CHAPTER VIII FORMULATION OF MASTER PLAN

8.1 General

Based on the outcomes from the plan formulation studies in Chapters V and VI and comparative studies in Chapter VII, this Chapter describes the formulation of a proposed Master Development Plan of the Agos River basin.

Chapter VII revealed that Development Scenario B would offer the most prospective development plan in the aspect of multipurpose development program including water supply for Metro Manila. Accordingly, the proposed master plan is formulated in line with the plans contemplated in the Scenario B.

The proposed master plan is presented dividing into the following two parts:

Master Development Plan towards the Year 2025: (Sections 8.2 to 8.5)

This constitutes mainly the water supply development plan for meeting water demand up to the year 2025 according to Scenario B (Section 8.2). Also, the plan includes hydropower projects associated with the water supply projects (Section 8.3), measures for mitigation of socio-environmental issues (Section 8.4) and some projects proposed for regional development of the basin (Section 8.5).

Optional Development Plan: (Section 8.6)

This includes the development option of the Laiban Dam for water supply as an alternative to the Scenario B development or otherwise as a development potential for meeting the demand after the year 2025. A hydropower scheme associated with the Laiban Dam development is also included. Hydropower development at the Kanan No.2 Dam is categorized in this optional development plan, since the scheme is independent from the water supply development towards 2025 and can be implemented at any period, not limited to the period up to 2025.

Succeeding Sections 8.2 to 8.6 discuss the projects proposed in the master plan. Figure 8.1 shows the configuration of the proposed master plan for the Agos River basin.

8.2 Water Supply Development towards Year 2025

8.2.1 Configuration of Proposed Development Plans

Development Scenarios B envisages the development of Kaliwa Low Dam in the 1st stage and Agos Dam in the 2nd stage for meeting water demand up to the year 2025 (3,000 MLD in total in daily average supply quantity). The sequence of proposed development is as shown in table below.

Sequence of Proposed Water Supply Development

Proposed Development	1st Stage Develop	2nd Stage Development	
		Stage 2-1	Stage 2-2
Water Supply Q'ty (Daily Average)	550 MLD initially	Additional 950 MLD	Additional 1,500 MLD
Kaliwa Low Dam	Supply of 550 MLD initially	(Supply substituted by Agos Dam)	-
Agos Dam	-	Supply of 1,500 MLD, incl. 550 MLD formerly supplied by Kaliwa Low Dam	Supply of additional 1,500 MLD
Waterways	1st Waterway for 1,500 MLD	-	2nd Waterway for additional 1,500 MLD
Water Treatment Plant (WTP)	WTP #1 – 750 MLD	WTP #2 - 750 MLD	WTP #3 & #4, each 750 MLD
Main Service Reservoir (SR)	SR #1 for 1,500 MLD (380,000 m^3)	-	SR #2 for additional 1,500 MLD (380,000 m^3)

Note: The above figures in MLD represent daily average supply quantity. The capacity of waterway and WTP is planned to be 1.21 times the daily average supply capacity to meet the day peak demand.

8.2.2 Kaliwa Low Dam

Kaliwa Low Dam is a temporary structure serving only for three (3) years until Agos Dam is completed. The main aim of building the Kaliwa Low Dam is to achieve the earliest commissioning of water supply to Metro Manila.

Kaliwa Low Dam will take water from natural runoff available at the site. The design intake discharge at this stage is 6.4 m^3/sec (equivalent to 550 MLD), which corresponds to 90 % dependable discharge at the Kaliwa Low Damsite. This implies that there will be a risk of failure of water supply at the designated discharge (6.4 m^3/sec) for a 10 % time period.

Water treatment plant #1 unit will be installed in the 1st stage. The plant has a treatment capacity of 910 MLD (1.21 times 750 MLD), which is equivalent to 10.5 m^3/sec in discharge. This means that Kaliwa Low Dam can supply water at the maximum quantity of 10.5 m^3/sec when the river runoff is more than that. Supply more than the designated 6.4 m^3/s could contribute to conservation of water from the Angat water supply system. The 10.5 m^3/sec corresponds to 79 % discharge at the Kaliwa Low Dam site.

The main body of Kaliwa Low Dam is a temporary embankment construction of random-fill materials. The downstream slope of the embankment is protected by wood crib-works filled with rocks to allow overtopping of excess flow throughout the year including flood flow during the rainy season. After the Agos Dam is completed, the upper half of the embankment will be removed by an excavator mounted on pontoons, so that it would not be a barrier causing excessive future sediment accumulation in the dam upstream area.

Construction of Kaliwa Low Dam will include the construction of two intake structures: one for the 1st waterway and the other for the future 2nd waterway.

8.2.3 Agos Dam

Water supply from Kaliwa Low Dam can meet water demand for only three years at the capacity of 550 MLD in daily average supply volume. By the period before the water demand reaches 550 MLD, Agos Dam should be completed.

After the Agos Dam is commissioned, Kaliwa Low Dam is submerged by the Agos reservoir. The runoff having been taken at the Kaliwa Low Dam is then deemed to be nil and substituted by the water yield from the Agos reservoir. The reservoir water yield, as a permanent water source, is designed to have a higher reliability capable of supply even in a dry hydrological regime occurring once 10 years, which roughly corresponds to 97-98 % dependability in the long term.

Agos Dam is proposed to be a Concrete Face Rockfill Dam (CFRD) having a maximum dam height of 164 m. The dam crest height is EL. 164 m. The Full Supply Level (FSL) of the reservoir is presently planned to be EL. 159 m, while the Minimum Operating Level (MOL) EL 133 m. The proposed FSL is a marginal water level that would possibly not inundate Barangay Daraitan even under the condition of rise of water level due to flood (See also Subsection 8.4.2).

The reservoir has 714 million m^3 of gross storage capacity and 356 million m^3 of effective capacity. With this effective capacity, the reservoir could yield 60.2 m^3/sec of water under the hydrological criteria stated above, of which 34.7 m^3/s is used for water supply (at time of supply of 3,000 MLD) and 25.5 m^3/s for hydropower generation.

Note: In the subsequent feasibility study (F/S), the crest elevation of the dam was modified to EL.165.2 m. The reservoir capacity and, accordingly, reservoir water yield were also modified based on the finding revealed from new topographic maps prepared in the F/S.

Geological study has identified that Agos Dam scheme would involve the following technical risk factors:

(a) Risk for high seismicity due to proximity to the Philippine Fault (Infanta Fault), which is known active in recent age

(b) Risk due to existence of faults in and around the damsite

(c) Possibility of landslide on the right abutment

(d) Thick riverbed deposit of some 40 m deep

(e) Concern for leakage of reservoir water through Daraitan limestone mass

These technical issues should be clarified in the next feasibility study stage.

8.2.4 Kaliwa-Angono Waterway

To supply the ultimate quantity of 3,000 MLD (daily average), the plan envisages constructing two waterways, 1,500 MLD per waterway. Taking into account day peak demand, each waterway has a conveyance capacity of 1,820 MLD or 21.0 m^3/sec (1.21 times the daily average supply quantity) to cope with the day peak demand.

Waterway is laid out between Kaliwa intake and Angono service reservoir for a length of approximately 39.0 km, consisting of Tunnel No.1 of 28.0 km, a pipeline of 4.4 km, Tunnel No.2 of 5.7 km, a powerhouse and a water treatment plant in the remainder length. Midway along the waterway, a pump station is provided to deliver water by a branch pipeline to a service reservoir at Antipolo plateau. The powerhouse will be built only at the 2nd stage (See Subsection 8.3.1 hereinafter).

Note: Name of the service reservoir was modified to 'Taytay Service Reservoir' in the F/S. The total length of waterway was also modified to 38.0 km based on a new waterway layout plan.

In the 1st development stage when the water is taken from Kaliwa Low Dam, the 1st waterway conveys 6.4 m^3/sec of water (550 MLD) normally or 10.5 m^3/sec (910 MLD) at the maximum to the full capacity of water treatment plant #1 unit.

After the Agos Dam is completed, the water conveyance quantity increases each year according to the growth in water demand in Metro Manila. The present plan assumes that the 1st waterway will be at full capacity around the year 2019. By that period, the 2nd waterway will be commissioned.

8.2.5 Abuyod Water Treatment Plant

A water treatment plant will be constructed at a location in the Municipality of Teresa, about 2 km south of Abuyod village or about 6 km east of Antipolo city. The site is located nearby a provincial road connecting Antipolo and Riza. The area consists of mixture of paddy field, upland farms, residential land and hilly shrub areas. Air photographs taken in 1999 indicate that there are about 10-20 small buildings (residential housing) and 10 relatively large buildings (presumably warehouse or greenhouse) in the area. These buildings are to be relocated.

Note: The location of water treatment plant was modified to Lagundi, Morong, in F/S. The new location is about 1 km east from that contemplated in M/P. The new name of the plant is Morong water treatment plant.

The water treatment plant (WTP) will be constructed in four phases. In the 1st stage, WTP #1 is installed together with Kaliwa Low Dam and the 1st Waterway. After completion of Agos Dam, WTP #2 to #4 will be installed stage-wise according to the increase of supply requirement. The 1st Waterway will feed water to WTP #1 and #2 and the 2nd Waterway to WTP #3 and #4. Each WTP will have a capacity of 910 MLD, which will process a daily average water quantity of 750 MLD.

A total area of about 70 ha will be required to accommodate the four WTP facilities.

8.2.6 Angono (Taytay) and Antipolo Service Reservoirs

Treated water is conveyed to service reservoirs provided at the end of waterways. These reservoirs will be the off-take point for delivery to the water distributors. Two service reservoirs are proposed: one is the main service reservoir built near Angono and the other a local service reservoir built at Antipolo.

The main service reservoir is located in the area of gentle hills on the north of Angono town. The area is in the territory of Municipality of Taytay. To receive 3,000 MLD of water (day average), two reservoirs are constructed, one each for the

two waterways. The effective storage capacity of each reservoir is 380,000 m^3, which corresponds to 6-hour retention volume. High water Level (HWL) and low water level (LWL) are set at EL.72 m and EL. 66 m, respectively, taking into account the altitude of supply areas in Metro Manila ranging from EL. 5 m to EL. 50 m.

The Antipolo supply area is situated at a higher attitude than EL. 200 m. Water is pumped up at a pump station provided on the midway of treated water pipeline and conveyed to a service reservoir located at Antipolo plateau. The capacity of the service reservoir is 22,000 m^3 at initial stage, which will be increased to 128,000 m^3 and further to 272,000 m^3 at ultimate stage.

Note: The capacity of Antipolo service reservoir was modified to 180,000 m^3 in F/S.

8.2.7 Distribution Mains

From the main service reservoir, water is further conveyed to Metro Manila supply areas through distribution mains. The service area is planned to be the areas covering the southwestern part (Cavite area), southern part (Montinlupa area) and southeastern part (Antipolo-Tanay area).

The estimated total length of distribution mains is some 122 km. The diameter ranges from 250 mm to 4,200 mm. The present plan contemplates that the facilities will be built by the present water distributors: i.e. MWSI and MWCI.

8.3. Hydropower Development

Water development plan proposed in Section 8.2 includes two potential hydropower development schemes: (i) Abuyod power station built at the downstream end of the water conveyance tunnel and (ii) Agos power station at the toe of Agos Dam.

8.3.1 Abuyod Power Station

A power station is planned at the outlet of water conveyance tunnel near Abuyod.

In the initial stage when the water is taken from Kaliwa Low Dam, no power station will be proposed in view of a relatively small discharge (6.4 m^3/s) and small effective head available (less than 10 m).

After the raising of the head water level by the impoundment of Agos reservoir and the completion of the 2nd waterway, a power station will be built with the installed capacity of 12.5 MW. Due to a large variation of effective head dependent on the draw down of the Agos reservoir water level, the 95 % guaranteed power output is relatively small (7.0 MW) even at the condition of full discharge by two waterways (3,000 MLD=34.7 m^3/s average). The annual energy production is 98.6 GWh.

Power generation at the Abuyod power station depends entirely on water discharge conveyed for water supply, which increases year by year depending on the growth of water demand. The plant is operated as a base-load plant.

Note: The location of powerhouse was modified in F/S to Lagundi (Lagundi P/S) due to change of location of water treatment plant. The Lagundi scheme, however, was finally ruled out due to the low financial viability evaluated in F/S.

8.3.2 Agos Power Station

A powerhouse is built at the toe of the Agos Dam. The plant uses the water available in excess of water transferred at the Kaliwa intake for water supply. The plant is planned to be a 6-hour peaking plant (subject to further review in the feasibility study). The installed capacity is 85.6 MW, and annual energy production is 499.0 GWh and 418.9 GWh under the conditions of water transfer of 1,500 MLD and 3,000 MLD, respectively.

Construction of an afterbay weir will be required for re-regulating peaking discharges released from the power station. The cost of the afterbay weir is estimated to be US$ 35 million. This cost burden is supposed to reduce the economic attractiveness of the power scheme. Alternative choice is to propose a semi-peaking plant allowing power generation without the afterbay weir. This will be examined in the feasibility study stage.

Note: In F/S, a semi-peaking plant with installed capacity of 51.5 MW was finally optimized.

8.4 Measures for Mitigation of Socio-Environmental Issues

Socio-environmental study (Chapter IV) has identified several potential issues to arise due to the proposed projects. These issues are taken into account as the components constituting the part of the master plan.

8.4.1 Reduced Sediment Yield at Agos River Mouth (E-1 in Figure 8.1)

A previous study (JICA 1981) estimated the rate of sediment yield to be 557 m^3/km^2/year. Present study assumes a rate of 1,000 m^3/km^2/year for a conservative estimate of reservoir sedimentation. On the basis of the latter figure, sediment transport at the Agos damsite (catchment area 860 km^2) is estimated to be 860,000 m3 annually. Since the Agos Dam is presumed to trap about 90 % of suspended loads and 100 % of bed loads, sediment released from the Agos Dam after its completion will be about 10 % of the present level. This will have a large impact on the downstream river morphology.

(1) Impact to Downstream River Use

The reduction of sediment release at Agos Dam will cause initially the degradation of riverbed levels in the lower river course. Further, the constant release of dry season flow from Agos dam is 25.5 m^3/sec (after water transfer of 3,000 MLD to Metro Manila), which is less than the present 90 % discharge (30.2 m^3/sec).

These changes of riverine condition should not cause the inconveniences of water use in the downstream area (navigation, bathing and washing), and hence construction of some river facilities is proposed as described in Subsection 8.5.2 hereinafter.

(2) Impact to River mouth Alluvial Plain

A major impact of serious concern is the possible change of river mouth morphology and moreover the possibility of coastal erosion in the worst case.

Figure 8.2 shows the change of river courses and coastlines between the years 1952 and 1995. The base map is NAMRIA 1:50,000 map showing the conditions of 1952 and the blue line indicates the latest conditions delineated from air-photographs taken in 1995. The Figure also shows Infanta Fault (PFZ). The following are interpreted from the Figure:

(a) No notable change of coastlines seems to have taken place during these 43 years, although the accumulation of sediment deposits (sandbars) at the river mouth is more active in 1995.

(b) Heavy meanders with bank erosions of the Agos River have taken place near Ilog on the right bank and at General Nakar on the left bank during 1952 and 1995.

(c) Agos River turns very sharply to the north at a point just downstream of the Infanta Fault. This infers that there was a large displacement of lands along the Fault around the area in the past. It is supposed that Agos River flowed directly east in earlier times and formed the main part of the alluvial plain south of Infanta.

(d) Gradient of the seabed is relatively gentle in the river mouth area and the northern area, but turns steep in the area near Dinahican. It is not known at this stage whether this condition is maintained on account of discharge of sediments from the Agos river mouth or by equilibrium in sea sand drift.

In case the Agos Dam is built, there would be further change of the morphology of alluvial plain and coastline. The change of coastline can be observed by installing surface markers at several cross sections along the coast and conducting the sounding survey of seabed levels periodically.

This issue should be further investigated during the feasibility study stage.

8.4.2 Resettlement Schemes (E-2 in Figure 8.1)

As stated in Chapter IV, proposed water resources development will require a varying extent of relocation of households. Construction of waterways and water treatment plants will also include the relocation. This issue is an important sociological parameter determining the feasibility of the proposed projects and hence is taken up as a planning element of the master plan.

(1) Kaliwa Low Dam

Normal high water level of the pond created by the Kaliwa Low Dam is EL.125 m. The pond inundates the bottom part of the river valley in a 4-km reach up to the downstream part of the Daraitan limestone gorge. The present plan foresees that there would be no PAFs (project affected families) to be directly affected. This will however be subject to confirmation in the next investigation.

