	287	23	4,898	4863
2069	62					35	35	3,423	364	261	539	287	23	4,898	4863
Total		4,503	2,355	2,459		1,802	10,832		18,873						243,611
Applied Discount Rate: 10 % according to a regulation of the nation															
NPV							4,817							17,010	12,193
EIRR				9,030											22.19%
B/C				288											3.53

Table 9.1 Tentative Work Schedule for Pilot Project in Imus

No.	Activities/Projects	Resp.	Schedule	Oct 07	Nov 07	Dec 07	Jan 08	February 2008
				F	S	S	M	T	W	TH	F	S	S	M	T	W	TH	F	S	S	M	T	W	TH	F	S	S	M	T	W	TH	F	S
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	1
A.	**IEC OF 26 Barangays along Riverbanks**																																
1	Preparation of Module for Trainers' Training		Oct-07																														
	1.2. Progress Monitoring	CCK																															
2	Trainors' Training	SCC/SIRP	Nov-Dec 2007																														
	2.1. Selection of Trainors	SIRP/SCC	Oct, 2007																														
	2.2. Actual Training of Trainors	SCC	Nov-Dec 2007																														
	2.3. Progress Monitoring	CCK																															
3	Development of training materials per target group	SCC/SIRP	Jan-08																														
	e.g. barangay leaders, residents, youth, mothers,																																
	business sectors, schools, etc																																
	- Progress Monitoring	CCK																															
4	Conduct of actual IEC per target group	SCC/SIRP																															
	4.1. Anabu 1-A, 1-C,1-E,1-F,1-G		Feb 2. 200																														
	4.2. Anabu II-B, II-C, II-D, II-E,II-F		Feb 2. 2008																														
	4.3. Palico 1,2,3,4		Feb.9, 2008																														
	4.4. Poblacion I-A, I-B, II-A		Feb. 16, 2008																														
	4.5. Tanzang Luma I,II,III,IV,V,VI		Feb. 23, 2008																														
	4.6. Toclong I-C, II-A,II-B		March 1, 2008																														
B	**Riverbank Enhancement**																																
1	Establishment of nursery plant co-managed by	SCC/LGU/	Oct. 2007																														
	community members	SIRP																															
	- Progress Monitoring																																
2	Tree Planting (simultaneously with the river clean	SCC/LGU/																															
	2.1. Anabu 1-A, 1-C,1-E,1-F,1-G	SIRP	Feb 2. 200																														
	2.2. Anabu II-B, II-C, II-D, II-E,II-F		Feb 2. 2008																														
	2.3. Palico 1,2,3,4		Feb.9, 2008																														
	2.4. Poblacion I-A, I-B, II-A		Feb. 16, 2008																														
	2.5. Tanzang Luma I,II,III,IV,V,VI		Feb. 23, 2008																														
	2.6. Toclong I-C, II-A,II-B		March 1, 2008																														
C.	Monitoring & Evaluation of the Project for its	LGU/	March ,08																														
	Effectiveness ans Sustainability	SCC/SIRP																															

SIRP Save Imus River Project
SCC Sagip-ilog Cavite Council
CCK C. C. Keiyo
JICA Japan International Cooperation Agency Study Team
LGU Local Government Unit

Table 9.2 Tentative Work Schedule for Pilot Project in Kawit

No.	Activities/Projects	Resp.	Schedule	Oct 07	Nov 07	Dec 07	Jan 08	February 2008
								F S S M T W TH F S S M T W TH F S S M T W TH F S S M T W TH F
								1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
1	Preparation of Module for Trainers' Training		Oct-07					
	1.1 Draft Module & Seminar Material Preparation	KSI	1-10 Oct '07					
	1.2 Review of Draft Module & Seminar Material	SICC	11-20 Oct '07					
	1.3 Finalization of Module/Seminar material	KSI	21-31 Oct '07					
	1.4 Progress Monitoring	CCK	Oct-07					
2	Preparation of Comic Reading Materials							
	2.1 Draft Design & Layout preparation	KSI	Nov. 2007					
	2.2 Review of Draft Design/Layout	SICC	Nov. 2007					
	2.3 Sample printing	KSI	Dec. 2007					
	2.4 Review of Sample Prints	SICC	Dec. 2007					
	2.5 Progress Monitoring	CCK	Nov/Dec 07					
3	Printing of Comics Reading materials	KSI/JICA	Jan-08					
	- Progress Monitoring	CCK						
4	Trainor's Training	KSI	Nov-Jan 08					
	- Continuous from Nov 07 to Jan 08							
	- Progress Monitoring	CCK						
5	Printing of Materials for Seminar Workshop	KSI/JICA	Jan-08					
	- Progress Monitoring	CCK						
6	Workshop/Seminar	KSI	Feb-08					
	- Assistance/Monitoring	SICC/CCK						
	February 4 - Marulas		Monday					
	February 7 - Kaingen and Poblacion		Thursday					
	February 11 - Wakas 1 & Wakas 2		Monday					
	February 14 - Sta. Isabel		Thursday					
	February 18 - Panamitan		Monday					
	February 21 - Gahak		Thursday					
	February 25 - Tabon 1,2 & 3		Monday					
	February 28 - Binakayan		Thursday					
7	Distribution of Comics reading Materials	KSI	Feb-08					
	- Distribution Monitoring	CCK						

KSI Kawit Sagip Ilog
SICC Sagip Ilog Cavite Council
CCK C. C. Keiyo
JICA Japan International Cooperation Agency Study Team

Table 9.3 Barangays Located in Flood Risk Area

Municipality	River	Barangay				
Bacoor	Imus	Tabing Dagat	Sineguelasan	Salinas I	Alima	Banalo
		Campo Santo	Daang Bukid	Digman	Dulong Bayan	Habay I
		Habay II	Kaingin (Pob.)	Mabolo I	Mabolo II	Mabolo III
		Maliksi I	Maliksi II	Mambog I	Mambog II	Mambog III
		Mambog V	Niog I	Niog II	Niog III	Panapaan I
		Panapaan II	Panapaan III	Panapaan IV	Panapaan VI	Panapaan VII
		Real II	Tabing Dagat	Sineguelasan	Maliksi III	Maliksi II
		Maliksi I	Kaingin (Pob.)	Digman	Campo Santo	Banalo
		Alima				
General Trais	Canas	Pinagtipunan	San Juan I	San Juan II	Tapia	
	San Juan	Navarro	Bacao I	Vibora Pob.	Tapia	Santa Clara
		San Gabriel Pob	Prinza Pob.	Pinagtipunan	Pasong Camachile	Navarro
		Dulong Bayan Po	Bacao II	Bacao I	Arnaldo Pob.	Tejero
		Bacao II	Bacao I			
Imus	Imus	Toclong II-B	Toclong II-A	Toclong I-C	Toclong I-B	Toclong I-A
		Tanzang Luma VI	Palico IV	Medicion II-D	Medicion II-C	Medicion II-B
		Medicion II-A	Medicion I-D	Medicion I-C	Medicion I-A	Malagasang I-E
		Malagasang I-D	Malagasang I-C	Malagasang I-B	Carsadang Bago	Bucandala I
		Bayan Luma VI	Bayan Luma V	Bayan Luma IX	Bayan Luma III	Anabu II-C
		Anabu II-A	Anabu I-G	Anabu I-D	Anabu I-C	Anabu I-B
		Anabu I-A				
	San Juan	Alapan II-B	Alapan II-A	Alapan II-B	Alapan II-A	Toclong II-B
		Pag-Asa III	Pag-Asa II	Medicion II-F	Medicion II-E	Medicion II-D
		Medicion II-C	Medicion II-B	Medicion II-A	Carsadang Bago	
Kawit	Imus	Samala-Marquez	Pulvorista	Manggahan-Lawin	Congbalay-Legas	Balsahan-Bisita
	San Juan	Wakas II	Wakas I	Santa Isabel	San Sebastian	Poblacion
		Panamitan	Magdalo (Putol)	Kaingen	Batong Dalig	Wakas II
		Wakas I	Tramo-Bantayan	Toclong	Tabon III	Tabon II
		Tabon I	Santa Isabel	Samala-Marquez	Pulvorista	Poblacion
		Panamitan	Marulas	Manggahan-Lawin	Kaingen	Gahak
		Congbalay-Legas	Binakayan-Kanluran	Binakayan-Aplaya	Batong Dalig	Balsahan-Bisita
Noveleta	San Juan	Santa Rosa II	Santa Rosa I	San Rafael IV	San Rafael III	San Rafael II
		San Juan II	San Juan I	San Jose II	San Jose I	San Antonio II
		San Antonio I	Santa Rosa II	Santa Rosa I	San Rafael IV	San Rafael III
		San Rafael II	San Rafael I	Salcedo II	Salcedo I	Poblacion
Rosario	Canas	Tejeros Convent	Wawa I	Wawa II	Wawa III	
	San Juan	Wawa II	Tejeros Convent	Silangan I	Sapa III	Sapa II
		Sapa I	Poblacion	Ligtong IV	Ligtong III	Ligtong II
		Ligtong I	Kanluran	Bagbag I		
Tanza	Santol	Santol	Julugan II	Julugan I	Bunga	Biwas

Table 9.4 Members of Barangay Disaster Coordinating Council and Required Tasks for Each of Members

Members of BDCC	Tasks to Be Undertaken
BDCC Chairman/ Vice-Chairman	• Convenes the BDCC and activate Disaster Operation Center • Identifies and designates a Barangay Disaster Operation Center. • Maintains liaison with the Municipal Disaster Coordinating Council Chairman. • Initiates and conducts training courses for disaster management activities. • Coordinates arrangement for and directs all drills and exercises. • Exercises the activities programmed in the Barangay Disaster Preparedness Plan. • Arranges for and supervises the storage and disposition of required supplies and equipment.
Staff Team (1) for Security	• Organizes and activates the security functions of the BDCC so as to augment the force of PNP. • Secures evacuees and properties in the areas of operations. • Checks unauthorized person in the cordoned areas. • Checks suspicious activities and reports them to higher authorities concerned • Performs escort duties in the transport of persons, supplies, and equipment.
Staff Team (2) for Supply	• Arranges and supervises the storage and disposition of required supplies and equipment. • Identifies the sources of supplies as may be needed.
Staff Team (3) for Transportation	• Inventories available vehicles for use of flood warning and evacuation. • Prepositions vehicles at pick-up points for a physically handicapped person. • Supports the transportation needs for flood warning and evacuation
Staff Team (4) for Communication	• Keep contact with MDCC communication teams to update the relevant information. • Keeps records of all warning and communication messages.
Operating Team (1) for Warning	• Monitors the river conditions. • Reports the river conditions to BDCC chairman for transmittal to higher DCCs. • Advices the BDCC chairman about necessity of emergency evacuation of the residents • Disseminates the information on warning and evacuation among the residents.
Operating Team (2) for Rescue	• Organizes and trains rescue service teams • Coordinates with the higher DCCs for training support. • Requests budget appropriation to support training requirements. • Conducts search, rescue and recovery operation in case of mass casualty incident. • Coordinates for emergency vehicles assistance, as required
Operating Team (3) for Evacuation	• Develops and reviews evacuation plan • Prepares the evacuation centers in coordination with the Department. of Education and other relevant agencies.. • Determines safe evacuation route in coordination with the aforesaid Staff Team (4) for transportation • Provides manpower support to the MDCC evacuation committee.
Operating Team (4) for Relief	• Coordinate with Municipal Social Welfare & Development Office for relief assistance. • Prepares and distributes relief goods. • Receives relief donations required. • Prepares relief status and reports them to MDCC.
Operating Team (5) for Medical	• Prepares medical kit/resources for health of evacuees • Provides manpower support to the MDCC medical committee. • Directs the first aid and medical self-help operations • Maintains adequate sanitation, hygienic standards, and other matters related to emergency health, hygiene and medical activities within the barangay during evacuation. • Ensures safety of the storage, handling of food and available drinking water in evacuation areas.
Operating Team (6) for Damage Control	• Develops damage control plans. • Deploys personnel after any flood disaster to correct the utilities damaged by the flood and to report conditions that require assistance. • Conducts road clearing after the calamity. • Conducts clearing of canals and waterways of with accumulated trashes or junks. • Installs warning signs on open manholes and dangerous structures/facilities.