(2) Agos Dam

The present plan envisages the FSL of Agos reservoir to be EL. 159 m. This water level is a marginal level that would not inundate the main area of Barangay

Daraitan even during flood period and also would not cause a vital influence on the subsequent development of Kanan No.2 Dam (riverbed level at EL.150 m).

At present, the average elevation of Barangay Daraitan is assumed to be around El.169 m. If subsequent investigation reveals a possibility of inundating Barangay Daraitan and public unacceptance of relocation, the FSL of Agos reservoir will have to be revised with a view to minimizing the relocation requirement.

Agos reservoir will inundate the low areas of several Sitios of Barangays Pagsangahan and Magsaysay situated along the Kaliwa River in the stretch downstream from Barangay Daraitan, and also at least one Sitio of Barangay Mahabang Lalim along the Kanan River. Although the exact number of PAFs is subject to further survey, the present plan conservatively assumes that about 300 families would possibly be affected.

Note: Number of affected households was revealed in F/S to be some 170 households.

The immediate action in mitigating the impact of displacement of PAFs would be to design a comprehensive and feasible resettlement action plan (RAP) for the displaced residents within the reservoir area. The feasibility of relocating the 300 PAFs to higher ground, but still within the reservoir's watershed area, may be a viable option worth studying. This would mitigate the impact of dislocation because the resettlement site would still be within the same familiar confines.

Some of the PAFs are Indigenous People (IPs), such as Dumagats and Remontados. Their displacement is governed by Sections 6-8 of Rule IV of the Indigenous People Rights Act of 1997, where a Socio-Cultural Impact Statement must be complied with and submitted to the IP community and the NCIP. The preparation of RAP should duly take into account the requirement of the Act, including provision of their new livelihood area.

(3) Water Conveyance Pipeline and Water Treatment Plant

Total length of the Kaliwa-Angono Waterway is 39.0 km, of which above-ground structures such as pipelines, water treatment plant and service reservoirs will be laid out in the sections of 5.3 km long. The estimated number of PAFs in the sections is around 50.

The PAFs will be relocated to areas in the vicinity of original location, with provision of suitable lands for compensation. A social acceptability plan must be prepared in order to identify in advance the sociological issues that may arise in connection with the relocation.

8.4.3 Watershed Management in Kaliwa River Basin (E-3 in Figure 8.1)

Kaliwa river basin is yielding a large quantity of sediments due mainly to deforestation over a long period and active development of cultivation lands. This constitutes an adverse factor for water resources environment in the Agos River basin, in terms of shortening the service life of any reservoirs that may be developed (e.g. Agos reservoir). Also, destruction of forest cover results in wildlife habitat loss and, consequently, diminishing biodiversity and wildlife.

The Forest Management Bureau (FMB) of DENR is currently implementing a Watershed Rehabilitation and Management Improvement Project for the Kaliwa catchment. Its primary objective is to organize, mobilize and empower the watershed stakeholders to become active partners of the FMB in implementing re-vegetation and sustainable management strategies for transforming the watershed into a productive area. The FMB study identified the existing problems in the Kaliwa watershed: i.e., illegal timber poaching, continuous grazing, illegal gathering of fuelwood, kaingin making (slash and burn farming) and forest fires.

Since the recovery of a sound watershed environment takes a relatively long period, the activities of Kaliwa Watershed Management Project should be further strengthened and continued henceforward.

8.4.4 Conservation of Eco-System in Kanan-Agos Watershed (E-4 in Figure 8.1)

Kanan-Agos basins are covered by thick vegetation, ranging from primary (old growth) forest in the upper watershed to residual forest in the lower watershed. This vegetation cover is home to some migratory and permanent endangered faunal species, such as Philippine eagle (*Pithecophaga jeferryii*), Philippine deer (*Cervus marianus*), wild pig *(Sus philippinensis*), monitor lizard (*Varanus salvator*) and kalaw (*Buceros hydrocorax*). These species are important components in the stability and productivity of the ecosystem.

Extensive logging, especially in the Agos-Kanan River watershed is already posing a serious threat to the primary forest in the upper catchment. Improved access by roads or navigation on the reservoir will stimulate human activities in the upper watershed. A major part of the Kanan and Agos basins are designated as National Park, Wildlife Sanctuary and Game Reserve areas. In order not to cause any adverse effects to such protected areas, the planning and design of the project should take into account adequate precautionary measures.

The impoundment of the Agos reservoir and the construction of Kanan No.2 Dam (including the reservoir, access road and transmission line) will have significant impacts on the forest environment and ecological systems in the basin. Hence, it is proposed that such impacts should be monitored under a single comprehensive monitoring program over a long period. In line with this comprehensive program, each individual project will evaluate the existing conditions/anticipated impacts and identify adequate mitigation measures.

8.5 Projects for Enhancement of Regional Development

The implementation of water resources development will cause various inconveniences to people in the project area, such as the relocation of settlements, change of river environments, disconnection of local communities due to reservoir impoundment, etc. For compensation for those inconveniences, it is worthy of considering the implementation of projects aiming at improvement of people's livelihood and enhancement of regional economic activities. The following describe the outline of the projects proposed in this respect:

8.5.1 Bank Erosion Protection Work in the Infanta-General Nakar Alluvial Plain (R-1 in Figure 8.1)

In the Infanta-General Nakar alluvial plain, severe bank erosion is taking place along the both banks of the Agos river. Figure 8.2 shows that erosion at the heaviest portion is as large as 300-400 m during 1952 and 1995. The bank has been incised already very close to the main part of the General Nakar town. According to the people in the area and the Municipality Office, the most urgent project needed by them is the protection of the banks from further erosion.

The proposed work consists of river bank revetment work coupled with the installation of groins in selected portions of the river course. The work is proposed for implementation as a part of Agos Dam construction works.

8.5.2 Provision of Riverine Facilities (R-2 in Figure 8.1)

As stated before, the riverine environment of the reaches downstream from the Agos Dam will change significantly, e.g. degradation of riverbed level, decrease of dry season flow, etc. This will cause the people in the area to change the ways of water use or river use.

The proposed project is to provide structures for facilitating the people's use of the river, such as navigation, bathing and washing, at the places where people use the river. The proposed structures are the places for boat landing, bathing and washing, that would be usable at any river water levels. The number of such places will not be more than 30 in the river stretch of 20 km between Agos Dam and Infanta-General Nakar Plain.

8.5.3 Provision of Access Roads/Footpaths for the Communities (R-3 in Figure 8.1)

Resettlement scheme for the Agos Dam contemplates the relocation of the existing settlements to lands at higher elevations in the vicinity of original locations. The project being proposed herein is to provide access to those new resettlement areas by extending a road from the access roads built for the construction works. If the resettlement site is less populated or at a relatively remote location, access will be by footpath.

In addition to access facilities to resettlement sites, a trunk footpath connecting Agos Dam, Kaliwa Low Dam and Barangay Daraitan will be built. This footpath will facilitate the people's access to shops, schools, medical facilities and other public facilities located at Barangay Daraitan.

For improving the access to Barangay Daraitan, a causeway (for use during the dry season) and a footpath suspension bridge (for use during the flood season) will also be built just upstream of the existing ferry site.

8.5.4 Establishment of a Vocational Training Center at Barangay Daraitan (R-4 in Figure 8.1)

Some of the PAFs will have to change their occupation due mainly to resettlement outside the present livelihood area. To support sustainable livelihood of those affected people, a vocational training center will be established at Barangay

Daraitan. The center will be operated by the project during the period of construction works and later transferred to the Municipality of Tanay after the construction works.

The subjects of vocational training would depend on what skills the local people would like to acquire for earning their living. This would be surveyed in the next stage of investigation. It is supposed that the skills for woodworking, woodcrafts, rattan crafts, citrus farming and inland fishery may be the vocational subjects fitting the economy around the area.

8.5.5 Establishment of a Medical Clinic at Barangay Daraitan (R-5 in Figure 8.1)

In Barangay Daraitan, there are at present two health centers staffed by a nurse and a midwife, the latter coming once a week, which is less than the quality level required for a medical facility for the area having about 4,000 population. The proposed project is to build a medical clinic with the minimum required equipment and being staffed by a physician and a nurse.

The clinic will be operated by the project during the period of the project construction works and later transferred to the Municipality of Tanay.

8.5.6 Power Supply to Infanta-General Nakar Area (R-6 in Figure 8.1)

Infanta-General Nakar area is presently interconnected with NPC Luzon grid by a 69 kV transmission line. The power received from the grid is distributed by QUEZELCO.

The present plan contemplates to supply the power generated at Agos Power Station to the Infanta-General Nakar area by a 69 kV transmission line. Stable supply of power will contribute to the further development of economic activities in the area through stimulating industrial and commercial development in the area.

8.6 Optional Development Plan

8.6.1 Option of Laiban Dam Development for Water Supply Development

In this Section, Laiban Dam scheme is presented either as an alternative development plan to be implemented ahead of the Scenario B plan or as a development plan for meeting the water demand after the year 2025.

The reason for retaining the Laiban Dam scheme as an optional plan is twofold:

(a) The project is the "Committed Project" already authorized by the Government, through the Memorandum Order No.10 of August 5, 1998 that mandated the MWSS to immediately resume the implementation of the project.

(b) Laiban Dam project was evaluated as one of least-cost schemes comparable to the Development Scenario B in terms of unit water cost index.

However, it is noted that Laiban Dam alone cannot meet the demand of planning horizon (up to 2025). It requires successive commissioning of Agos Dam after 7-8 years. This case corresponds to the Development Scenario F, which was less favorably evaluated in the Scenario comparison in Chapter VII.

There are two hurdles for the implementation of Laiban Dam: one is the resettlement of about 3,000 households, which has been a long outstanding issue left unsolved since 1984, and the other is possible delay in completion due to time requirement for solving the resettlement issue. It depends on MWSS's decision and prospect in how quickly the resettlement issue could be solved and how fast the project could be commissioned.

In this respect, MWSS shall review the implementation program of the Laiban Dam scheme from the following aspects:

(a) Set up a resettlement study team within the MWSS, to review the reasons of present constraints and re-evaluate the possibility of solving the resettlement issue

(b) Review how properly to comply with the Memorandum Order No.10, incorporating the findings from the study (a) above

(c) Prepare an updated resettlement action plan (RAP) including the identification of additional relocation sites, as far as there is a prospect for solving the resettlement issue

(d) Resume the initial dialogue with representatives of the local government and PAFs based on the updated RAP, to sound the actual response from them

(e) Determine the project implementation program, either the Laiban Dam or the Scenario B Scheme, depending on the findings from the resettlement studies for the former and the feasibility study for the latter

In case the Laiban Dam is implemented prior to the Agos Dam, the overall development scenario will be as envisaged in Development Scenario F as stated above. Even in that case, the development program of Agos Dam is identical to the plans envisaged in Scenario B, except that Kaliwa Low Dam will not be required and Kaliwa-Angono 2nd Waterway required only after year 2025 for meeting water demand thenceforward.

In case the development of Laiban Dam at the immediate stage is not practicable due to the difficulty of solving the resettlement issue, the development potential should be preserved for future water supply needs for the year 2025 onward.

8.6.2 Options of Hydropower Development

In addition to two hydropower schemes mentioned in Section 8.3 before, there are another two hydropower development potentials: one is a scheme at the Kanan No.2 Dam and the other a scheme associated with Laiban Dam.

(1) Kanan No.2 Hydropower Scheme

Kanan No.2 Dam will be developed solely for hydropower development, independent from the water supply development mentioned in Section 8.2 before. The scheme can be developed at any period, disregarding the timeframe envisaged by this master plan (planning horizon up to 2025). Timing of the implementation of

Kanan No.2 Scheme is entirely dependent on the interest expressed by BOT Proponents. Power demand of the Luzon grid is already large enough to accommodate the power from Kanan No.2 Scheme at any time.

The power plant will be built at the toe of the dam as a peaking plant, where Agos reservoir will act as a re-regulating pond. The installed capacity is 209.5 MW under the assumption of 6-hour/day peaking operation and the annual energy production 503.6 GWh.

The water right of the Kanan River (at a quantity of 38.0 m^3/sec) was transferred from MWSS to the Municipality of General Nakar of Quezon Province under the permission of NWRB. After the transfer of the water right, the Quezon Province, together with BOT Proponents, independently prepared a dam development plan on the Kanan River, which aims at hydropower generation. The water right owned by the Quezon Province is effective until the year 2025. This implies that power development at the Kanan No.2 site will have to be formulated involving the Quezon Province.

The back water level of Agos reservoir (FSL 159 m) reaches the Kanan No.2 Dam site (riverbed elevation around EL. 150 m). This means that power development potential at the Kanan No.2 Dam would vary with the FSL of Agos reservoir.

(2) Pantay Hydropower Scheme associated with Laiban Dam

This scheme is an optional plan, only be possible in the case Laiban Dam is developed for water supply as stated in Subsection 8.6.1 before.

Under this plan, a power plant is built at Pantay at the downstream end of the conveyance waterway from the Laiban Dam (estimated as 19.6 MW). The plant will be operated basically as a base load plant (24-hour operation) using water conveyed for water supply purpose (1,830 MLD=21.2 m^3/s). Water conveyed in excess of the water supply requirement will be spilled out to a nearby river.

(3) Possibility of Hydropower Scheme at Toe of Laiban Dam

Laiban Dam has a potential of hydropower development if it is not developed for water supply. In this case, the power plant is built at toe of the Dam. However, the difficulty in resettlement issue involved in the project would not justify the Laiban Dam to be developed for hydropower purpose alone, since there are a number of alternative hydropower development sites in other river basins that are free from such sociological difficulty. Development of the Laiban Dam seems to be justified only for water supply purpose, in view of its unique location of proximity to the Metro Manila. Hence, this hydropower scheme was ruled out from the consideration in this master plan.

8.6.3 Resettlement Issues in Optional Development Plan

As a continuation of the descriptions in Subsection 8.4.2 before, the issues involved in the Kanan No.2 Dam and Laiban Dam developments are noted below.

(1) Kanan No.2 Dam

No firm information is available with regard to the number of PAFs in the reservoir area of the Kanan No.2 Dam (FSL 310 m). NAMRIA 1:50,000 map shows a settlement area in the upper reach of the Kanan mainstream, which is situated at altitude ranging from EL. 240 m to 280 m. The map indicates the existence of a number of houses, paddy field and shrub lands in gently sloped area. It is tentatively assumed that there would be at least 100 PAFs in the area (subject to confirmation in further study).

People residing at a settlement in the upper watershed would presumably be Indigenous People (IP). The same consideration as described in Subsection 8.4.2 should be given for the IPs in the Kanan No.2 area.

(2) Laiban Dam

Laiban Dam will involve a significant relocation program for some 3,000 PAFs. This has been a long outstanding issue hindering the implementation of the project since 1984. If the resumption of the project is attempted, a new "Resettlement Action Plan (RAP)" must be re-formulated to find social, cultural, economic and political acceptability from all identified stakeholders, particularly those adversely affected. It should be a detailed plan, complete with timetable and budget requirements.

The following are the issues to be tackled for solving this long outstanding issue:

(a) Number of PAFs should be re-surveyed based on updated information

(b) Land acquisition costs must be updated using actual values for the year 2001, since the price of land at the Kaliwa watershed has steadily been going up.

(c) Additional relocation sites must be identified, since only San Ysiro would not be enough to accommodate 3,000 PAFs.

(d) Two recent surveys have revealed that the existing compensation plan seems to be no longer acceptable to the PAFs. The plan must be reformulated so that dialogue with PAFs could be resumed smoothly.

According to the UPSARDFI survey, 76% of the respondents (PAFs) wants to be resettled in Tanay, which is a logical choice politically, culturally and socially. Being in the same municipality would allow for a better chance of being accepted by and integrating with the host community. Thus, serious efforts must be exerted by MWSS in locating other resettlement sites such as Palayang Bayan in Tanay, often mentioned by the relocatees.

A strategy being offered here is to look for and acquire several small sites within Tanay, which would become "satellite resettlement sites" to San Ysiro. Each site could be made to accommodate the PAFs of one project-affected Barangay. By having satellite resettlement sites, the entire resettlement process can be broken down into technically and financially manageable packages. It could also have a positive impact to the PAFs, as they could be resettled together with their own

co-Barangay members. However, this approach will take enormous effort and time for both the planning and implementation.