Table 10.1 Score of Environmental Impacts of Alternative Plans for Flood Mitigation

Environmental Element/Alternative Project	Imus River-overflow Flood Prevention			San Juan River-overflow Flood Prevention					Inland Drainage		Without Project
	FI-1	FI-2	FI-3	FS-1	FS-2	FS-3	FS-4	FS-5	D-1	D-2	
1. Construction Phase											
1.1 Social Environment											
(1) Involuntary Resettlement and Land Acquisition	A	B	B	A	B	B	B	B	B	B	
(2) Impact on Livelihood and Local Economy (unemployment)	A	B	B	A	B	B	B	B	B	B	A
(3) Infrastructure (road/bridge)	B*	B	B	B*	B	B	B	B			A
(4) Poverty	A	B	B	A	B	B	B	B	B	B	
(5) Water Use (irrigation)		B	B		B	B	B	B			
(6) Fishery (boat anchorage)									B	B	
1.2 Natural Environment											
(1) Groundwater		B	B		B	B	B	B	B	B	
(2) Flora (mangrove)		B	B	B	B	B	B	B	B	B	
1.3 Public Hazard											
(1) Air Pollution (dust)	B*	B*	B*	B*	B*	B*	B*	B*	B*	B*	
(2) Water Pollution (turbidity)	B*	B*	B*	B*	B*	B*	B*	B*			
(3) Noise/Vibration	B*	B*	B*	B*	B*	B*	B*	B*	B*	B*	
2. Operation Phase											
2.1 Social Environment											
(1) Impact on Livelihood and Local Economy (due to land development control)	B	B	B	B	B	B	B	B			
(2) Regional Conflicts of Interests (due to land development control)	B	B	B	B	B	B	B	B			
2.2 Natural Environment											
(1) No notable element											
2.3 Public Hazard											
(1) Solid Waste	C	C	C	C	C	C	C	C	C	C	
(2) Water Pollution		C	C		C		C	C	C	C	
(3) Odor		C	C		C		C	C	C	C	

Note: (1) A: significant impact, B: moderate impact, C: uncertain, Blank: no impact,
(2) * during construction period

Table 10.2 Number of House Relocation by Each Component Project

(Unit: household)

Alt. No.	Component Project	Design Flood Scale			
		2-year	5-year	10-year	20-year
River-overflow Flood Prevention of Imus River					
F I-1	Full-scale River Improvement				
	Main River	400	520	650	780
	Bacoor River	330	330	330	330
	Julian River	350	500	500	500
	Total	1,180	1,350	1,480	1,610
F I-2	Partial River Improvement				
	Main River	90	90	90	90
	Bacoor River	60	60	60	60
	Julian River	80	80	80	80
	Off-site Retarding Basin				
	Main River (1 basin: I 1)	7	10	10	10
	Bacoor River (4 basins: B 1, B 2, B 3, B 4)	30	30	30	30
	Julian River (2 basins: J 1, J 2)	3	5	5	5
	Total	270	275	275	275
F I-3	Partial River Improvement				
	Main River	90	90	90	90
	Bacoor River	60	60	60	60
	Julian River	80	80	80	80
	Off-site Retarding Basin				
	Main River (1 basin: I 1)	0	10	10	10
	Bacoor River (4 basins: B 1, B 2, B 3, B 4)	30	30	30	30
	Julian River (2 basins: J 1, J 2)	0	5	5	5
	Total	260	275	275	275
River-overflow Flood Prevention of San Juan River					
F S-1	Full-scale River Improvement	250	330	460	650
FS-2	Partial River Improvement	60	60	60	60
	Retarding Basin (S 1, Y 1, Y 2)	11	13	14	16
	Total	71	73	74	76
F S-3	Partial River Improvement	60	87	150	260
	Diversion Channel	92	105	135	253
	Total	152	192	285	513
F S-4	Partial River Improvement	60	77	87	100
	Retarding Basin (S 1, Y 1, Y 2)	10	11	12	14
	Diversion Channel	90	101	105	110
	Total	160	189	204	224
F S-5	Partial River Improvement	60	85	60	60
	Retarding Basin (S 1, Y 1, Y 2)	0	0	14	15
	Diversion Channel	0	100	0	0
	Total	60	185	74	75
Inland Drainage					
D-1	Coastal Dike	78	-	-	-
	Retention Pond (M 1, M 2, K 1, P 1, E 1, E 2)	1	-	-	-
	Drainage Channel Improvement and Others	42	-	-	-
	Total	121	-	-	-
D-2	Coastal Dike	78	-	-	-
	Ring Dike	220	-	-	-
	Retention Pond (M 1, M 2, K 1, P 1, E 1, E 2)	1	-	-	-
	Drainage Channel Improvement and Others	42	-	-	-
	Total	341	-	-	-

Note: The alternative FS-5 consists of sub-projects of partial river improvement, retarding basin, diversion channel and on-site regulation pond. In this alternative, the least cost combination of sub-projects varies depending on the design flood scale as follows: (i) partial river improvement + on-site regulation pond for 2-year flood, (ii) partial river improvement + diversion channel + on-site regulation pond for 5-year flood, and (iii) partial river improvement + retarding basin + on-site regulation pond for 10-year and 20-year floods. In this alternative, number of the house relocation for 10-year and 20-year floods are smaller than that for 5-year flood since the retarding basin requires a smaller number of house relocation than the diversion channel.

Table 10.3 (1/3) Land Acquisition Area by Each Component Project (River-over flow Flood Prevention of Imus River)

(Unit: ha)

Alt. No.	Flood Scale	2-year					5-year					10-year					20-year				
	Project/Land Use	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total
FI-1	Full-scale R. Improvement																				
	Main River	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Bacoor River	-	-	-	4	4	-	-	-	4	4	-	-	-	4	4	-	-	-	4	4
	Julian River	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Total	0	0	0	4	4	0	0	0	4	4	0	0	0	4	4	0	0	0	4	4
FI-2	Partial River Improvement																				
	Main River	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Bacoor River	-	-	-	3	3	-	-	-	3	3	-	-	-	3	3	-	-	-	3	3
	Julian River	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Retarding Basin																				
	Main River (I 1)	13	12	-	-	25	18	18	-	-	36	23	22	-	-	45	31	31	-	-	62
	Bacoor River																				
	B 1	-	-	5	3	8	-	-	5	3	8	-	-	5	3	8	-	-	5	3	8
	B 2	-	-	14	8	22	-	-	14	8	22	-	-	14	8	22	-	-	14	8	22
	B 3	-	-	21	11	32	-	-	21	11	32	-	-	21	11	32	-	-	21	11	32
	B 4	-	15	-	-	15	-	15	-	-	15	-	15	-	-	15	-	15	-	-	15
	Julian River																				
	J 1	4	3	-	-	7	8	8	-	-	16	8	8	-	-	16	8	8	-	-	16
	J 2	4	7	-	-	11	5	8	-	-	13	5	8	-	-	13	5	8	-	-	13
	Total	21	37	40	25	123	31	49	40	25	145	36	53	40	25	154	44	62	40	25	171
FI-3	Partial River Improvement																				
	Main River	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Bacoor River	-	-	-	3	3	-	-	-	3	3	-	-	-	3	3	-	-	-	3	3
	Julian River	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Retarding Basin																				
	Main River (I 1)	-	-	-	-	0	17	17	-	-	34	20	20	-	-	40	28	28	-	-	56
	Bacoor River																				
	B 1	-	-	5	3	8	-	-	5	3	8	-	-	5	3	8	-	-	5	3	8
	B 2	-	-	14	8	22	-	-	14	8	22	-	-	14	8	22	-	-	14	8	22
	B 3	-	-	21	11	32		-	21	11	32		-	21	11	32		-	21	11	32
	B 4	-	12	-	-	12	-	12	-	-	12	-	12	-	-	12	-	12	-	-	12
	Julian River																				
	J 1	-	-	-	-	0	7	7	-	-	14	7	7	-	-	14	7	7	-	-	14
	J 2	-	-	-	-	0	4	7	-	-	11	4	7	-	-	11	4	7	-	-	11
	Total	0	12	40	25	77	28	43	40	25	136	31	46	40	25	142	39	54	40	25	158

Note: 1) F: active farmland, G: grassland includes abandoned farm/bush, F.P: active fishpond, A.P: abandoned fishpond. 2) The above land acquisition area excludes housing lots and public land.

Table 10.3 (2/3) Land Acquisition Area by Each Component Project (River-over flow Flood Prevention of San Juan River)

(Unit: ha)

Alt.	Flood Scale	2-year					5-year					10-year					20-year				
No.	Project/Land Use	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total
FS-1	Full-scale R. Improvemer	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
FS-2	Partial River Improvemer	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Retarding Basin																				
	S 1	15	4	-	-	19	19	5	-	-	24	36	9	-	-	45	46	12	-	-	58
	Y 1	-	5	-	-	5	-	13	-	-	13	-	13	-	-	13	-	13	-	-	13
	Y 2	9	-	-	-	9	16	-	-	-	16	26	-	-	-	26	32	-	-	-	32
	Total	24	9	0	0	33	35	18	0	0	53	62	22	0	0	84	78	25	0	0	103
FS-3	Partial River Improvemer	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Diversion Channel	-	1	-	5	6	-	1	-	7	8	-	2	-	9	11	-	2	-	12	14
	Total	0	1	0	5	6	0	1	0	7	8	0	2	0	9	11	0	2	0	12	14
FS-4	Partial River Improvemer	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Retarding Basin																				
	S 1	8	2	-	-	10	12	3	-	-	15	19	5	-	-	24	34	8	-	-	42
	Y 1	-	5	-	-	5	-	5	-	-	5	-	13	-	-	13	-	13	-	-	13
	Y 2	5	-	-	-	5	8	-	-	-	8	15	-	-	-	15	23	-	-	-	23
	Diversion Channel	-	1	-	4	5	-	1	-	6	7	-	1	-	7	8	-	2	-	8	10
	Total	13	8	0	4	25	20	9	0	6	35	34	19	0	7	60	57	23	0	8	88
FS-5	Partial River Improvemer	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
	Retarding Basin																				
	S 1	-	-	-	-	0	-	-	-	-	0	34	9	-		43	45	11	-	-	56
	Y 1	-	-	-	-	0	-	-	-	-	0	-	13	-	-	13	-	13	-	-	13
	Y 2	-	-	-	-	0	-	-	-	-	0	24	-	-	-	24	31	-	-	-	31
	Diversion Channel	-	-	-	-	0	-	1	-	6	7	-	-	-	-	0	-	-	-	-	0
	Total	0	0	0	0	0	0	1	0	6	7	58	22	0	0	80	76	24	0	0	100

Note: 1) F: active farmland, G: grassland includes abandoned farm/bush, F.P: active fishpond, A.P: abandoned fishpond. 2) The above land acquisition area excludes housing lots and public land.

Table 10.3 (3/3) Land Acquisition Area by Each Component Project (Inland Drainage)

(Unit: ha)

Alternative No.	D 1					D 2				
Flood Scale	2-year					2-year				
Project/Land Use	F	G	F.P	A.P	Total	F	G	F.P	A.P	Total
Coastal Dike	-	-	8	-	8	-	-	8	-	8
Ring Dike	-	-	-	-	-	-	-	1	-	1
Retention Pond										
M 1	-	-	-	4	4	-	-	-	4	4
M 2	11	-	-	-	11	11	-	-	-	11
K 1	-	-	1	3	4	-	-	1	3	4
P 1	-	16	-	-	16	-	16	-	-	16
E 1	-	3	-	-	3	-	3	-	-	3
E 2	9	5	-	-	14	9	5	-	-	14
Drainage Channel Imp.	-	-	-	1	1	-	-	-	1	1
Total	20	24	9	8	61	20	24	10	8	62

Note: 1) F: active farmland, G: grassland includes abandoned farm/bush, F.P: active fishpond, A.P: abandoned fishpond.
2) The above land acquisition area excludes housing lots and public land.

Table 11.1 Features of Structures/Improvement for Proposed Overall Comprehensive Flood Mitigation Plan