8.7 Implementation Schedule of Master Plan

Table 8.3 shows the proposed implementation schedule of the works contained in the Master Plan. The schedule is presented in two parts: one is for the "Master Development Plan towards the Year 2025", and the other for "Optional Development Plan". The main project in the former is water supply development for Metro Manila, which should be implemented for the period up to 2025. The latter presents the schedule of optional projects, the implementation of which depends on the decision of the Government or the interest offered by BOT Proponents.

The schedule also shows for each project the proposed procurement method, either BOT or ODA. Further description in this respect is given in Section 8.9 hereinafter.

Note: At the stage of M/P, the completion of the first stage project was assumed to be year 2010 on the basis of accomplishing a rushed program for pre-construction activities. However, further review in F/S suggested a practical completion schedule to be year 2013. F/S adopted the latter schedule.

8.8 Proposed Implementation Organizations

In the Progress Report (August 2001), it was proposed that there would be two alternatives for setting up the implementing organizations:

Alternative-A: Since the main component of the proposed project is the water supply for Metro Manila, MWSS will be assigned as the Executing Agency for the project implementation. In order to assist and coordinate the roles and duties of the MWSS, an "Inter-Agency Coordinating Committee" will be organized. The Committee will consist of representatives from the agencies concerned with water supply, hydropower, flood control, watershed environments, land acquisition and relocation, and other local public affairs.

Alternative-B: Once the development of the basin is commenced, the activities will continue for more than 20-30 years or longer. A proposal is to establish a new organization, called here "Agos River Basin Authority". The need of creation of the River Basin and Watershed Authorities (RBWA) is suggested in the latest version of the Mid-Term Philippines Development Plan prepared by NEDA. The Authority will oversee the integrated water resources management of the basin and also act as the Executing Agency for the proposed project. The Authority can entrust the physical part of the implementation work to MWSS as required. As is the case for Alternative-A, the "Inter-Agency Coordinating Committee" will also be organized.

The Steering Committee meeting for this Study, held on August 21, 2001, agreed that "MWSS will handle the implementation of the water resources development of the Agos River Basin until such time that a River Basin Authority is created". Following this conclusion, this Study hereby assumes an implementation framework in line with Alternative-A above: that is, MWSS to act as the Executing Agency.

The "Inter-Agency Coordinating Committee on Agos River Project" (ICCARP) will be composed of the representatives from NEDA, DPWH, DENR, DILG, DOE/NPC, NWRB, NIA, MWSS and Quezon Province. MWSS will chair the Committee. The detail of the roles and functions of the Committee are described in Chapter X hereinafter.

8.9 Proposed Financial Arrangement

8.9.1 Procurement of Works

This Study proposes the following procurement approaches to be most advantageous to the project:

(a) In line with the policy of the Government as well as the MWSS, the basic principle would be to procure the work through maximum use of private financing resources (e.g. BOT). This procurement will be applied to the following work components:

- Water treatment plant and transmission mains (from water treatment plant up to service reservoirs)
- Distribution mains (preferably to be implemented by the present water distribution concessionaires)
- Hydropower plants at Abuyod and Agos Dam
- Kanan No.2 hydropower development project, including the dam in this case

The facilities will be owned and operated by the BOT Contractor/ Concessionaire for a predetermined period.

(b) Construction of water resources facilities (dam and tunnel) involves greater technical risks and requires a large investment cost, which would be large burdens to most BOT Proponents. Recovery of the investment cost in a relatively short period (say, 15-20 years in the case of BOT scheme) will lead the water cost to be on the high side. The least costly approach is to build the water resources facilities as a Government project by utilizing the ODA loans with a low interest rate, which affords the amortization of costs over a longer repayment period (say, 30-40 years) and accordingly contributes to minimizing the burden to the water cost. The work components proposed for the implementation by the Government project include:

- Water source development, i.e. Kaliwa Low Dam and Agos dam
- Water conveyance tunnel up to Abuyod hydropower plant
- Projects proposed for regional development (See Section 8.5)

The fund for repayment of loans can be generated from the water rate charged to the BOT Concessionaires for water supply and electricity supply. For the regional development projects, fund from ODA grant aid may be available depending on the nature of the proposed project.

8.9.2 Financing for the Government-initiated Portion

As stated in Subsection above, the implementation of water resources facilities is not always appropriate for BOT scheme. The Government is the most suitable investor for the project. It is suited to an ODA project according to its scale of fund requirements and its public nature. A large portion of the total construction fund requirement can be financed by concessional ODA loan. The remainder will have to be raised by the Government either from the Government budget or the commercial bank loans, preferably from the former in order to reduce the water cost.

8.9.3 Financing and Procurement Method for BOT Portion

It is proposed that work components other than the portions of the Government project be built under the BOT scheme framework.

(1) BOT Project

The BOT project is a project in the field of public works that is built by the private sector investment for the Government. The private investors will BUILD the public facility, OPERATE it for an agreed period during which they will recover all the investment, and finally TRANSFER the facility to the Government.

(2) Project Finance

The BOT system is a method of project finance in which project funding is made by a new Project Company to be established for this specific project. The Project Company will be composed of various private companies who have concerns with this project area. The borrowings made by the Project Company shall be paid back only from the cash flow generated from the Project. In case the Project is liquidated, the lenders (banks) cannot claim the repayment from any other agents such as the parent companies of the Consortium (Project Company). This is a special nature of the Project Finance called “Non-recourse Finance”.

(3) Agos Project under BOT Framework

The schematic framework of a BOT Project is depicted in Figure 11.3 of Chapter 11 of Volume IV, Main Report of Feasibility Study. Under a BOT scheme, a Project Company will be newly established for the Agos Project. Stakeholders of a BOT scheme will include the following.

(a) The *Project Company* will be the executing organization of the Agos Project and be comprehensively responsible for all the aspects of the management of the Project.

(b) The *investors (shareholders)* of the Company will include water companies, power companies, construction companies and/or institutional investors. The equity capital of the Company will be raised from these investors. The share of the equity capital is assumed at 35% of the total fund requirement in the case of Laiban Dam BOT Study.

(c) The *financial institutions* will provide the balance of funds required by the Project beyond the equity capital of the investors of the Project Company. The share of loan to be obtained for the Project is assumed at 65% of the total fund requirement in the case of Laiban Dam BOT Study.

(d) The *construction joint venture* will participate in the Project construction works after being awarded the tender competition called by the Project Company. In many cases, they are one of the shareholders of the Company.

(e) The *operation company* will be responsible for the operation of the Project after its completion. They may also be such a shareholder of the Company as water company and/or power company.

Details of the terms and conditions of the BOT scheme framework will be discussed in the financial analysis of the Project to be conducted in the Feasibility Study.

8.9.4 Risks Factors in Financing for the Project

It is very important to find attractive financing sources in the case of the Government-initiated project and to create competitive bidding environments in the case of the BOT project, respectively. The financing conditions will give a greater influence on the financial viability of the proposed project. Failure of acquiring appropriate financing constitutes a risk for the successful implementation of the project.

The following briefly describe the factors to be taken into account for achieving the successful financing for the proposed project.

(1) Financing for the Government Project

The most ideal financing conditions are twofold. The first is (i) to procure the ODA bilateral loans and international multi-lateral loans of favorable financial terms (low interest rate and long-term repayment period) to cover the foreign currency portion of the fund requirement and a major part of the local currency portion. The second is (ii) to seek the possibility of acquiring the Government budget on grant basis to cover the remaining part of local currency portion.

For enabling the successful procurement of (i) above, the following should be clarified in the feasibility study:

(a) Fair economic viability of the project

(b) Fair financial viability of the project, with clarification of certainty of water sales, proposed water tariffs, and proposed principles for concluding the concession agreements with the concerned companies (covering both the BOT Project Company for Agos water supply project and the existing Water Distribution Companies)

(c) Programs for mitigating socio-environmental issues, particularly formulation of a feasible resettlement plan

(d) Institutional and organizational strengthening of the concerned agencies, for both the implementation and O&M

The possibility of (ii) above depends entirely on the Government policy for the proposed project. If the Government budget on grant basis is available, it will greatly contribute to reducing the water cost. If not available, the project has to seek the fund from local commercial loans.

(2) Financing of BOT Projects

Financial sources and conditions of the BOT projects depend on the proposals offered by BOT Proponents interested in the proposed project. The financing will principally consist of equity fund from the investors of the Project Company and loans from commercial sector financial institutions. The risk involved in the procurement of BOT project is whether the project could receive the interest from many BOT Proponents and have a competitive bidding environment.

In order to receive competitive BOT offers, the following should be clarified:

(a) Identification of all potential technical and socio-environmental risks

(b) Measures for elimination of potential sociological issues, particularly people-related issues such as relocation of people and acquisition of right-of way

(c) Certainty of water sales

(d) Principles of agreement with the Water Distribution Companies with regard to water sale price

(e) Soundness of anticipated cash flow throughout the whole stage of the project, e.g. in the aspects of net profit, return on equity, debt service coverage ratio, etc.

The interest rate of loans is a factor affecting the condition of BOT offers and ultimately the financial viability of the project. In this respect, the procurement of financing from official or semi-official financial institution(s) will be an attractive situation for the project, if the institution can provide a fund of low interest rate for the BOT projects.

Also, a possibility is the participation of MWSS in the Project Company to share the risks that the private sector cannot bear. It may create the procurement of a favorable BOT contract depending on the conditions offered from the BOT Proponents.

8.10 Economic Evaluation of the Master Plan

8.10.1 General

The master plan of the water resources development for Metro Manila was formulated and the Scenario B Scheme selected for water supply purpose. And the Kanan No.2 hydropower Scheme is also focussed as a hydropower development scheme of the master plan as an optional BOT scheme. This sub-chapter is devoted to examine the economic viability of these Schemes through computation of the economic internal rate of return (EIRR).

8.10.2 Conditions and Assumptions

The following conditions and assumptions are adopted for the economic evaluation.

1) The project cost is estimated based on the market price in June 2001. The various taxes and duties, however, are not included in the cost.

2) The monetary value is in principle indicated in US Dollar. The foreign exchange premium is adjusted to reflect real value by applying a standard conversion factor of 0.83 that was utilized in a recent appraisal report of Water Resources Development Project in the Philippines conducted by the World Bank. This adjustment is required, as there is a gap between the official exchange rate and real exchange rate due to the scarcity of foreign currency in the country.

   The US Dollar is adopted in estimating the local currency portion to avoid the influence of the possible future fluctuation in the foreign exchange rate of Philippine Peso.

3) The shadow pricing of the wage rate for unskilled labor is incorporated in such a way that 10% of the local currency portion in average is assumed as unskilled labor wage. This portion is discounted by 50% for shadow pricing of the unskilled labor. Under the current labor market situation with the unemployment ratio of 14% throughout the country, this shadow pricing is deemed necessary.

4) The economic value of the land to be committed to the Project including those to be submerged by the reservoirs constructed is to be shadow-priced by estimating the value of the production foregone. In case of the present Project, however, this conventional way was not adopted. Instead, the land acquisition and resettlement is treated in such a way that all the people to be displaced by the Project will be recovered the same conditions as they received before the displacement in terms of either land and/or housing. These costs are incorporated in the Project cost.

5) The operation and maintenance costs of the facilities to be built by the Project are incorporated in this economic evaluation as follows:

i) For facilities of civil works like a dam, waterways and powerhouse: 0.5% of capital cost, and
For metal works and equipment: 2.5% of capital cost

ii) For primary distribution main: 0.5% of capital cost

iii) Water treatment cost: Peso 0.25 per cubic meter of throughput

iv) For distribution network: 60% of averaged water tariff rate

6) The evaluation period is taken at 50 years after the commissioning of the final stage structures (Stage 2-2) namely from year 2023 to 2072. The replacement of metal works/equipment is considered every 20 years.

7) In this Study, the water tariff rate is considered to be the minimum level of consumers' willingness to pay for water. In order to make water tariff comparable to project cost, such non-project cost as those of distribution main and pipeline networks are also taken into account for the sake of economic evaluation.

8) The opportunity cost of capital is assumed at 12% in this Study following recent practices of similar studies in the Philippines.

8.10.3 Derivation of Economic Cost

The capital cost of the Project estimated on the basis of the market price is summarized in Table 8.1 for the Scenario B Scheme and Table 8.2 for Kanan No.2 Scheme with the disbursement schedule. The total capital cost (at 2001 constant prices) of Scenario B Scheme is estimated at US$ 1,826.6 million, while the total capital cost of Kanan No.2 Scheme is estimated at US$ 452.7 million respectively.

The financial cost is adjusted to economic cost based on the conditions and assumptions stated in the preceding subsection 8.8.2. The conversion of financial cost to economic cost is summarized in Table 8.3 for Scenario B Scheme and Table 8.4 for Kanan No.2 Scheme. The consequent yearly distribution of the economic cost is as shown in Table 8.5 for Scenario B Scheme and Table 8.6 for Kanan No.2 Scheme.

8.10.4 Estimate of Economic Benefit

The economic benefit of the Scenario B Scheme is composed of two sources: one is the benefit from domestic and municipal water supply and another from hydropower generation. The economic benefit of the Kanan No.2 Scheme is accrued from power generation only.

(1) Economic benefit accrued from water supply

In principle, economic benefit of water supply project is measured by consumers' willingness to pay (WtP). The WtP represents how many consumers are ready to pay for the satisfaction or utility they expect to obtain from utilizing water. And the WtP naturally differs by quality of the water as the satisfaction or utility of water differs by the quality of water.

Apparently, consumers' water demand is composed of two parts in terms of quality; one is non-quality water for general use including washing clothes, water closet, bathing, cleaning, gardening and others, and another is quality water for drinking and/or cooking. When consumers' WtP for water is measured, these two different quality waters must be taken into consideration. In this Study, these two kinds of water are integrated to evaluate the consumers' WtP for water.

Firstly, for non-quality water, water tariff is assumed to represent the WtP of consumers. However, in stead of the presently valid water tariff, the water tariff prevailed before the privatization namely September 1st 1997 is adopted as the surrogate of consumers' WtP, because the tariff rate was largely bargained down by competitive bidding at the time of privatization. The water tariff before privatization seems to reflect the consumers' WtP better than the present one.

Secondly, for quality water, bottled water prevailing at markets is taken into consideration. In reality, consumers nowadays purchase the bottled quality water at markets for drinking or cooking uses everyday. According to the information we obtained, an average household with five families consumes one 5 gallon-bottled water a day. Since average water consumption of an average household with five families is estimated at 20 cubic meters per month, the share of bottled water is computed at 2.8% (= 5 gallons x 30 days / 20 cubic meters). We assumed conservatively, however, that one percent at minimum of water demand is procured from the bottled water. The WtP is computed by the procedures stated below:

i) The averaged water tariff rate in 1994 was estimated at Peso 7.8 per cubic meter based on the MWSS annual report 1994 (the water tariff rate as of August 1997 was not availed to us). The averaged water rate as of June 2001 was computed on the basis of this water rate of 1994 at Peso 13.6 per cubic meter by applying consumer price index (CPI).

ii) Meanwhile we estimated the price of bottled water from market price. The cheapest bottled water is 50 Pesos per five-gallon vessel at gas stations that is equivalent to Peso 2,641.8 per cubic meter.[1]

iii) Finally, the consumers' WtP for water was computed at Peso 38.9 per cubic meter as shown below:

$$WtP = 13.6 \times 0.99 + 2{,}641.8 \times 0.01 = \text{Peso } 38.9 \text{ per cubic meter}$$

The benefit stream of water supply presented in Table 8.9 is computed based on this unit benefit multiplied by the water volume supplied from the Scenario B Scheme.

The inference on the consumers' WtP for water stated above is based on the reasoning that price fluctuation of the bottled water cannot be neglected when the WtP of piped water is considered. The WtP for piped water may increase when the price of bottled water skyrockets by some possible reasons like supply shortage. To the contrary, the WtP for piped water may reduce when the price of bottled

[1] 1 gallon = 3.785343 liter. Prevailing market prices of bottled water are more expensive than the five-gallon container: 320 ml bottle: Peso 10.0 500 ml bottle: Peso 12.5 1000 ml bottle: Peso 15.0

water decreases by some reasons like over production. Therefore, the WtP for piped water cannot be evaluated correctly without taking into consideration the price of the bottled water.