Contents/Items of	Scale		Remarks	F/S
For River Over-Flow				
Protection Level				
Imus River Basin				
	Imus River	: 10-year return period		
	Bacoor River	: 2-year return period		
	Julian River	: 5-year return period	Incl. Left Tributary	
San Juan River Basin				
	San Juan River	: 10-year return period	Incl. Ylang-Ylang River	
Length of Partial River Improvement				
Imus River	3.4km	(Rivermouth ~ Confluence point with Julian River)	Dredging, Dike and Etc	
Bacoor River	6.4km	(Confluence point with Imus River ~ B4 Retarding Basin)	At designated and scattered sections	
Julian River	9.0km	(Confluence point with Imus River ~ NIA Cala Irrigation Canal)	At designated and scattered sections and incl. 100m long x 3 sections of Left Tributary	
San Juan River	2.0km	(Rivermouth ~ Diversion point with a	Dredging, Widening, Dike and Etc	
Total	20.8km			
Extent of Off-Site Retarding Basin				
Imus River Basin				
	Imus River	I1 : 40ha	Storage Capacity : Approx. 1.72 MCM	☑
	Bacoor River	B1 : 8ha	Storage Capacity : Approx. 0.39 MCM	
		B2 : 22ha		
		B3 : 32ha		
		B4 : 12ha	Storage Capacity : Approx. 0.45 MCM	☑
	Julian River	J1 : 14ha	Storage Capacity : Approx. 0.31 MCM	☑
		J2 : 11ha	Storage Capacity : Approx. 0.48 MCM	☑
	Sub-total RB(1)	139 ha		
San Juan River Basin				
	San Juan River	S1 : 43ha	Storage Capacity : Approx. 0.66 MCM	
	Ylang-Ylang River	Y1 : 13ha	Storage Capacity : Approx. 1.28 MCM	
		Y2 : 24ha	Storage Capacity : Approx. 2.18 MCM	
	Sub-total RB(2)	80ha		
Total (RB)	219 ha			
For Inland Drainage				
Protection Level				
Inland Drainage	Inland Area	: 2-year return period	Partial Protection	
Length of Drainage Channel Improvement				
Bacoor	Tributary of Bacoor	B3 : 0.3km	Parapet Wall and Dike	
Kawit	Malamok River	Dr_1 : 1.2km	Widening and Dike	
Kawit	Panamitan River	Dr_5 : 2.3km	Widening and Dike	
Total (CI)	3.8 km			
Extent of Off-Site Retention Pond				
Imus (Dr_1)	Malamok River	M2 : 11ha	Storage Capacity : Approx. 0.3 MCM	
Kawit (Dr_1)	Malamok River	M1 : 4ha		
Kawit (Dr_3)	Tirona River	K1 : 4ha		
Kawit (Dr_5)	Panamitan River	P1 : 16ha		
Rosario (Dr_9)	Malimango River	E1 : 3ha		
Gen Trias (Dr_9)	Malimango River	E2 : 14ha		
Total (RP)	52 ha			
Length of New Drainage Main				
Kawit	Binakayan	L=1.5km, B=6m	Concrete Lining Channel	
Novereta	San Rafael	L=1.1km, Box Culvert Type	2.7m x 2.4m x 1Barrel	
Total (DM)	2.6 km			
Length of New Interceptor				
Kawit (Dr_5)	Panamitan River	L=1.5km, Box Culvert Type	3.0m x 2.5m x 2Barrels	
Gen Trias (Dr_9)	Malimango River	L=2.9km, Box Culvert Type	2.7m x 2.4m x 1Barrel	
Total (IC)	4.4km			
Length of Coastal Dike				
Total (CD)	4.1km			
Installation of Tidal Gate (Slide Gate Type)				
Total (TG)	12 Gates			
Installation of Flap Gate				
Total (FG)	18 Gates			

Note : Items/Components marked in Column "FS" are selected as Priority Projects and Feasibility Study will be Conducted.

Table 11.2 Total Project Costs for Proposed Overall Optimum Flood Mitigation Plan

Imus River Basin	Initial	Physical	Price	Total		Remarks
Item	(1)	(2)	(3)	(1)+(2)	(1)+(2)+(3)	
Construction Base Cost	1,543	77	402	1,620	2,022	
Compensation Cost	693	35	259	728	987	
Subtotal_(a)	**2,236**	112	661	2,348	3,009	
Engineering S.C.	247	12	43	259	302	
Subtotal_(b)	2,483	124	704	2,607	3,311	(a)+Engineering S.C.
Administration Cost	22	0	7	22	29	
Subtotal_(c)	2,505	124	711	2,629	3,340	(b)+Administration Cost
Duties and Taxes	215	11	53	226	279	
Subtotal_(d)	2,720	135	764	2,855	3,619	(c)+Duties and Taxes
On-site	**2,404**	120	685	2,524	3,209	
Duties and Taxes	288	14	82	302	384	
Total	5,412	269	1,531	5,682	7,212	(d)+OnSite+Duties and Taxes

San Juan River Basin	Initial	Physical	Price	Total		Remarks
Item	(1)	(2)	(3)	(1)+(2)	(1)+(2)+(3)	
Construction Base Cost	789	40	233	829	1,062	
Compensation Cost	339	17	130	356	486	
Subtotal_(a)	**1,128**	57	363	1,185	1,548	
Engineering S.C.	126	6	21	132	153	
Subtotal_(b)	1,254	63	384	1,317	1,701	(a)+Engineering S.C.
Administration Cost	12	0	4	12	16	
Subtotal_(c)	1,266	63	388	1,329	1,717	(b)+Administration Cost
Duties and Taxes	110	6	30	116	146	
Subtotal_(d)	1,376	69	418	1,445	1,863	(c)+Duties and Taxes
On-site	**1,282**	64	366	1,346	1,712	
Duties and Taxes	154	8	44	162	206	
Total	2,812	141	828	2,951	3,781	(d)+OnSite+Duties and Taxes

Inland Partial	Initial	Physical	Price	Total		Remarks
Item	(1)	(2)	(3)	(1)+(2)	(1)+(2)+(3)	
Construction Base Cost	1,520	76	502	1,596	2,098	
Compensation Cost	444	22	209	466	675	
Subtotal_(a)	**1,964**	98	711	2,062	2,773	
Engineering S.C.	243	12	48	255	303	
Subtotal_(b)	2,207	110	759	2,317	3,076	(a)+Engineering S.C.
Administration Cost	20	0	8	20	28	
Subtotal_(c)	2,227	110	767	2,337	3,104	(b)+Administration Cost
Duties and Taxes	212	11	66	223	289	
Subtotal_(d)	2,439	121	833	2,559	3,393	(c)+Duties and Taxes
On-site	**321**	16	91	337	428	
Duties and Taxes	39	2	11	41	52	
Total	2,799	139	935	2,937	3,873	(d)+OnSite+Duties and Taxes

Grand Total	Initial	Physical	Price	Total		Remarks
Item	(1)	(2)	(3)	(1)+(2)	(1)+(2)+(3)	
Construction Base Cost	3,852	193	1,137	4,045	5,182	
Compensation Cost	1,476	74	598	1,550	2,148	
Subtotal_(a)	**5,328**	267	1,735	5,595	7,330	
Engineering S.C.	616	30	112	646	758	
Subtotal_(b)	5,944	297	1,847	6,241	8,088	(a)+Engineering S.C.
Administration Cost	54	0	19	54	73	
Subtotal_(c)	5,998	297	1,866	6,295	8,161	(b)+Administration Cost
Duties and Taxes	537	28	149	565	714	
Subtotal_(d)	6,535	325	2,015	6,860	8,875	(c)+Duties and Taxes
On-site	**4,007**	200	1,142	4,207	5,349	
Duties and Taxes	481	24	137	505	642	
Total	11,023	549	3,294	11,572	14,866	(d)+OnSite+Duties and Taxes