(2) Economic benefit of hydropower generation

The economic benefit accrued from hydropower generation is estimated by the method of alternative thermal power plant. The cost of thermal power plants with the same capacity as those planned in the Scenario B Scheme and Kanan No.2 hydropower scheme is computed. This cost is considered as economic benefit since, from the point of view of the socio-economy as a whole, it is the value to be saved by constructing the hydropower plants contemplated in this Project.

The procedures for computation of capacity (kW) cost and energy (kWh) cost of alternative thermal power plants are presented in Table 8.7. The related data was provided by NPC. The relevant data of three types of thermal power plants including diesel, gas turbine and combined cycle gas turbine are presented in the table. According to the supply characteristics of the hydropower plants, the combined-cycle gas turbine was considered as the alternative of Agos and Kanan No.2 hydropower stations and the gas turbine as the alternative of Abuyod hydropower station respectively.

The power generation benefit of hydropower station is computed based on each kW cost and kWh cost by multiplying the installed capacity and energy output of each hydropower plant as shown in Table 8.8.

8.10.5 Computation of EIRR

All the costs and benefits are consolidated in two tables: Table 8.9 for the Scenario B Scheme and Table 8.10 for the Kanan No.2 Hydropower Scheme. The EIRR was derived at 13.5% for the former and at 5.4% for the latter, respectively.

Since the opportunity cost of capital is assumed at 12% in this Study, the Scenario B Scheme is economically justified. The benefit-cost ratio of the Scenario B Scheme was computed for reference sake at 1.2 under a discount rate of 12%.

However, the Kanan No.2 Hydropower Scheme cannot pass the economic justification. The power generation cannot bear the burden of a heavy dam cost alone. Subsequent study will further review the adequacy of the plan formulation and the expected benefits (including the flow augmentation effect to the Agos hydropower plant), and re-evaluate the economic attractiveness of the Scheme.

8.11 Technical and Social Aspects

The projects proposed in the Master Plan involve various technical and social issues that need to be further examined in the subsequent studies. The major issues are as described in Sections 8.2 to 8.5 above,

The Feasibility Study scheduled in the subsequent stage will look into most items of these issues.

Table 8.1 Investment Schedule: Scenario B Scheme

Sce-nario	Stage	Work Items	Const. Cost (US$ 10^3)	Year 01 2001	02 2002	03 2003	04 2004	05 2005	06 2006	07 2007	08 2008	09 2009	10 2010	11 2011	12 2012	13 2013	14 2014	15 2015	16 2016	17 2017	18 2018	19 2019	20 2020	21 2021	22 2022
B	**B-1**	**Kaliwa Low Dam w/Kaliwa-Angono 1st waterway**																							
		Engineering & Administration	30,460			1,828	2,132	2,132	4,569	5,483	5,483	4,569	4,264												
		Foreign Currency (70%)	21,322			1,279	1,493	1,493	3,198	3,838	3,838	3,198	2,985												
		Local Currency (30%)	9,138			548	640	640	1,371	1,645	1,645	1,371	1,279												
		Physical Contingencies	69,839			274	924	1,226	15,087	16,908	13,623	12,526	9,271												
		Foreign Currency	48,133			192	224	224	10,199	11,685	9,808	9,040	6,761												
		Local Currency	21,706			82	700	1,002	4,889	5,223	3,815	3,486	2,509												
		Kaliwa Low Dam (Temporary)																							
		Kaliwa-Angono 1st Waterway																							
		Land Acquisition & Resettlement (Including WTP)	20,135				4,027	6,041	6,041	4,027															
		Local Currency (100%)	20,135				4,027	6,041	6,041	4,027															
		1st Waterway Sub-total (Excluding land acquisition)	324,357						71,845	85,082	67,208	60,812	39,411												
		Civil works	306,920						71,633	81,505	60,961	55,171	37,650												
		Foreign Currency (70%)	214,844						50,143	57,054	42,673	38,619	26,355												
		Local Currency (30%)	92,076						21,490	24,452	18,288	16,551	11,295												
		Metal works	17,437						212	3,577	6,247	5,641	1,760												
		Foreign Currency (70%)	12,206						148	2,504	4,373	3,949	1,232												
		Local Currency (30%)	5,231						64	1,073	1,874	1,692	528												
		Water Treatment Plant #1 Unit	90,643						18,129	18,129	18,129	18,129	18,129												
		Metal works (100%)							20%	20%	20%	20%	20%												
		Foreign Currency (80%)	72,515						14,503	14,503	14,503	14,503	14,503												
		Local Currency(20%)	18,129						3,626	3,626	3,626	3,626	3,626												
		Stage 1 Total	**535,435**			2,102	7,083	9,399	115,670	129,629	104,442	96,036	71,074												
		Foreign Currency	369,019			1,471	1,716	1,716	78,191	89,583	75,194	69,310	51,837												
		Local Currency	166,416			631	5,367	7,682	37,479	40,046	29,248	26,726	19,238												
		Metal works	108,081																						
		Foreign Currency	84,721																						
		Local Currency	23,360																						
	B-2-1	**Agos Dam + WTP #2**																							
		Engineering & Administration	35,232				1,057	1,409	1,409	1,409	1,762	5,285	5,637	5,989	5,989	5,285									
		Foreign Currency (70%)	24,662				740	986	986	986	1,233	3,699	3,946	4,193	4,193	3,699									
		Local Currency (30%)	10,569				317	423	423	423	528	1,585	1,691	1,797	1,797	1,585									
		Physical Contingencies	80,781				159	211	211	753	1,076	16,436	12,217	15,664	18,329	15,725									
		Foreign Currency	52,319				111	148	148	148	185	10,185	7,748	10,573	12,441	10,633									
		Local Currency	28,462				48	63	63	605	891	6,252	4,469	5,091	5,888	5,092									
		Agos Dam																							
		Land Acquisition & Resettlement	18,044							3,609	5,413	5,413	3,609												
		Local Currency (100%)	18,044							3,609	5,413	5,413	3,609												
		Agos Dam sub-total (excluding L.A. & Resettlement)	320,400									74,514	50,274	62,272	71,067	62,272									
		Civil works(100%)																							
		Foreign Currency (60%)	192,240									44,708	30,164	37,363	42,640	37,363									
		Local Currency (40%)	128,160									29,806	20,110	24,909	28,427	24,909									
		Power House																							
		Power House Sub-total	97,222									10,834	8,397	22,633	31,608	23,749									
		Metal works(100%)																							
		Foreign Currency (80%)	77,777									8,668	6,717	18,107	25,287	18,999									
		Local Currency (20%)	19,444									2,167	1,679	4,527	6,322	4,750									
		Water Treatment Plant #2 Unit	67,643									13,529	13,529	13,529	13,529	13,529									
		Metal works(100%)										20%	20%	20%	20%	20%									
		Foreign Currency (80%)	54,115									10,823	10,823	10,823	10,823	10,823									
		Local Currency(20%)	13,529									2,706	2,706	2,706	2,706	2,706									
		Stage 2-1 Total	**619,322**				1,215	1,621	1,621	5,771	8,251	126,011	93,662	120,087	140,523	120,560									
		Foreign Currency	401,113				851	1,134	1,134	1,134	1,418	78,083	59,398	81,058	95,384	81,517									
		Local Currency	218,208				365	486	486	4,636	6,833	47,928	34,264	39,029	45,139	39,042									
		Metal works	164,865																						
		Foreign Currency	131,892																						
		Local Currency	32,973																						
	B-2-2	**Kaliwa-Angono 2nd Waterway + WTP #3 & 4**																							
		Engineering & Administration	38,217											1,529	1,911	1,911	2,293	3,822	4,586	5,350	5,350	4,586		3,822	3,057
		Foreign Currency (70%)	26,752											1,070	1,338	1,338	1,605	2,675	3,210	3,745	3,745	3,210		2,675	2,140
		Local Currency (30%)	11,465											459	573	573	688	1,147	1,376	1,605	1,605	1,376		1,147	917
		Physical Contingencies	87,627											229	287	1,159	1,652	14,803	18,100	15,707	14,524	9,988		5,647	5,532
		Foreign Currency	60,825											161	201	201	241	9,751	12,364	11,300	10,471	7,296		4,460	4,380
		Local Currency	26,802											69	86	958	1,412	5,052	5,736	4,407	4,052	2,691		1,187	1,152
		Kaliwa-Angono 2nd Waterway																							
		Land Acquisition & Resettlement (Including WTP)	29,077													5,815	8,723	8,723	5,815						
		Local Currency (100%)	29,077													5,815	8,723	8,723	5,815						
		2nd Waterway Sub-total (Excluding land acquisition)	347,598															65,812	89,937	79,034	71,144	41,671			
		Civil works	297,643															65,344	78,517	60,961	55,171	37,650			
		Foreign Currency (70%)	208,350															45,741	54,962	42,673	38,620	26,355			
		Local Currency (30%)	89,293															19,603	23,555	18,288	16,551	11,295			
		Metal works	49,955															468	11,421	18,072	15,974	4,020			
		Foreign Currency (70%)	34,968															327	7,995	12,651	11,181	2,814			
		Local Currency (30%)	14,986															140	3,426	5,422	4,792	1,206			
		Water Treatment Plant #3 Unit	101,643															20,329	20,329	20,329	20,329	20,329			
		Metal works(100%)																							
		Foreign Currency (80%)	81,315															16,263	16,263	16,263	16,263	16,263			
		Local Currency(20%)	20,329															4,066	4,066	4,066	4,066	4,066			
		Water Treatment Plant #4 Unit	67,643																					33,822	33,822
		Metal works(100%)																							
		Foreign Currency (80%)	54,115																					27,057	27,057
		Local Currency(20%)	13,529																					6,764	6,764
		Stage 2-2 Total	**671,806**											1,758	2,197	8,885	12,669	113,488	138,768	120,420	111,347	76,573		43,290	42,411
		Foreign Currency	466,325											1,231	1,538	1,538	1,846	74,757	94,794	86,632	80,281	55,939	0	34,192	33,577
		Local Currency	205,481											527	659	7,347	10,823	38,731	43,974	33,788	31,066	20,634	0	9,097	8,834
		Metal works	219,241																						
		Foreign Currency	170,398																						
		Local Currency	48,844																						
		SCENARIO TOTAL	**1,826,563**			2,102	8,299	11,019	117,291	135,399	112,693	222,047	164,736	121,845	142,720	129,445	12,669	113,488	138,768	120,420	111,347	76,573		43,290	42,411
		FOREIGN CURRENCY	1,236,458			1,471	2,567	2,851	79,326	90,718	76,612	147,393	111,235	82,289	96,922	83,056	1,846	74,757	94,794	86,632	80,281	55,939	0	34,192	33,577
		LOCAL CURRENCY	590,105			631	5,731	8,169	37,965	44,682	36,081	74,654	53,501	39,556	45,798	46,389	10,823	38,731	43,974	33,788	31,066	20,634	0	9,097	8,834

Table 8.2 Investment Schedule: Kanan No.2 Scheme

(US$ 10^3)

Description	Const. Cost	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year
Kanan No.2 Dam Total	**215,997**	**3,036**	**4,553**	**16,444**	**14,926**	**35,856**	**30,092**	**33,584**	**44,686**	**32,821**
Civil Works	204,357	3,036	4,553	16,444	14,926	35,856	30,092	30,092	40,030	29,329
Foreign Currency	113,507	0	0	7,135	7,135	21,514	18,055	18,055	24,018	17,598
Local currency	90,849	3,036	4,553	9,310	7,792	14,343	12,037	12,037	16,012	11,732
Metal Works	11,640							3,492	4,656	3,492
Foreign Currency	6,984	0	0	0	0	0	0	2,095	2,794	2,095
Local currency	4,656	0	0	0	0	0	0	1,397	1,862	1,397
Power House Total	**151,875**					**13,104**	**23,492**	**39,383**	**44,637**	**31,267**
Civil Works	45,872	0	0	0	0	10,541	17,084	9,537	5,854	2,860
Foreign Currency (8	36,698	0	0	0	0	8,433	13,667	7,629	4,683	2,288
Local currency (20%	9,174	0	0	0	0	2,108	3,417	1,907	1,171	572
Metal Works	106,003	0	0	0	0	2,563	6,408	29,846	38,783	28,407
Foreign Currency (8	84,802	0	0	0	0	2,050	5,126	23,876	31,027	22,726
Local currency (20%	21,201	0	0	0	0	513	1,282	5,969	7,757	5,681
Indirect Costs	**84,799**	**1,344**	**1,572**	**3,651**	**4,016**	**10,897**	**13,369**	**17,460**	**18,730**	**13,760**
Engineering and Administration										
Foreign Currency	18,028	541	541	721	1,082	2,163	3,245	3,966	3,245	2,524
Local currency	7,728	232	232	309	464	927	1,391	1,700	1,391	1,082
Physical Contingency										
Foreign Currency	39,002	81	81	1,178	1,232	5,124	6,014	8,343	9,865	7,084
Local currency	20,041	490	718	1,443	1,238	2,683	2,719	3,451	4,229	3,070
TOTAL	**452,671**	**4,380**	**6,125**	**20,095**	**18,942**	**59,857**	**66,952**	**90,427**	**108,053**	**77,849**
Foreign Currency	241,992	0	0	7,135	7,135	31,997	36,848	51,656	62,521	44,707
Local currency	125,880	3,036	4,553	9,310	7,792	16,964	16,735	21,310	26,802	19,382

Table 8.3 Derivation of Economic Cost from Financial Cost: Scenario B Scheme

(US$ mil.)

	Financial cost			Economic cost		
	F.C.	**L.C.**	**Total**	**F.C.**	**L.C.**	**Total**
I. Stage-1						
1) Kaliwa low dam & 1st waterway	227.1	117.4	344.5	227.1	95.6	322.6
2) WTP #1	72.5	18.1	90.6	72.5	14.8	87.3
3) Engineering & administration	21.3	9.1	30.5	21.3	7.6	28.9
4) Physical contingency	48.1	21.7	69.8	48.1	18.0	66.1
Stage-1 Total	**369.0**	**166.4**	**535.4**	**369.0**	**136.0**	**505.0**
II. Stage 2-1						
5) Agos dam	192.2	146.2	338.4	192.2	119.0	311.3
6) Power house	77.8	19.4	97.2	77.8	15.8	93.6
7) WTP #2	54.1	13.5	67.6	54.1	11.0	65.1
8) Engineering & administration	24.7	10.6	35.2	24.7	8.8	33.4
9) Physical contingency	52.3	28.5	80.8	52.3	23.6	75.9
Stage 2-1 Total	**401.1**	**218.2**	**619.3**	**401.1**	**178.2**	**579.4**
III. Stage 2-2						
10) Kaliwa-Angono 2nd waterway	243.3	133.4	376.7	243.3	108.6	351.9
11) WTP #3	81.3	20.3	101.6	81.3	16.5	97.9
12) WTP #4	54.1	13.5	67.6	54.1	11.0	65.1
13) Engineering & administration	26.8	11.5	38.2	26.8	9.5	36.3
14) Physical contingency	60.8	26.8	87.6	60.8	22.2	83.1
Stage 2-2 Total	**466.3**	**205.5**	**671.8**	**466.3**	**167.9**	**634.2**
Scenario B Total	**1,236.5**	**590.1**	**1,826.6**	**1,236.5**	**482.1**	**1,718.5**

Notes:

1) Financial cost does not include VAT, import duties and other taxes.

2) Standard conversion factor of (SCF) was assumed at 0.83.

3) Shadow wage rate was assumed at 0.5 for unskilled labor.

Table 8.4 Derivation of Economic Cost from Financial Cost: Kanan No.2 Scheme

(US$ mil.)

	Financial cost			Economic cost		
	F.C.	L.C.	Total	F.C.	L.C.	Total
I. Kanan No.2 Dam						
1) Civil works	113.5	90.8	204.4	113.5	74.0	187.5
2) Metal works	7.0	4.7	11.6	7.0	3.8	10.8
Sub-Total	120.5	95.5	216.0	120.5	77.7	198.2
II. Power House						0.0
3) Civil works	36.7	9.2	45.9	36.7	7.5	44.2
4) Metal works	84.8	21.2	106.0	84.8	17.3	102.1
Sub-Total	121.5	30.4	151.9	121.5	24.7	146.2
III. Indirect costs						
5) Engineering and administration	18.0	7.7	25.8	18.0	6.4	24.4
6) Physical contingency	39.0	20.0	59.0	39.0	16.6	55.6
Sub-Total	57.0	27.8	84.8	57.0	23.0	80.1
Total	**299.0**	**153.6**	**452.7**	**299.0**	**125.5**	**424.5**

Notes:

1) Financial cost does not include VAT, import duties and other taxes.

2) Standard conversion factor of (SCF) was assumed at 0.83.

3) Shadow wage rate was assumed at 0.5 for unskilled labor.

Table 8.5 Yearly Disbursement of Capital Cost for Economic Evaluation: Scenario B Scheme

Scenario B	F.C. (US$ mil.)	L.C. (US$ mil.)	Total (US$ mil.)	Foreign currency portion (US$ mil.)																						
				2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
I. Stage-1																										
1) Kaliwa low dam & 1st waterway	227.1	95.6	322.6						50.3	59.6	47.0	42.6	27.6													227.1
2) WTP #1	72.5	14.8	87.3						14.5	14.5	14.5	14.5	14.5													72.5
3) Engineering & administration	21.3	7.6	28.9			1.3	1.5	1.5	3.2	3.8	3.8	3.2	3.0													21.3
4) Physical contingency	48.1	18.0	66.1			0.2	0.2	0.2	10.2	11.7	9.8	9.0	6.8													48.1
Stage-1 Total	369.0	136.0	505.0			1.5	1.7	1.7	78.2	89.6	75.2	69.3	51.8													369.0
II. Stage 2-1																										
5) Agos dam	192.2	119.0	311.3									44.7	30.2	37.4	42.6	37.4										192.2
6) Power house	77.8	15.8	93.6									8.7	6.7	18.1	25.3	19.0										77.8
7) WTP #2	54.1	11.0	65.1									10.8	10.8	10.8	10.8	10.8										54.1
8) Engineering & administration	24.7	8.8	33.4				0.7	1.0	1.0	1.0	1.2	3.7	3.9	4.2	4.2	3.7										24.7
9) Physical contingency	52.3	23.6	75.9				0.1	0.1	0.1	0.1	0.2	10.2	7.7	10.6	12.4	10.6										52.3
Stage 2-1 Total	401.1	178.2	579.4				0.9	1.1	1.1	1.1	1.4	78.1	59.4	81.1	95.4	81.5										401.1
III. Stage 2-2																										
10) Kaliwa-Angono 2nd waterway	243.3	108.6	351.9															46.1	63.0	55.3	49.8	29.2				243.3
11) WTP #3	81.3	16.5	97.9															16.3	16.3	16.3	16.3	16.3				81.3
12) WTP #4	54.1	11.0	65.1																					27.1	27.1	54.1
13) Engineering & administration	26.8	9.5	36.3											1.1	1.3	1.3	1.6	2.7	3.2	3.7	3.7	3.2		2.7	2.1	26.8
14) Physical contingency	60.8	22.2	83.1											0.2	0.2	0.2	0.2	9.8	12.4	11.3	10.5	7.3		4.5	4.4	60.8
Stage 2-2 Total	466.3	167.9	634.2											1.2	1.5	1.5	1.8	74.8	94.8	86.6	80.3	55.9		34.2	33.6	466.3
Scenario B Total	1,236.5	482.1	1,718.5			1.5	2.6	2.9	79.3	90.7	76.6	147.4	111.2	82.3	96.9	83.1	1.8	74.8	94.8	86.6	80.3	55.9		34.2	33.6	1,236.5

Scenario B	F.C. (US$ mil.)	L.C. (US$ mil.)	Total (US$ mil.)	Local currency portion (US$ mil.)																						
				2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
I. Stage-1																										
1) Kaliwa low dam & 1st waterway	227.1	95.6	322.6				3.3	4.9	22.5	24.1	16.4	14.8	9.6													95.6
2) WTP #1	72.5	14.8	87.3						3.0	3.0	3.0	3.0	3.0													14.8
3) Engineering & administration	21.3	7.6	28.9			0.5	0.5	0.5	1.1	1.4	1.4	1.1	1.1													7.6
4) Physical contingency	48.1	18.0	66.1			0.1	0.6	0.8	4.1	4.3	3.2	2.9	2.1													18.0
Stage-1 Total	369.0	136.0	505.0			0.5	4.4	6.3	30.6	32.7	23.9	21.8	15.7													136.0
II. Stage 2-1																										
5) Agos dam	192.2	119.0	311.3							2.9	4.4	28.7	19.3	20.3	23.1	20.3										119.0
6) Power house	77.8	15.8	93.6									1.8	1.4	3.7	5.1	3.9										15.8
7) WTP #2	54.1	11.0	65.1									2.2	2.2	2.2	2.2	2.2										11.0
8) Engineering & administration	24.7	8.8	33.4				0.3	0.4	0.4	0.4	0.4	1.3	1.4	1.5	1.5	1.3										8.8
9) Physical contingency	52.3	23.6	75.9				0.0	0.1	0.1	0.5	0.7	5.2	3.7	4.2	4.9	4.2										23.6
Stage 2-1 Total	401.1	178.2	579.4				0.3	0.4	0.4	3.8	5.6	39.1	28.0	31.9	36.9	31.9										178.2
III. Stage 2-2																										
10) Kaliwa-Angono 2nd waterway	243.3	108.6	351.9													4.7	7.1	23.2	26.7	19.3	17.4	10.2				108.6
11) WTP #3	81.3	16.5	97.9															3.3	3.3	3.3	3.3	3.3				16.5
12) WTP #4	54.1	11.0	65.1																					5.5	5.5	11.0
13) Engineering & administration	26.8	9.5	36.3											0.4	0.5	0.5	0.6	1.0	1.1	1.3	1.3	1.1		1.0	0.8	9.5
14) Physical contingency	60.8	22.2	83.1											0.1	0.1	0.8	1.2	4.2	4.8	3.7	3.4	2.2		1.0	1.0	22.2
Stage 2-2 Total	466.3	167.9	634.2											0.4	0.5	6.0	8.8	31.6	35.9	27.6	25.4	16.9		7.4	7.2	167.9
Scenario B Total	1,236.5	482.1	1,718.5			0.5	4.7	6.7	31.0	36.5	29.5	61.0	43.7	32.3	37.4	37.9	8.8	31.6	35.9	27.6	25.4	16.9		7.4	7.2	482.1

Table 8.6 Yearly Disbursement of Capital Cost for Economic Evaluation: Kanan No.2 Scheme

	F.C.	L.C.	Total	Foreign currency portion (US$ mil.)									
	(US$ mil.)	(US$ mil.)	(US$ mil.)	1	2	3	4	5	6	7	8	9	Total
I. Kanan No.2 Dam													
1) Civil works	113.5	74.0	187.5			7.1	7.1	21.5	18.1	18.1	24.0	17.6	113.5
2) Metal works	7.0	3.8	10.8							2.1	2.8	2.1	7.0
Sub-Total	120.5	77.7	198.2			7.1	7.1	21.5	18.1	20.2	26.8	19.7	120.5
II. Power House													
3) Civil works	36.7	7.5	44.2					8.4	13.7	7.6	4.7	2.3	36.7
4) Metal works	84.8	17.3	102.1					2.1	5.1	23.9	31.0	22.7	84.8
Sub-Total	121.5	24.7	146.2					10.5	18.8	31.5	35.7	25.0	121.5
III. Indirect costs													
5) Engineering & Administration	18.0	6.4	24.4	0.5	0.5	0.7	1.1	2.2	3.2	4.0	3.2	2.5	18.0
6) Physical Contingency	39.0	16.6	55.6	0.1	0.1	1.2	1.2	5.1	6.0	8.3	9.9	7.1	39.0
Sub-Total	57.0	23.0	80.1	0.6	0.6	1.9	2.3	7.3	9.3	12.3	13.1	9.6	57.0
Total	299.0	125.5	424.5	0.6	0.6	9.0	9.4	39.3	46.1	64.0	75.6	54.3	299.0

	F.C.	L.C.	Total	Local currency portion (US$ mil.)									
	(US$ mil.)	(US$ mil.)	(US$ mil.)	1	2	3	4	5	6	7	8	9	Total
I. Kanan No.2 Dam													
1) Civil works	113.5	74.0	187.5	2.5	3.7	7.6	6.3	11.7	9.8	9.8	13.0	9.5	74.0
2) Metal works	7.0	3.8	10.8							1.1	1.5	1.1	3.8
Sub-Total	120.5	77.7	198.2	2.5	3.7	7.6	6.3	11.7	9.8	10.9	14.5	10.7	77.7
II. Power House													
3) Civil works	36.7	7.5	44.2					1.7	2.8	1.6	1.0	0.5	7.5
4) Metal works	84.8	17.3	102.1					0.4	1.0	4.9	6.3	4.6	17.3
Sub-Total	121.5	24.7	146.2					2.1	3.8	6.4	7.3	5.1	24.7
III. Indirect costs													
5) Engineering & Administration	18.0	6.4	24.4	0.2	0.2	0.3	0.4	0.8	1.2	1.4	1.2	0.9	6.4
6) Physical Contingency	39.0	16.6	55.6	0.4	0.6	1.2	1.0	2.2	2.3	2.9	3.5	2.5	16.6
Sub-Total	57.0	23.0	80.1	0.6	0.8	1.5	1.4	3.0	3.4	4.3	4.7	3.4	23.0
Total	299.0	125.5	424.5	3.1	4.5	9.0	7.8	16.8	17.0	21.6	26.5	19.2	125.5

Table 8.7 Computation of kW and kWh Values of Alternative Thermal Power Plants

(1) Cost Data of Alternative Thermal

Items		Diesel	Gas Turbine	Comb. Cycle
1. Construction cost	:$/kW	850	585	700
2. Economic life	:year	20	20	20
3. Capital recovery factor	:for 12%	0.133879	0.133879	0.133879

(2) Computation of cost per kW

Items		Diesel	Gas Turbine	Comb. Cycle
1) Annualized construction cost:	($/kW)	140.0	96.4	115.3
2) Fixed O&M (annual cost):	($/kW)	20.0	12.4	28.7
3) Cost per kW (annual cost)	($/kW)	160.0	108.8	144.0
4) Adjustment factor		1.279	1.279	1.279
5) Cost per kW (after adjusted)	($/kW)	204.7	139.1	184.1

(3) Computation of cost per kWh

Items		Diesel	Gas Turbine	Comb. Cycle
1) Fuel cost (Primary energy)	($/kWh)	0.0137	0.0217	0.0217
2) ditto (Secondry energy)	($/kWh)	0.0044	0.0044	0.0044
3) Adjustment factor		1.061	1.061	1.061
4) Cost per kWh (after adjusted)	(C/kWh)	1.454	2.302	2.302

Note for annualized construction cost:

Assumed construction period : 3 years Assumed disbursement: 35%, 45%, 20%

Table 8.8 Calculation of Power Generation Benefits

Power station:			Agos H/P	Abuyod H/P	Kanan No.2*[1]	Total
1) Capacity and annual generation						
Installed capacity		(MW)	85.6	12.5	209.5	307.6
95% guaranteed		(MW)	80.1	7.0	135.3	222.4
	2020 & thereafte	(MW)	71.3	-	-	71.3
Energy output:						
2014 & thereafter	Primary	(GWh/year)	180.2	0.0	394.2	574.4
	Secondary	(GWh/year)	303.8	0.0	94.3	398.1
	Total	(GWh/year)	484.0	0.0	488.5	972.5
2020 & thereafter	Primary	(GWh/year)	172.7	95.6	394.2	662.5
	Secondary	(GWh/year)	233.7	0.0	94.3	328.0
	Total	(GWh/year)	406.3	95.6	488.5	990.5
2) Unit value of alternative thermal						
Capacity value	(US$/kW)		184.1	139.1	184.1	-
Energy value	(UsC/kWh)		2.302	2.302	2.302	-
Fuel cost	(UsC/kWh)		0.440	0.440	1.370	-
3) Assumption of commissioning						
2014	(%)		80	-	80	-
2015	(%)		100	-	100	-
2020	(%)		100	80	100	-
2021	(%)		100	100	100	-
4) Annual economic benefit (US$ million)						
2014	Capacity value		11.8	0.0	19.9	31.7
	Energy value		3.3	0.0	7.3	10.6
	Secondary energy		1.1	0.0	1.0	2.1
	Total benefit		16.2	0.0	28.2	44.4
2015	Capacity value		14.7	0.0	24.9	39.7
	Energy value		4.1	0.0	9.1	13.2
	Secondary energy		1.3	0.0	1.3	2.6
	Total benefit		20.2	0.0	35.3	55.5
2020	Capacity value		14.7	0.8	24.9	40.4
	Energy value		4.1	1.8	9.1	15.0
	Secondary energy		1.3	0.0	1.3	2.6
	Total benefit		20.2	2.5	35.3	58.0
2021	Capacity value		14.7	1.0	24.9	40.6
	Energy value		4.1	2.2	9.1	15.4
	Secondary energy		1.3	0.0	1.3	2.6
	Total benefit		20.2	3.2	35.3	58.7

Note: *[1] The time of commission is tentatively assumed at 2014 in this table.

Table 8.9 Computation of Economic Internal Rate of Return (EIRR): Scenario B Scheme

(Unit: US$ million)

No.	Year	Capital costs F.C.	Capital costs L.C.	Distribution main / Metal works replace F.C.	Distribution main / Metal works replace L.C.	Capital costs Total	O & M cost Facilities	O & M cost Metal works	O & M cost Treatment	O & M cost Distribution Main	O & M cost Distribution Network	O&M cost Total	Total costs	Water supply (MLD)	Power generated (GWh)	Economic benefits Water supply	Economic benefits Power generation	Total benefit	B - C
1	2001					0.0						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2002					0.0						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	2003	1.5	0.5			2.0						0.0	2.0	0.0	0.0	0.0	0.0	0.0	(2.0)
4	2004	2.6	4.7			7.3						0.0	7.3	0.0	0.0	0.0	0.0	0.0	(7.3)
5	2005	2.9	6.7			9.6						0.0	9.6	0.0	0.0	0.0	0.0	0.0	(9.6)
6	2006	79.3	31.0			110.3						0.0	110.3	0.0	0.0	0.0	0.0	0.0	(110.3)
7	2007	90.7	36.5			127.2						0.0	127.2	0.0	0.0	0.0	0.0	0.0	(127.2)
8	2008	76.6	29.5	21.1	11.4	138.6						0.0	138.6	0.0	0.0	0.0	0.0	0.0	(138.6)
9	2009	147.4	61.0	28.2	15.2	251.7						0.0	251.7	0.0	0.0	0.0	0.0	0.0	(251.7)
10	2010	111.2	43.7	21.1	11.4	187.4						0.0	187.4	0.0	0.0	0.0	0.0	0.0	(187.4)
11	2011	82.3	32.3	5.4	2.9	122.9	2.5	2.7	0.3	0.5	5.3	8.6	131.5	103.7	0.0	28.3	0.0	28.3	(103.1)
12	2012	96.9	37.4	7.2	3.9	145.3	2.5	2.7	0.5	0.5	10.5	14.1	159.4	210.0	0.0	57.3	0.0	57.3	(102.1)
13	2013	83.1	37.9	5.4	2.9	129.3	2.5	2.7	0.8	0.5	15.8	19.7	148.9	320.0	0.0	87.4	0.0	87.4	(61.6)
14	2014	1.8	8.8			10.6	5.4	6.8	1.1	0.7	21.0	28.2	38.8	432.3	484.0	118.0	16.2	134.2	95.4
15	2015	74.8	31.6			106.4	5.4	6.8	1.4	0.7	26.3	33.8	140.2	548.1	484.0	149.7	20.2	169.9	29.7
16	2016	94.8	35.9			130.7	5.4	6.8	1.7	0.7	31.9	39.7	170.4	675.2	484.0	184.4	20.2	204.6	34.2
17	2017	86.6	27.6	13.7	7.4	135.3	5.4	6.8	2.0	0.7	37.5	45.6	180.9	804.7	484.0	219.7	20.2	239.9	59.1
18	2018	80.3	25.4	18.3	9.8	133.8	5.4	6.8	2.3	0.7	43.1	51.5	185.3	938.0	484.0	256.1	20.2	276.3	91.0
19	2019	55.9	16.9	13.7	7.4	93.9	5.4	6.8	2.5	0.7	48.7	57.3	151.2	1073.3	501.9	293.1	20.2	313.3	162.0
20	2020					0.0	5.4	6.8	2.8	1.0	54.3	63.6	63.6	1212.0	501.9	330.9	22.7	353.6	290.0
21	2021	34.2	7.4			41.6	5.4	6.8	3.2	1.0	61.8	71.5	113.1	1399.3	501.9	382.1	23.4	405.5	292.4
22	2022	33.6	7.2			40.8	5.4	6.8	3.6	1.0	69.3	79.4	120.2	1590.5	501.9	434.3	23.4	457.7	337.5
23	2023					0.0	8.6	12.3	4.0	1.0	76.7	90.4	90.4	1784.6	501.9	487.3	23.4	510.7	420.3
24	2024					0.0	8.6	12.3	4.4	1.0	84.2	98.3	98.3	1982.7	501.9	541.4	23.4	564.8	466.5
25	2025					0.0	8.6	12.3	4.8	1.0	91.7	106.1	106.1	2184.0	501.9	596.3	23.4	619.7	513.6
26	2026					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
27	2027					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
28	2028					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
29	2029					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
30	2030			76.2	21.0	97.3	8.6	12.3	5.3	1.0	100.8	115.7	213.0	2400.0	501.9	655.3	23.4	678.7	465.8
31	2031					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
32	2032					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
33	2033					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
34	2034			118.7	29.7	148.4	8.6	12.3	5.3	1.0	100.8	115.7	264.1	2400.0	501.9	655.3	23.4	678.7	414.7
35	2035					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
36	2036					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
37	2037					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
38	2038					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
39	2039					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
40	2040					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
41	2041					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
42	2042			153.4	44.0	197.3	8.6	12.3	5.3	1.0	100.8	115.7	313.0	2400.0	501.9	655.3	23.4	678.7	365.7
43	2043					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
44	2044					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
45	2045					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
46	2046					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
47	2047					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
48	2048					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
49	2049			76.2	21.0	97.3	8.6	12.3	5.3	1.0	100.8	115.7	213.0	2400.0	501.9	655.3	23.4	678.7	465.8
50	2050					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
51	2051					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
52	2052					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
53	2053			118.7	29.7	148.4	8.6	12.3	5.3	1.0	100.8	115.7	264.1	2400.0	501.9	655.3	23.4	678.7	414.7
54	2054					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
55	2055					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
56	2056					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
57	2057					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
58	2058					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
59	2059					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
60	2060					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
61	2061			153.4	44.0	197.3	8.6	12.3	5.3	1.0	100.8	115.7	313.0	2400.0	501.9	655.3	23.4	678.7	365.7
62	2062					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
63	2063					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
64	2064					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
65	2065					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
66	2066					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
67	2067					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
68	2068			76.2	21.0	97.3	8.6	12.3	5.3	1.0	100.8	115.7	213.0	2400.0	501.9	655.3	23.4	678.7	465.8
69	2069					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
70	2070					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
71	2071					0.0	8.6	12.3	5.3	1.0	100.8	115.7	115.7	2400.0	501.9	655.3	23.4	678.7	563.0
72	2072			118.7	29.7	148.4	8.3	11.9	5.3	1.0	100.8	115.4	115.4	2400.0	501.9	655.3	23.4	678.7	563.4