Table 11.3 Implememtation Schedule of Structural Measures

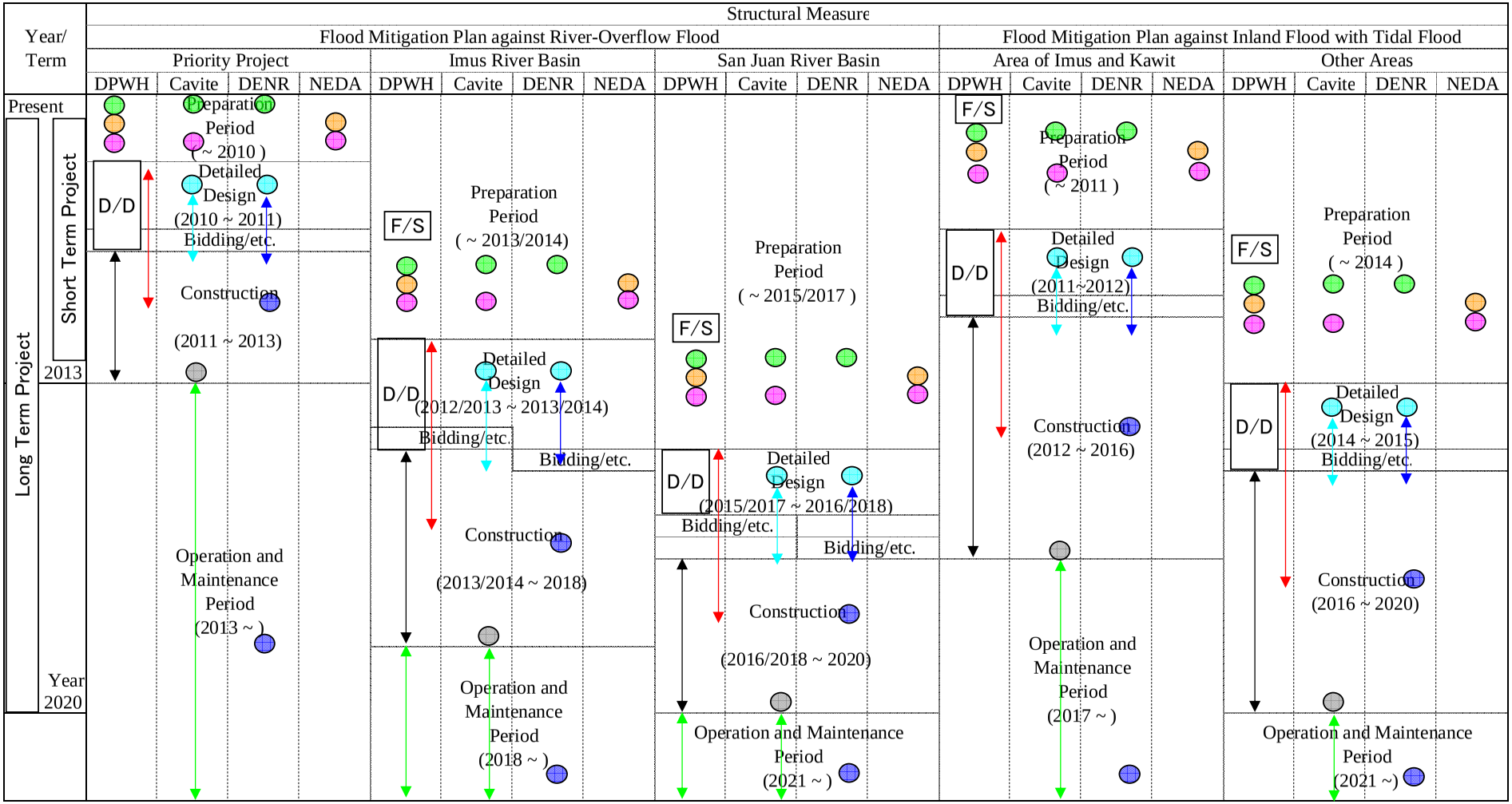
Component	Description	Year 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Structural Project: Package 1 (Project against Overflow of Imus River)													
Imus River Improvement (10-year Protection)													
Imus River Channel Improvement	L=3.4km					River-3							
Retarding Basin (I-1)	A=40ha	*2)River-1											
Bacoor River Improvement (2-year Protection))													
Bacoor River Channel Improvement	L=6.4km					River-3							
Retarding Basin (B-1, 2 & 3)	A=58ha				River-2								
Retarding Basin (B-4)	A=12ha	River-1											
Julian River Improvement (5-year Protection)													
Julian River Channel Improvement	L=9.0km					River-3							
Retarding Basin (J-1 & 2)	A=25ha	River-1											
Structural Project: Package 2 (Project against Overflow of San Juan River)													
San Juan/Ylang-Ylang River Improvement (10-year Protection)													
San Juan River Channel Improvement	L=2.0km						River-4						
Retarding Basin (S-1 and Y-1&2)	A=80ha								River-5				
Structural Project: Package 3 (Drainage Improvement Project)													
Inland Drainage Improvement (2-year Improvement)													
Bacoor Area	*1) FP									Drainage-3			
Imus Area	IC, RP		*2)Drainage-1										
Kawit Area	CI, DM, CD, IC, RP, TD, RP, FP		Drainage-1										
Noveleta Area	TD, FP					Drainage-2							
Rosario Area	TD, RP, FP					Drainage-2							
General Trias Area	IC, RP					Drainage-2							
Tanza Area	TD, CD, RP, FP									Drainage-3			
Compensation	Land Acquisition, House Relocation		for Short Term Project										
				for Long Term Project									
Project Terms			Short-Term										Completion
				Long-Term									

Note: *1) <Abbreviation> FP: Flap Gate, IC: Interceptor, RP: Retention Pond, CI: Channel Improvement (existing), DM: Drainage Main (new), CD: Coastal Dike, TD: Tidal Dik
*2) The numbers attached on bar (River-1~5, Drainage-1~3) intend ordering of priority for implementation. Smaller number has higher priority
*3) : Preparation Activity (Detailed Design, Bidding, etc.) : Construction for Short Term Project : Construction for Long Term Project

Table 11.4 Implementation Schedule for Setup of Non-structural Flood Mitigation Program

Work Item	Year			
	2007	2008	2009	2010
1. IEC on Cleanup of Water Way				
(1) Pilot Project				
(2) Expansion Program				
2. Prevention of Encroachment to River Area				
(1) Establishment of Boundary for River Area				
(2) Development of Database of River Area				
(3) Formulation and Execution of Management Plan				
3. Land Use Control				
(1) Legislation of Ordinances for Land Use Control				
(2) Review of CLUP and PPP				
(3) Organization and Human Resources Development				
4. Setup and execution of Flood Warning and Evacuation				
(1) Setup of Local Disaster Coordinating Committee				
(2) Formulation of Calamities and Disaster Prevention Plan				
(3) Establishment of Disaster Operation/Evacuation Center				
(4) Development of Flood Hazard Map				
(5) Development of Hydrological Gauging Network				
(6) Training for Flood Warning and Evacuation				