EIRR = 13.5%

Table 8.10 Computation of EIRR: Kanan No.2 Hydropower Station Scheme

(Unit: US$ million)

No.	Year	Capital costs F.C.	Capital costs L.C.	Metal works replacem't	Capital costs Total	O & M cost Facilities	O & M cost Metal works	O&M cost Total	Total costs	Power generated (GWh)	Eco. Benefit Power generation	B - C
1		0.6	3.1		3.7				3.7	0.0	0.0	(3.7)
2		0.6	4.5		5.1				5.1	0.0	0.0	(5.1)
3		9.0	9.0		18.0				18.0	0.0	0.0	(18.0)
4		9.4	7.8		17.2				17.2	0.0	0.0	(17.2)
5		39.3	16.8		56.1				56.1	0.0	0.0	(56.1)
6		46.1	17.0		63.1				63.1	0.0	0.0	(63.1)
7		64.0	21.6		85.6				85.6	0.0	0.0	(85.6)
8		75.6	26.5		102.1				102.1	0.0	0.0	(102.1)
9		54.3	19.2		73.5				73.5	0.0	0.0	(73.5)
10					0.0	1.6	2.8	4.4	4.4	503.6	28.2	23.8
11					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
12					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
13					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
14					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
15					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
16					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
17					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
18					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
19					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
20					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
21					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
22					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
23					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
24					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
25					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
26					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
27					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
28					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
29				101.6	101.6	1.6	2.8	4.4	106.0	503.6	35.3	(70.7)
30					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
31					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
32					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
33					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
34					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
35					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
36					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
37					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
38					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
39					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
40					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
41					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
42					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
43					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
44					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
45					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
46					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
47					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
48				101.6	101.6	1.6	2.8	4.4	106.0	503.6	35.3	(70.7)
49					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
50					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
51					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
52					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
53					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
54					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
55					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
56					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
57					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
58					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
59					0.0	1.6	2.8	4.4	4.4	503.6	35.3	30.9
											EIRR =	***5.4%***

PROPOSED MASTER PLAN

I. Master Development Plan towards Year 2025	II. Optional Development Plan
Water Supply Development:	**Optional Water Supply Development:**
W-1 Water Supply Development Project with Agos Dam –Stege1: Kaliwa Low Dam+1st Waterway+WTP#1 –Stege2–1: Agos Dam+WTP#2 –Stege2–2: 2nd Waterway+WTP#3 and #4	W-2 Water Supply Development Project with Laiban Dam (as alternative development option to be implemented in advance of W-1)
Hydropower Development:	**Optional Hydropower Development:**
P-1 Abuyod Power Station 12.5MW P-2 Agos Power Station 85.6MW	P-3 Kanan No.2 Power Station 209.5MW P-4 Pantay Power Station 22.6MW (in case of W-1)
Projects for Mitigation of Socio-Environmental Issues:	**Optional Projects for Mitigation of Socio-Environmental Issues:**
E-1 Monitoring of Morphological Change of Alluvial Plain and Coastal Line E-2 Resettlement Schemes E-3 Watershed Management in Kaliwa River Basin E-4 Monitoring of Ecosystem in Kanan–Agos Watershed	E-2 Resettlement Schemes
Projects for Regional Development:	**Optional Projects for Regional Development:**
R-1 Bank Erosion Protection Work in Infanta–General Nakar Alluvial Plain R-2 Provision of River Facilities for Facilitating the Use of River (in the river reach downstream from Agos Dam) R-3 Construction of Access Roads/Footpashs for Enhancement of Regional Economic Activities R-4 Establishment of a Vocational Training Center at Barangay Daraitan R-5 Establishment of a Medical Clinic at Barangay Daraitan R-6 Power Supply to Infanta–General Nakar Area	R-3 Construction of Access Roads/Footpashs for Enhancement of Regional Economic Activities

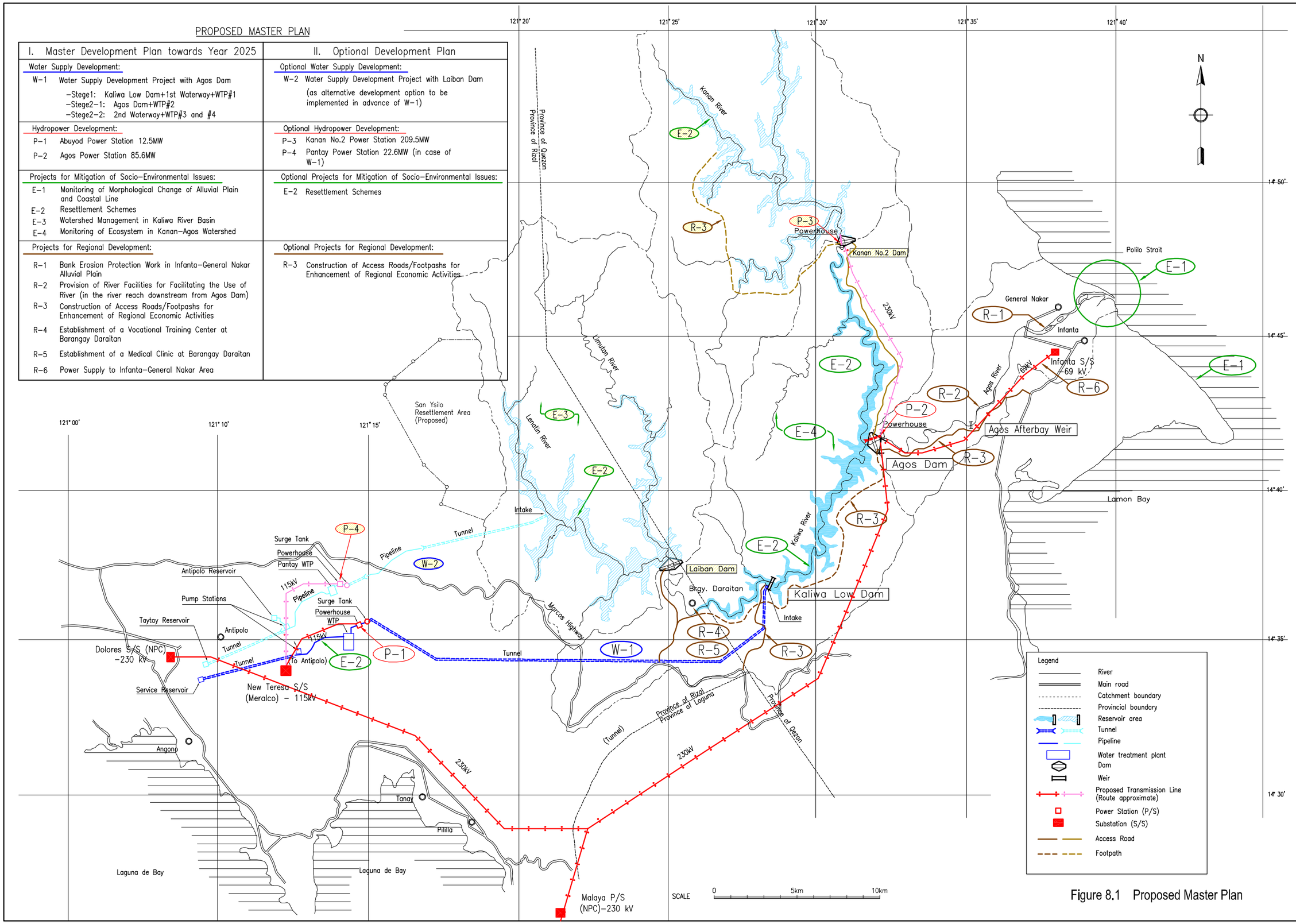
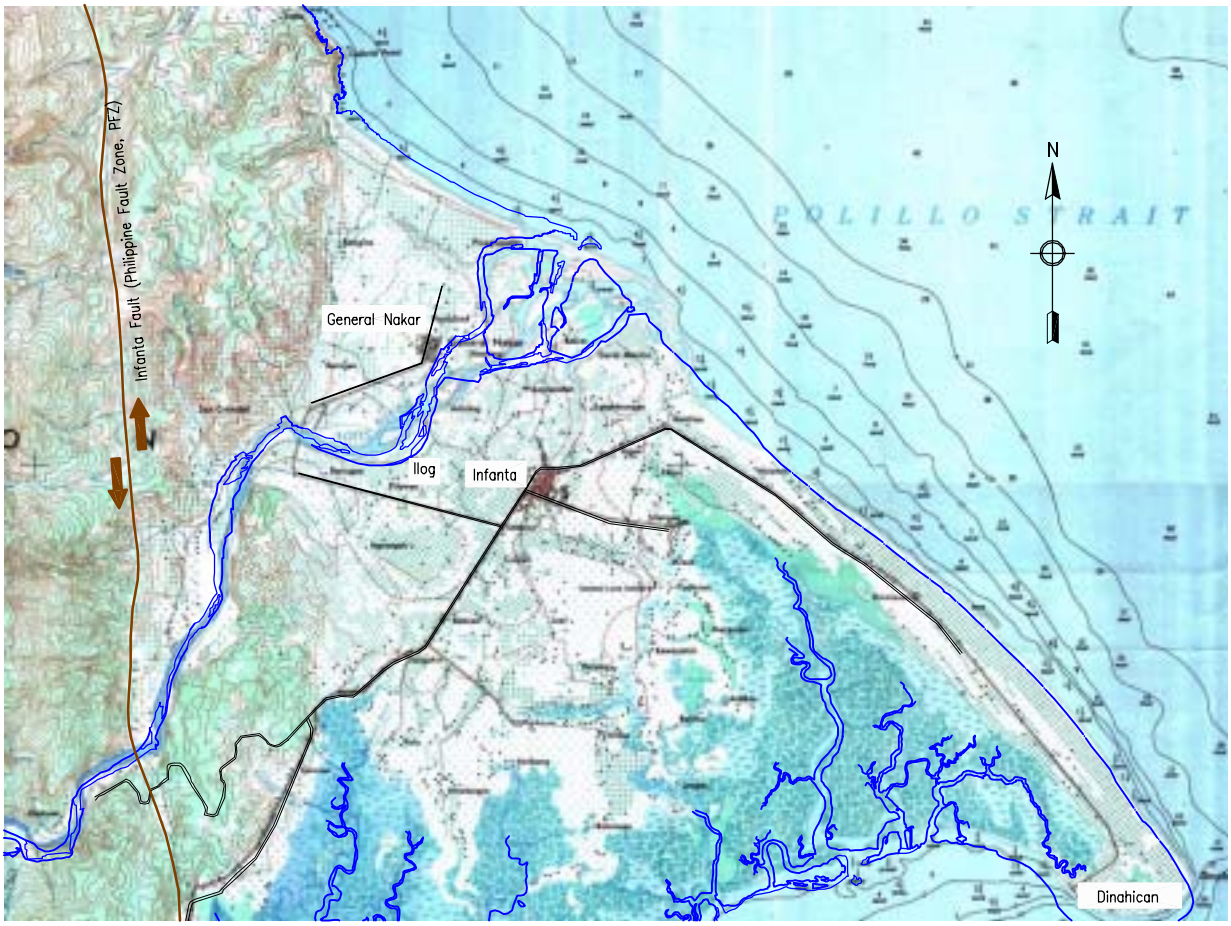


Figure 8.1 Proposed Master Plan



Scale 0 2.5km

Note	This figure shows 1/50,000 scaled topographic map of NAMRIA (1952), on which coastline and river channel (blue-color lines explained in the "Legend" below) showing the condition in 1995 are illustrated to assess the morphological change in Infanta Peninsula that took place between 1952 and 1995.
Legend	
———	Coastline and river channel drawn based on a photogrametric map produced from aerial photos taken in 1995
→	Direction of presumed displacement along Fault

Figure 8.2

Morphological Change of Infanta-General Nakar Alluvial Plain and Coastlines during 1952 and 1995