Table 11.5 Sharing Roles for Each Related Agency and Road Map for Structural Measures



Legend

DPWH : Department of Public Works and Highways
Cavite : Provincial Government of Cavite and LGUs
DENR : Department of Environmental and Natural Resources
NEDA : National Economic Development Authority
F/S : Conduting of F/S
D/D : Conduting of D/D

Items/Responsibilities to be executed by each Agency concerne	
: Issuance of ECC	: Undertaking of Construction
: Implementation Approval of the Project	: Preparation of Budget of O&M
: Budgetary Approval for Construction and Compensation	: Operation and Maintenance Activities
: Preparation/Approval of RAP & Development of Relocation Site	: Monitoring and Evaluation (Continuously)
: Implementation of Land Acquisition	: Monitoring and Evaluation (Periodically)
: Implementation of House Relocation	

Note: All the responsibilities/tasks shall be completed in advance of the priod marked for each actibity by executing Agencies.

Table 11.6 Execution Body and the Roles for Structural Measures

Term	Item	Execution Bodies and the Roles			
		DPWH	**Cavite (LGUs)**	**DENR**	**NEDA**
Preparation Period	ECC	Preparation Submission	Support	Issuance	
	Project Approval	Preparation		-	Evaluation Approval
		Document (e.g. ICC-CC)			
	Budgetary Arrangement	Conclusion of MOA		-	Approval
		Loan Agreement (if Any)			
Pre-Construction and Construction Period	Detailed Design and Bidding	Execution	-	-	-
	Resettlement Action Plan (RAP)	-	Preparation	Evaluaiton Monitoring	-
	Development of Resettlement Site	-	Execution	-	-
	House Relocation	-	Execution	Monitoring	-
	Land Acquisition of Project Site	Execution	-	-	-
	Construction	Undertaking	-	Monitoring	-
	O&M	Preparation of Budgetary Arragement	Preparation of Budgetary Arragement	-	-
Operation and Maintenance Period	O&M	Responsible for River Structures thru District Office	Responsible for Drainage Structures, Retarding Basins, and other structures incl. On-site regulation ponds	Monitoring	-

Note : ECC : Environmental Compliance Certificate
ICC-CC : the Investment Coordination Committee-Cabinet Committee

Table 11.7 Executing Bodies for Proposed Non-structural Flood Mitigation Programs

Work Item	Executing Body
1. Cleanup of Water Way	
(1) Setup of system for declogging at critical bottlenecks	DPWH, Municipality and Community (Barangay)
(2) Setup of system for IEC	Members of Oplan Linis Cavite
(3) Setup of system for capacity development	Members of Oplan Linis Cavite
(4) Development of materials for IEC and capacity development	Members of Oplan Linis Cavite
(5) Open of seminar for IEC and capacity development	Members of Oplan Linis Cavite
(6) Installation of signboard	Members of Oplan Linis Cavite
2. Prevention of Encroachment to River Area	
(1) Setup of boundary of river area	TFPSSS at Provincial and Municipality Level
(2) Development of inventory on dwellers in the river area	TFAPSSS at Provincial and Municipality Level
(3) Relocation of dwellers in the river area	TFAPSSS at Provincial and Municipality Level
(4) Setup of management system of the river area	TFPSSS at Municipal Level and MDCC
(5) Land zoning in the river area	MPDO and MDCC
3. Enactment of ordinance for construction of on-site flood regulation pond	
(1) Preparation of draft of ordinance	Office of Legislative Council, PPDO and MPDO
(2) Evaluation and approval of the draft by Legislative Council	Legislative Council (Sangguang Panalawigan)
(3) Promulgation of the ordinance	Provincial Governor
4. Setup and execution of Flood Warning and Evacuation	
(1) Reorganization of PDCC and MDCC	Existing PDCC and MDCC
(2) Setup of BDCC (community-based flood warning and evacuation system)	Existing BDCC
(3) Development of flood risk map	MDCC and BDCC
(4) Setup of stepwise flood warning and evacuation procedures	PDCC, CDCC, MDCC and BDCC
(5) Establishment of hydrological gauging system	PDCC, CDCC, MDCC and BDCC
(6) Establishment of operation center	PDCC, CDCC, MDCC and BDCC
(7) Establishment of evacuation center	PDCC, CDCC, MDCC and BDCC
(8) Establishment of communication system	PDCC, CDCC, MDCC and BDCC
(9) Setup of system for IEC	PDCC, CDCC, MDCC and BDCC

Note (1) : All works by the executing bodies are subject to coordination by the newly proposed Flood Mitigation Committee (FMC)

Note (2) : TFPSSS = Task Force against Proffesional Squatters and Squatting Syndicates headed by Provincial Houseing and Urban Development Officer
PPDO = Provincial Planning and Development Office
CPDO = City Planning and Development Officw
MPDO = Municipal Planning and Development Office
PDCC = Provincial Disaster Coordinating Council
CDCC = City Disaster Coordinating Council
MDCC = Municipal Disaster Coordinating Council
BDCC = Barangay Disaster Coordinating Council

Table 11.8 Existing and Potential Sites identified for Ongoing and Future Resettlement Programs within the Province of Cavite