Plan No.	Name of Scheme	Water Supply (MLD)	Year 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
	MASTER DEVELOPMENT PLAN TOWARDS YEAR 2025		
	WATER SUPPLY DEVELOPMENT:		
W-1	**Water Supply Development with Agos Dam**		
Stage 1	**Kaliwa Low Dam w/Kaliwa-Angono 1st waterway**		(1st Waterway: 1500 MLD average)
(B-1)	Feasibility Study		
	Basic Design and Tender Documents (Financing by MWSS)		
	Land Acquisition and Compensation (Mainly for Waterway)		
	Resettlemnt of People (Mainly for Waterway)		
	Financing for ODA Portion (Low Dam & Waterway Tunnel)		
	Tender/Evaluation/Negotiation		
	Main Construction Works (ODA+BOT)		1st Waterway + WTP #1
	- Kaliwa Low Dam + Waterway Tunnel up to Powerhouse (ODA)	750	
	- WTP #1 Unit + Waterway up to Service Reservoir (BOT)		
Stage 2-1	**Agos Dam + WTP #2**		
(B-2-1)	Financing for Detailed Design		
	Detailed Design and Tender Documents		
	Financing for ODA Portion (Agos Dam)		
	Land Acquisition and Compensation		
	Resettlement of People		
	Tender/Evaluation/Negotiation (ODA+BOT)		
	Main Construction Works		WTP #2
	- Agos Dam (ODA)		
	- WTP #2 Unit (BOT)	750	
Stage 2-2	**Kaliwa-Angono 2nd Waterway + WTP #3 & 4**		(2nd Waterway: 1500 MLD average)
(B-2-2)	Basic Design and Tender Documents (Financing by MWSS)		
	Land Acquisition and Compensation		
	Resettlemnt of People		
	Financing for ODA Portion (Waterway Tunnel)		
	Tender/Evaluation/Negotiation		
	Main Construction Works		WTP #3 WTP #4
	- 2nd Waterway (ODA)		
	- WTP #3 Unit (BOT)	750	
	- WTP #4 Unit (BOT)	750	
Total		**3,000**	
	HYDROPOWER DEVELOPMENT: (as BOT Scheme)		
P-1	**Abuyod Power Station 12.5 MW (In paralell with W-1 Stage 2-2)**		
	Tender/Evaluation/Negotiation (BOT)		
	Main Construction Works (BOT)		Manufacture
P-2	**Agos Power Station 85.6 MW (In paralell with W-1 Stage 2-1)**		
	Tender/Evaluation/Negotiation (BOT)		
	Main Construction Works (BOT)		Manufacture
	PROJECTS FOR MITIGATION OF SOCIO=ENVIRONMENTAL ISSUES (as Government Project)		
E-1	**Monitoring of Morphological Change of Alluvial Plain and Coast Line**		
	Monitoring Program		
	Installation of Monitoring Facilities		
	River Mouth and Coastal Protection Measures as Required		
E-2	**Resettlement Schemes**		
	Resettlement Schemes for W-1 Stage 1		
	Resettlement Schemes for W-1 Stage 2-1		
	Resettlement Schemes for W-1 Stage 2-2		
E-3	**Watershed Managemant in Kaliwa River Basin**		
	Continuation of Present Watershed Management Project by DENR		
E-4	**Monitoring of Ecosystem in Kanan-Agos Watershed**		
	Preparation of a Comprehensive Monitoring Program		Stage 1 Stage 2-1 Stage 2-2
	EIA and EMP by Each Project		
	Implementation of Monitoring Program		
	PROJECTS FOR REGIONAL DEVELOPMENT: (as Government Project)		
R-1	**Bank Erosion protection Works in Infanta-General Nakr Alluvial Plain**		
	Prelimanary Planning and Basic Design		
	Tender and Contract		
	Construction Works		
R-2	**Provision of River Facilities for Facilitating the Use of River**		
	Prelimanary Planning and Basic Design		
	Tender and Contract		
	Construction Works		
R-3	**Construction of Access Road/Footpaths for Enhancement of Regional Economic Activities**		
	Basic Design		
	Tender and Contract		
	Construction Works		
R-4	**Establishment of Vocational Training Center at Barangay Daraitan**		
	Basic Design		
	Tender and Contract		
	Construction Works		
	Operation		By Project Operated by Municipality of Tanay
R-5	**Establishment of Medical Clinic at Barangay Daraitan**		
	Basic Design		
	Tender and Contract		
	Construction Works		
	Operation		By Project Operated by Municipality of Tanay
R-6	**Power Supply to Infanta-General Nakar Area**		
	Basic Design		
	Tender and Contract		
	Construction of Transmission Line and Substation		

Pre- Construction Activitie Construction Intermittent Activities

Figure 8.3 Master Plan - Implementation Schedule (1/2)

Plan	Name of Scheme	Water Supply (MLD)
	OPTIONAL DEVELOPMENT PLAN	
	WATER SUPPLY DEVELOPMENT	
Case-1:	**In Case of Government Decision on Implementation of Laiban Dam ahead of Agos Dam**	
W-2	**Laiban Dam w/Laiban-Taytay 1st Waterway (as BOT Scheme)**	**1,830**
(F-1)	Mobilization of Resettlement Team within MWSS	
	Dialogue with Project Affected People by MWss	
	Land Acquisition and Compensation	
	Resettlement Site Infrastructure	
	Resettlement of People	
	Finalization of BOT Tender Documents	
	Tender/Evaluation/Negotiation (BOT)	
	Design Review by BOT Contractors	
	Construction Works (All works by BOT as prently envisaged)	
	- Laiban Dam + 1st Waterway + WTP #1Unit	610
	- WTP #2 Unit	610
	- WTP #3 Unit	610
W-1	**Agos Dam w/Kaliwa-Angono 1st Waterway (as ODA/BOT Scheme)**	**1,500**
(F-2)	Financing for Detailed Design	
	Detailed Design and Tender Documents	
	Financing for ODA Portion (Agos Dam & Waterway Tunnel)	
	Land Acquisition and Compensation	
	Resettlement of People	
	Tender/Evaluation/Negotiation	
	Main Construction Works	
	- Agos Dam + 1st Waterway (ODA)	
	- WTP #1 Unit + Waterway up to Service Reservoir (BOT)	750
	- WTP #2 Unit (BOT)	750
Total		**3,330**
Case-2:	**In case of Deferment of Laiban Dam as Future Project for Meeting Demand after Year 2025**	
W-2	**Laiban Dam w/Laiban-Taytay 1st Waterway**	**1,830**
(F-1)	Mobilization of Resettlement Team within MWSS	
	Dialogue with Project Affected People by MWss	
	Land Acquisition and Compensation	
	Resettlement Site Infrastructure	
	Resettlement of People	
	Finalization of BOT Tender Documents	
	Tender/Evaluation/Negotiation (BOT)	
	Design Review by BOT Contractors	
	Construction Works (All works by BOT as prently envisaged)	
	- Laiban Dam + 1st Waterway + WTP #1Unit	610
	- WTP #2 Unit	610
	- WTP #3 Unit	610
	HYDROPOWER DEVELOPMENT: (as BOT Scheme)	
P-3	**Kanan No.2 Power Station 209.5 MW**	
	(This scheme can be implemented independently from Water Supply Schemes)	
	Feasibility Study	
	BOT Tender/Evaluation/Negotiation	
	Detailed Design and Tender Documents	
	Land Acquisition and Compensation	
	Resettlement of People	
	Main Construction Works	
	- Access Roads (along Kanan River) (ODA)	
	- Kanan Dam + Powerhouse	
P-4	**Pantay Power Station 22.6 MW**	
	(This scheme is implemented in conjunction with Laiban Dam Sheme)	
Case-1:	**In Case of Laiban Dam Optional Development Case-1:**	
	Tender/Evaluation/Negotiation (BOT)	
	Main Construction Works (BOT)	
Case-2:	**Im Case of Laiban Dam Optional Development Case-2:**	
	Tender/Evaluation/Negotiation (BOT)	
	Main Construction Works (BOT)	

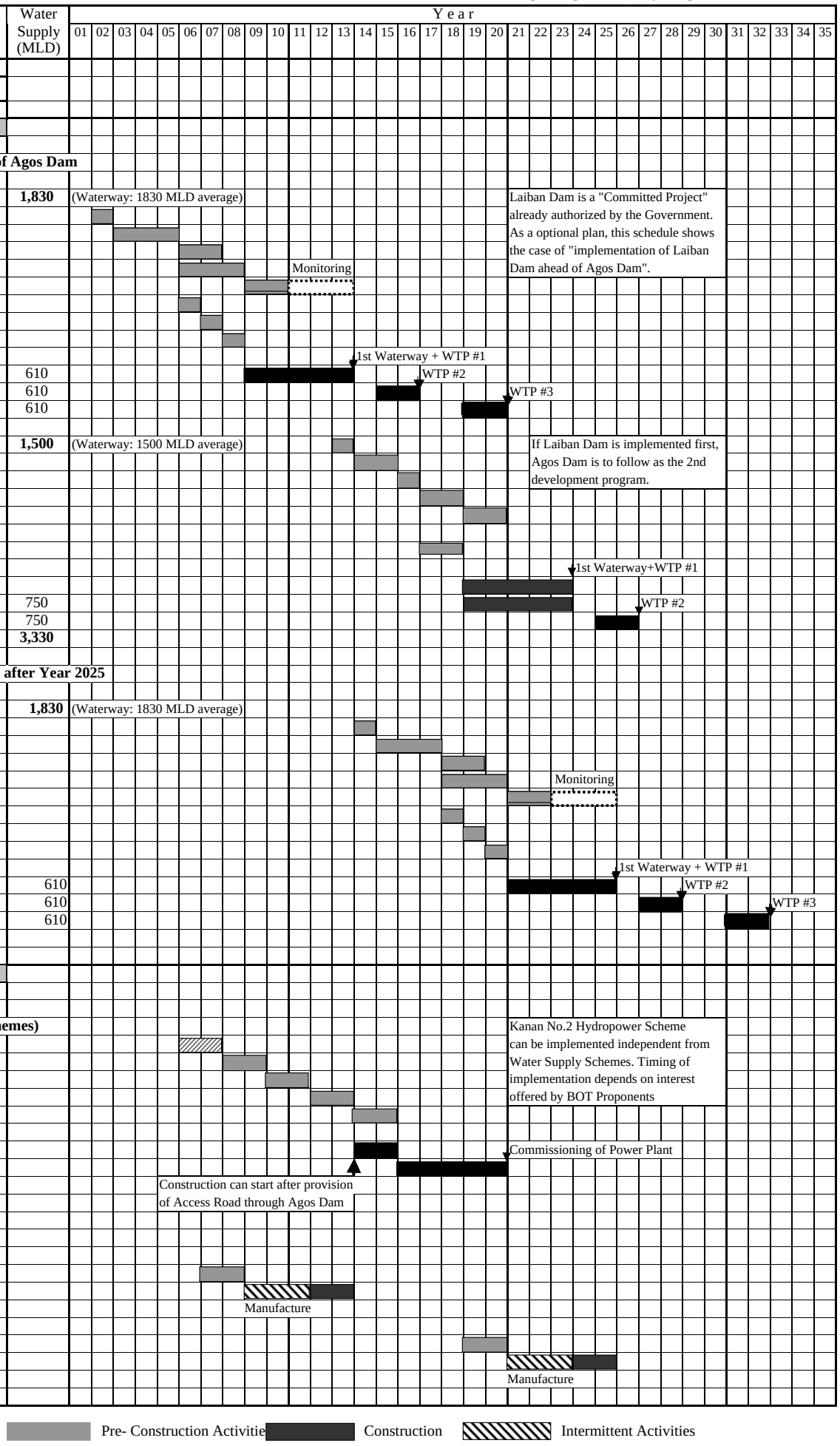


Figure 8.3 Master Plan - Implementation Schedule (2/2)

CHAPTER IX PRIORITY PROJECT FOR FEASIBILITY STUDY

9.1 Selection of Priority Project for Feasibility Study

Among the projects included in the Master Plan (Chapter VIII), the most urgent project is water supply development for attaining the earliest supply of water to Metro Manila. The Master Plan contemplates two options for the 1st stage development of water supply project. The two options are:

(a) Option-1: Kaliwa Low Dam + Agos Dam + Kaliwa-Angono Waterway

- Proposed as the scheme constituting the least costly development scenario (Scenario B Scheme)

(b) Option-2: Laiban Dam + Laiban-Taytay Waterway

- The project was already committed by the Memorandum Order in August 1998

The Master Plan proposed that Option-1 would be the main program to be further looked into. The Laiban Dam project has already had the detailed design. It is not a project requiring feasibility study. Hence, Laiban Dam is ruled out from further study program (feasibility study) in this JICA Study.

Accordingly, the projects proposed in Option-1 will be taken up for the feasibility study scheduled in the next stage.

9.2 Components of the Project for the Feasibility Study

In the case Option-1 is adopted, the immediate object of the feasibility study is to formulate the plan of the 1st stage project, which is the Kaliwa Low Dam scheme with the Kaliwa-Angono (Taytay) 1st waterway. A matter to be noted is that the viability of the 1st stage project relies largely on the feasibility of the Agos Dam since it is the key project of the Option-1. Therefore, the feasibility study should also include the investigation and studies of the Agos Dam as well.

Accordingly, the feasibility study will examine the following components of the project:

(a) Kaliwa Low Dam

(b) Agos Dam with Agos Hydropower Station

(c) Kaliwa- Angono (Taytay) 1st Waterway

(d) Water Treatment Plant for the 1st stage development

(e) Pumping Station and Service Reservoir for water supply to Antipolo area

(f) Main Service Reservoir at Angono (Taytay) for the 1st stage development

(g) Projects proposed for regional development (See Chapter VIII)

The 1st stage projects will be formulated within the framework of a total development plan including the 2nd stage development.

9.3 Major Issues to be Examined in the Feasibility Study

The proposed project contains a wide range of technical and socio-environmental issues to be investigated in the feasibility study. The following describe the major items of the scheduled activities in this respect:

9.3.1 Hydrological Investigation

(1) Flow Regime of the Kaliwa River

Hydrological observation during the 1st field investigation period indicated that runoff recorded at Barangay Daraitan during April-June period was only 2 to 3 m^3/s, which is extraordinarily low compared with the anticipated runoff in the Kaliwa River.

This is presumably due to water seepage into limestone mass in the reach upstream of Barangay Daraitan. It seems that flow returns back to the Kaliwa river channel downstream of the Daraitan limestone gorge. This aspect will be investigated during the feasibility study by spot discharge measurement at several points both upstream and downstream of the Daraitan limestone mass.

(2) Reservoir Operation Study

Based on a new reservoir capacity curve to be derived from new 1:5,000 maps, detailed reservoir operation study for the Agos Dam will be conducted to assess the water resources exploitable for water supply and hydropower generation. The study will also examine the change of low flow regime and flood water levels in the downstream reaches.

9.3.2 Geological Investigation

(1) Damsite Geology

A major concern is the existence of faults near the damsite. At present, two faults are identified: one runs in a N-S direction along the Kanan River (an assumed active fault according to classification by PHILVOLCS) and the other in an E-W direction crossing the left abutment of the damsite. There is a possibility of the existence of other faults. There is also a possibility of landslide on the right abutment. These issues will have to be investigated by intensive surface reconnaissance survey, supplemented by core-drilling tests and seismic refraction survey.

(2) Reservoir Watertightness

A major concern is the possibility of leakage of reservoir water through the limestone mass at Daraitan. This will be investigated by surface reconnaissance survey, drilling test and electric prospecting survey.

(3) Tunnel Geology

The waterway tunnel will cross several faults: one of which is a major fault designated by PHILVOLCS as an assumed active fault. Geological difficulties are also anticipated in the tunneling in the area of Daraitan limestone mass and in the downstream most 10-km section where the tunnel passes through thin Quaternary mountain ridges.

Investigation of the tunnel geology will be principally by surface reconnaissance, supplemented by drilling test.

9.3.3 Socio-Environmental Investigation

(1) Morphological Change of Infanta-General Nakar Plain and Coastline

Reduction of sediment discharges from the upper basin will have impacts on the river and coastal morphology of Infanta-General Nakar alluvial plain. The largest concern is that coastal erosion may take place on account of reduced sediment discharge. This issue will be studied through site reconnaissance, collection/analysis of the relevant data made available.

(2) Resettlement Requirement

The present plan presumes that there will be about 300 PAFs (project affected families) in the Agos reservoir area and about 50 PAFs on the route of the waterway including the water treatment plant site. The feasibility study will investigate the exact number of PAFs by means of socio-economic survey and air-photo mapping.

(3) Mitigation of Environmental Impacts

Agos reservoir will inundate the inhabiting area of rare and threatened fauna/flora species. A survey for Environmental Impact Assessment (EIA) will identify the detail of the issues and propose the necessary mitigation and compensation measures.

9.3.4 Plan Formulation and Design Aspects

(1) Agos Reservoir Water Level

The present plan contemplates the Full Supply Level (FSL) of Agos reservoir to be EL.159.0 m so as not to inundate the main area of Barangay Daraitan. The feasibility study will compare varying cases. Public acceptance for the relocation will be looked into as a part of the EIA survey.

(2) Design of Agos Dam

Agos Dam will be subject to high seismicity due to its location at only 7-8 km distant from the Philippines Fault (Infanta Fault), which is known as an active fault. Also, a particular aspect of the Agos damsite is a thick riverbed deposit of about 40 m deep. These aspects will require a proper design of dam structures. The study will examine the following at a feasibility study level:

- Selection of dam type (presently, concrete face rockfill dam is proposed)
- Study on safety of dam structure against seimicity
- Foundation design
- Care for landslides

(3) Hydropower Scheme at Agos Dam

The present plan contemplates to build a peaking plant of 6-hour/day operation with an afterbay weir for re-regulation of flow released from the power plant. The feasibility study will examine whether benefit from the peaking operation would justify the cost of the afterbay weir. Also, the power transmission planning is a subject to be investigated further.