Location	Area (ha)	Beneficiaries	Status	Remarks
1 Bgy. Langkaan I, Dasmarinas	7.0	(1) Families affected by on-going demolition from danger areas and other public lands (2) Homeless teachers and other national or provincial government employees	Acquired through community ownership scheme under the CMP ; Phased site development and improvement is in progress; financed by private developer, with NHMFC acting as guarantor.	Limited capacity; may accommo-date a few PAFs from Gen. Trias who will be affected by off-site retarding basin and drainage improvement
2 Bgy. Langkaan II, Dasmarinas	5.0	Families who will be affected by the subsequent wave of anti-squatting drive.	For future acquisition, out of the proceeds from amortization for the Bgy. Osorio resettlement site.	May accommodate PAFs from Gen. Trias who will be affected by off-site retarding basin and drainage improvement
3 Bgy. Pasong Kawayan II, Gen. Trias	53.0	Homeless government employees, factory workers and minimum wage earners who are PAG-IBIG members	Inaugurated in early 2008 after successful loan negotiation with a government bank. Land development is now in progress through a private developer. 25%-30% of the area is planned as socialized housing for informal settlers.	May accommmodate PAFs from Bacoor, Kawit and Imus who will be displaced by river improvement, off-site retarding basin and drainage works
4 Bgy. Pasong Camachile, Gen. Trias	44.0	Families affected by the on-going demolition from danger areas and other public lands	For future acquisition, out of the proceeds from amortization for the Bgy. Osorio resettlement site.	May accommodate PAFs from Gen. Trias who will be displaced by off-site retarding basin
5. Pamayanang GK ng Imus, Bgy. Alapan II, Imus	2.3	Poorest of the poor families in Imus	First batch of resettlers (32 HH) already in place; seond batch (32 HH) to be relocated before the end of 2008.	1.5 ha available for development as resettlement site for the PAFs from Imus who will be displaced by river improvement works.
6 Bgy. Toclong, Kawit	7.3	Fisherfolks and coastal communities affected by recent demolition in danger areas, fishpond areas for priority development and areas around the Aguinaldo Shrine	The province has initiated dialogues with the LGUs for the purpose. PHDMO is presently ngotiating with landowner to purchase a 1.3 ha area in Toclong; Bacoor has identified another 2.0 ha lot in Toclong for Bacoor PAFs and will negotatiate with owner soon; Kawit municipality is negotiating with an owner of a 4.0 ha land within this same barangay	May accommodate fisherfolks, fishpond tenants and other residents from Kawit and Bacoor who will be affected by river improvement, retarding basin and coastal dike. This may be the best resettlement option for PAFs of Kawit and Bacoor.
7. Bgy. Sta. Isabel, Kawit	1.0	Informals settlers from fishponds and coastal areas affected by recent demolition activities	Kawit municipality acquired this site but land development and basic infrastructure are still lacking; 20 families now occupy the site	Slots will be allotted by LGU to accommodate PAFs who will be affected by dike construction
8. Camp David GK Village Pabahay Site, Bgy. Sta Rosa I, Noveleta	1.4	Squatter families who were displaced by priority national government railway project and natural calamities	Presently occupied by 33 families; 34 more units are under construction for the next batch of beneficiaries. The site is good for 150 households	May accommodate up to 90 PAFs from Noveleta who will be displaced by river and drainage improvement
9. PNOC GK Village, Bgy. Ligtong III, Rosario	1.2	Families now informally occupying PNOC land	On-site resettlement for 10 squatter families. The site could accommodate 120 households.	May accommodate PAFs from Rosario who will be affected by drainage improvement
10 Bgy. Halang, Naic	No data	For fisherfolks who will be displaced by clearing of danger areas along the coast	Site still to be identified	May accommodate PAFs fishing communities from Bacoor, Kawit, Noveleta and Rosario who will be displaced by river improvement, drainage and coastal structures
11 NHA Resettlement Sites (private subdivisions)	No data	Squatter families who were displaced by priority national government projects and private land developments in Metro Manila and suburbs	Some units are not yet occupied; other units have serious default problems on loan repayment and may be re-possessed	Subject to negotiations with NHA, some units may be awarded to potential PAFs who are qualified PAG-IBIG members, if cancellation of award to original absentee awardees is feasible
Total	***122.2+***			

-IBIGSource: PHDMO, 2007; NHA,2008; LGU-MPDCs, 2008

Table 11.9 DPWH Resettlement Policy Compensation Matrix

Type of Loss	Application	Entitled Person	Compensation / Entitlements
LAND (Classified as Agricultural, Residential, Commercial or Institutional)	More then 20% of the total landholding lost or where less than 20% lost but the remaining landholding becomes economically unviable	PAF with TCT or Tax Declaration (Tax Declaration can be legalized to full title)	PAFs will be entitled to: + Cash compensation for loss of land at 100% replacement cost at the informed request of PAFs + If feasible, land for land will provided in terms of a new parcel of equivalent productivity, at a location acceptable to PAFs, or + Holders of free or homestead patents and CLOAs under CA 141 (Public Land Act) will be compensated on land improvements only. + Holders of Certificate of Land Ownership Award (CLOA) granted under the Comprehensive Agrarian Reform Act shall be compensated for the land of zonal value. + Cash compensation for damaged crops at market value at the time of taking. + Rehabilitation assistance in the form of skills training equivalent to the amount of P15, 0000.00 per family, if the present means of livelihood is no longer viable and the PAF will have to engage in a new income-earning activity.
		PAF without TCT	+ Cash compensation for damaged crops at market value at the time of taking. + Agricultural lessor are entitled to disturbance compensation equivalent to five times the average of the gross harvest for the past 3 years but not less than PhP15, 000.00.
	Less than 20% of the total landholding lost or where less than 20% lost or where the remaining landholding still viable for continued use	PAF with TCT or Tax Declaration (Tax Declaration can be legalized to full title)	PAF will be entitled to: + Cash compensation for lost of land at 100% replacement cost at the informed request of PAFs + Holders of free or homestead patents and CLOAs under CA 141. (Public Lands Act) shall be compensated on land improvements only. + Holders of Certificate of Land Ownership Award (CLOA) granted under the Comprehensive Agrarian Reform Act shall be compensated for the land at zonal value. + Cash compensation for damaged crops at market value at the time of taking.
		PAF without TCT	+ Cash compensation for damage crops at market value at the time of taking. + Agricultural lessor are entitled to disturbance compensation equivalent to five times the average of the gross harvest for the past 3 years but not less than PhP15, 000.00.
STRUCTURES (Classified as Residential, Commercial or Industrial)	More than 20% of the total landholding lost or where less than 20% lost but the remaining structures no longer function as intended or no longer viable for continued use	PAF with TCT or Tax Declaration (Tax Declaration can be legalized to full title)	PAF will be entitled to: + Cash compensation for entire structure at 100% replacement cost. + Rental subsidy for the time between the submission of complete documents and the release of payment on land.
		PAF without TCT	PAF will be entitled to: + Cash compensation for entire structure at 100% replacement cost + Rental subsidy for the time between the submission of complete documents and the release of payment on land.
	Less than 20% of the total land holding lost where the remaining structure is still viable for continued use	PAF with TCT or Tax Declaration (Tax Declaration can be legalized into full title)	+ Compensation for affected portion of the structure.
		PAF without TCT	+ Compensation for affected portion of the structure.
IMPROVE-MENTS	Severely or marginally affected	PAF with or without TCT, tax declaration, etc.	PAF will be entitled to: + Cash compensation for the affected improvements at replacement cost.
CROPS, TREES, PERENNIALS			PAF will be entitled to: + Cash compensation for crops, tress, and perennials at current market value as prescribed by the concerned LGUs and DENR