(4) Selection of Water Treatment Plant and Service Reservoir Sites

Construction of the water treatment plant requires about 70 ha of land for accommodating the plant facilities of 3,640 MLD capacity (3,000 MLD in daily average treatment quantity). The plant site should be selected at a location where the required area can be secured at altitude of around EL. 95 m. In selecting the site, due consideration should be given to minimizing the relocation requirement. The selection of the site will be based on field reconnaissance.

Similar survey will be carried out for service reservoir sites.

(5) Selection of Pipeline Route

The pipeline will be laid out along existing roads as far as possible. Selection of the pipeline route will take into account the minimization of subsequent land acquisition and resettlement problems. The selection of the route will be based on field reconnaissance survey.

9.3.5 Projects for Regional Development

Chapter VIII proposed several projects aimed at improving the livelihood of people and enhancing community activities in the basin. The feasibility study will present the preliminary plan of these works.

CHAPTER X ORGANIZATIONAL AND INSTITUTIONAL ASPECTS

10.1 Introduction

The study on organizational and institutional aspects of the Project was carried out aiming at proposing an appropriate organizational framework to implement the water resources development project for Metro Manila water supply. For this purpose, current conditions of public and private organizations involved in the Metro Manila water supply and related laws and regulations were reviewed. Problems in the organizational and institutional aspects of the water resources sector were identified. The organizational structure for the implementation of Agos Project is proposed and the framework for operation and management after the Project completion is also suggested. Finally, the recommendation for institutional reform of the water resources sector as a whole is made to implement the Project successfully.

10.2 Current Organization/institution concerned with Water Resources Development for Metro Manila Water Supply

10.2.1 Key Agencies related to Metro Manila Water Supply

There are a number of government and private agencies that are involved in development and management of water resources for Metro Manila area. The whole structural organization of water-related departments and agencies are depicted in Figure 10.1. They are also listed in Table 10.1 and their tasks and responsibilities are briefed below.

(1) NEDA

As the primary planning agency, the National Economic and Development Authority (NEDA) is responsible for coordinating the development planning and policy formulation and shall coordinate the formulation of socio-economic development plans, policies and projects. The activities include the formulation of annual and medium-term public investment program, programming of official development assistance (ODA) in the form of grants and concessional loans from foreign governments and multilateral agencies.

The powers and functions of the NEDA reside in the NEDA Board. It is the country's highest social and economic development planning and policy coordinating body with the Chairman being the President of the Philippines.

The NEDA Board is assisted by five Cabinet-level agency committees:

- Development Budget Coordination Committee (DBCC)
- Infrastructure Committee (INFRACOM)
- Investment Coordination Committee (ICC)
- Social Development Committee (SDC)
- Committee on Tariff and Related Matters (CTRM)

The NEDA Secretariat headed by a Director-General, serves as the research and technical support arm of the NEDA Board. The NEDA Director-General is assisted by three Deputy Directors-General, each of whom is responsible for the three major offices of NEDA, namely the National Development Office (NDO), Regional Development Office (RDO) and Central Support Office (CSO).

(2) DPWH

The Department of Public Works and Highways (DPWH) is the State's construction arm responsible for the planning, design, construction and maintenance of infrastructure facilities, particularly national highways, flood control and water resources development systems, and other public works.

The DPWH's responsibility in the areas of water supply includes funding, design and construction of Level-1 facility (point source) with foreign financing (Local funded Level-1 is concerned with LGUs). In the areas of flood control, DPWH is responsible for planning, funding, construction, and maintenance of major flood control and drainage systems (Local drainage concerned is with LGUs).

The DPWH has five Staff Bureaus consisting of:

- Bureau of Design,
- Bureau of Construction,
- Bureau of Maintenance,
- Bureau of Equipment, and
- Bureau of Research and Standards.

It maintains many offices nationwide with key organizational units including 15 Regional Offices, 116 District Engineering Offices and 29 Project Management Offices.

There are four national government agencies that are attached to the DPWH, namely:

- National Water Resources Board (NWRB)
- Metropolitan Waterworks and Sewerage System (MWSS)
- Local Water Utilities Administration (LWUA)
- Toll Regulatory Board (TRB)

(3) DENR

The Department of Environment and Natural Resources (DENR) is the primary government agency responsible for the sustainable development of the country's natural resources and ecosystems.

DENR's mandate is the conservation, management, development and proper use of the country's environment and natural resources. It is also responsible for licensing and regulation of all natural resources as may be provided by law. DENR's major functions are to:

(a) Formulate and implement the department's policies, plans and programs for sustainable development;

(b) Support natural resources-based industries to promote countryside development;

(c) Regulate the exploration, disposition and utilization of the country's environment and natural resources;

(d) Conduct inventory survey and assessment of the Country's environment and natural resources; and

(e) Establish an integrated protected areas (IPAs).

The DENR has four staff bureaus as shown below:

- Land Management Bureau (LMB)
- Forest Management Bureau (FMB)
- Environmental Management Bureau (EMB)
- Ecosystems Research and Development Bureau (ERDB)

Three national government agencies shown below are attached to it.

- National Mapping and Resource Information Authority (NAMRIA)
- National Resources Development Corporation (NRDC)
- Laguna Lake Development Authority (LLDA)

(4) DILG

The Department of the Interior and Local Government (DILG) is delegated the power of general supervision of the President based on primarily the Local Government Code of 1991. Its mandate is to promote peace and order, ensure public safety and further strengthen local government capability aimed towards the effective delivery of basic services to the citizenry.

LGU's are, under the Local Government Code of 1991, given more latitude for resource generation, such as generation of local revenues, local share in national taxes, grants and subsidies, and in credit financing.

(5) DOE

The Department of Energy (DOE) is mandated to ensure a continuous, adequate and economic supply of energy with the end in achieving self-reliance in the country's energy requirements through the integrated and intensive exploration, production, management and development of the country's indigenous energy resources.

Its powers and functions are:

(a) To formulate policies for the planning and implementation of a comprehensive program for the efficient supply and economical use of energy consistent with the national economic plan;

(b) To develop and upgrade the existing Philippines energy program for an integrated and comprehensive exploration, development, utilization, distribution and conservation of energy resources. The program shall include a policy direction towards the privatization of government agencies related to energy.

(c) To regulate private sector activities relative to energy projects as provided for under existing laws;

(d) To devise ways and means of giving direct benefit to the province, city, or municipality, and preferential benefit to the region that hosts the energy resource and/or the energy generating facility; and

The National Power Corporation (NPC) is now attached to the DOE.

(6) NWRB

The NWRB is responsible for coordinating and integrating all activities related to water resources development and management. Its principal objective is to achieve a scientific and orderly development and management of the water resources of the country consistent with the principles of optimum utilization, conservation and protection to meet present and future needs.

NWRB's governing board is composed of the secretaries of six Cabinet Departments namely, DPWH, DENR, NEDA, DA, DOH and DTI and the heads of four water agencies including LWUA, MWSS, NIA and DOE/NPC. The Secretary of DPWH is the chairman of the Board as NWRB is attached to the DPWH. The organization chart of NWRB is depicted in Figure I1.1 of Part I of Volume III.

The jurisdictional powers, functions and duties of the board are provided in three Presidential Decrees including NWRC Charter (PD 424 of 1974), Water Code of the Philippines (PD 1067 of 1976) and PD 1206 of October 6, 1977.

Among others, the Water Code of the Philippines (PD 1067 of 1976) designates NWRB as the primarily responsible agency on behalf of the government for utilization, exploitation, development, conservation and protection of water resources. Major role and function of NWRB stipulated in the Water Code are to be referred to Part-I of Volume III.

(7) MWSS

MWSS is responsible for municipal water supply and sewerage disposal in the Metropolitan Manila area. Its major function includes the following:

(a) To construct, maintain and operate dams, reservoirs, conduits, aqueducts, tunnels, purification plants, water mains, pipes, fire hydrants, pumping stations, machinery and other waterworks for the purpose of supplying water to the inhabitants of its territory, for domestic and other purposes; and to purify, regulate and control the use as well as prevent the wastage of water;

(b) To construct, maintain, and operate such sanitary sewerage as may be necessary for the proper sanitation and other uses of the cities and towns comprising the System;

(c) To fix periodically water rates and sewerage service fees, as the System may deem just and equitable;

(d) To construct, develop, maintain and operate such artesian wells and springs as may be needed in its operation within its territory;

(e) To construct works across, over through any stream, watercourse, street, highway or railway, whether public or private, as the location of said works may require;

(f) To approve, regulate and supervise the establishment, operation and maintenance of waterworks and deep-well within its jurisdiction operated for commercial, industrial and government purposes and to fix just and equitable rates or fees that may be charged to consumers thereof; and

(g) To approve and regulate the establishment and construction of waterworks and sewerage systems under cooperative basis and/or in privately owned subdivisions within its jurisdiction.

The MWSS has performed the role of the public water utility to the Metro Manila region and its surrounding areas for over 120 years. However, recent economic growth and population increase in Manila had outpaced the expansion of water and wastewater conditions. In order to upgrade and expand the existing facilities and services of MWSS, the Government of the Philippines enacted the National Water Crisis Act in 1995, empowering the President Fidel Ramos to privatize MWSS. The privatization process took more than two years to complete and two concessionaires were awarded: MWCI (Manila Water Company Inc.) for East Zone and MWSI (Maynilad Water Service Inc.) for West Zone of Metro Manila area. The Concession Agreement was signed on August 1, 1997. The Regulatory Office is set up within the MWSS to oversee the two private companies. The organization chart of MWSS is depicted in Figure I1.2 of Part I of Volume III. (With respect to the details of MWSS privatization including two Concessionaires i.e. MWCI and MWSI, refer to Subsection 2.4.1.)

(8) NPC

NPC is mandated to set up transmission line grids and construction of associated generation facilities in Luzon, Visayas and Mindanao and other major island in the Philippines. It is responsible for supplying reliable electricity at the least possible cost to its customers, mainly entities that distribute to the final consumers and a few industrial firms. After the aftermath of the oil crisis in the 1970's, NPC now undertakes the development of non-oil based power sources such as hydro, nuclear, geothermal, coal and other energy sources.

The major mandates of NPC are summarized as follows:

(a) To promote the total electrification of the whole country;

(b) To undertake the generation of power and the production of electricity through the development of hydro, oil, geothermal, coal, nuclear and other sources, as well as the transmission of electric power on a nationwide basis; and

(c) To set up transmission line grids and construct associated generation facilities.

The NPC's role in the water sector is to develop electric power generation facilities including hydroelectric and geothermal power, and to construct dams, reservoirs, diversion facilities and plants.

Nowadays, the privatization of NPC has being undertaken. The generation sector is already privatized through dividing into six divisional companies. The privatization of the transmission/distribution sector is under planning stage and its itinerary is going to be disclosed recently. Its details, however, are not available to the Study Team yet.

10.2.2 Ambiguity of Responsibilities among Water-related Agencies

It may be a widely accepted common knowledge that water resources planning and management are to be made on a basis of one river basin. The catchment-based planning is an effective way of creating an integrated planning framework in a river basin. The reality in the Philippines, however, is that there are a number of government agencies involved in different aspects of the water resources sector:

1) Water resources planning:
NEDA, NWRB, LLDA, MWSS, LWUA, DPWH, NIA, DILG and DA

2) Water resources assessment:
NWRB, MWSS, BRS, PAGASA, LWUA and DOE/NPC

3) Water quality and sanitation:
DOH, EMB, EHS, MWSS and LWUA

4) Watershed management:
DENR, NIA, BSWM, DOE/NPC and WD

Functions of water resources management are distributed among different government agencies and administrative supervision is under 12 government agencies. Overall responsibility for water resources management is one of the most basic mandates of NWRB. In past Water Summits, the institutional weaknesses were pointed out including a) resources within NWRB; b) composition of the Board of NWRB; c) difficulty in resolving conflicts; and d) enforcing decisions arrived at by NWRB. It is also pointed out that the provisions of the Water Code are to be strictly enforced under the responsibility of NWRB.

The primary importance of NWRB in water resources development and management naturally leads to its major role in the River Basin Committee that is proposed in the following sub-section 10.4 of this Report.

10.3 Organizational Structure for Implementation of Agos Project

10.3.1 Decision of Steering Committee Meeting

Since the Agos Project is a multi-sectoral water resources development Project, opinions of related agencies should be collected as far as possible. At the meeting of the Steering Committee of the present Study held on August 20, 2001, the organizational aspect of the Project was discussed. The discussion was made centering on the creation of Agos River Basin and Watershed Authority that was proposed by the Study Team in the Progress Report (1). With regard to organization, the establishment of a strong organization was suggested necessary for the facilitation of project financing as well. The committee was informed that a study is ongoing by the World Bank on an Executive Order for the creation of the river basin authority.

The committee was also informed that MWSS was already mandated to manage the Laiban Dam reservation under the administration of President Estrada[1] and that MWSS could ask for expansion of authority to manage the whole Agos River basin. After these discussions, the Steering Committee agreed that "MWSS will handle the implementation of the water resources development of Agos River basin until such time that a Basin Authority is created".

10.3.2 Implementing Framework

(1) Executing Agency and Coordinating Committee

(Refer to Chapter 11 of Volume IV, Main Report of Feasibility Study.)

(2) Private Sector Participation

At this stage of the Study, we assume that Agos Project will be implemented under the combination of Government initiated framework and BOT scheme framework. The inclusion of BOT may be justified since the BOT seems most implementable project framework under such circumstances that the Government of the Philippines has been encouraging the private finance initiatives (PFI) through the issuance of the BOT Law in 1993 that has some incentive provisions to attract private investment to public works construction. However, such public works like dam construction inevitably involves many unknown risks and requires a large investment that causes the investment less attractive to private sector. While, there are no specified beneficiaries for dam project, which means that Government is the most appropriate investor for dam.

In these contexts, it is preliminarily proposed that the combination should be the

[1] Memorandum Order No. 10: "Mandating the Metropolitan Water and Sewerage System (MWSS) to immediately resume the implementation of the Manila Water Supply Project (MWSP) III, also known as the Laiban Dam Project" dated on August 5, 1998.

dam portion with appurtenant tunnel for waterway up to hydropower station and other portions than this including hydropower station, treatment plant and service reservoir. The former is assumed to be implemented under the Government initiated framework and the latter under the BOT framework. The implementation framework is depicted in Figure 11.2 of Chapter 11 of Volume IV, Main Report of Feasibility Study for the former and Figure 11.3 of Chapter 11 of Volume IV, Main Report of Feasibility Study for the latter respectively. More details of the BOT framework will be discussed in the next stage of the Study including financial viability of the Project under the BOT system.

10.4 Organizational Structure for Operation and Management after Completion

10.4.1 Creation of Agos River Basin Committee

As stated in the preceding section, NEDA is preparing an Executive Order (EO) for the creation of river basin authorities. At present time, however, no details of the EO are available. Perspectives of the destiny of WRAP Bills, many of which variations appeared and vanished in the past, are still unforeseeable. Under these circumstances, we propose, independently from the current vagueness, the creation of Agos River Basin Committee (ARBC) after the Project completion. Figure 11.4 of Chapter 11 of Volume IV, Main Report of Feasibility Study presents the conceptual framework for development and management of Agos River Basin.

1) Name of committee: Agos River Basin Committee (ARBC)

2) Purpose:

   To implement the water resources development and management efficiently and effectively avoiding overlapping and/or ambiguity of responsibility coverage among concerned agencies as far as possible.

3) Function of ARBC:

   a. To prepare water resources development and management plans

   b. To make water allocation plan

   c. To develop land utilization plan

   d. To provide flood control operation plan

   e. To tackle natural disaster including drought

   f. To conduct soil and water conservation activities

   g. To promote the community awareness and participation in developing, utilizing, protecting and controlling water resources

4) Composition: Chairman (1): NWRB
   Members (9): NEDA, DPWH, DENR, DOE/NPC, MWSS, DA/NIA, Quezon, Rizal and Bulacan Provinces

5) Allocation of responsibility/task for water resources development and management:

a. Preparation of water resources development master plan: NEDA, NWRB, related Provinces

b. Planning, design and construction of water resources development project and river structures: DPWH, DOE/NPC, MWSS, DA/NIA

c. Watershed management: DENR

d. Flood control/management: DPWH

e. Water quantity management: MWSS, DOE/NPC, and DA/NIA

f. Water quality management: DENR

g. River environmental management: DPWH

10.4.2 Rationale for creation of ARBC

It is widely understood that one river basin should be developed and managed under one consistent and consolidated plan. As pointed out in the preceding section, there are a number of agencies involved in water resources sector in the Philippines. Ambiguity for responsibility sometimes causes duplication of duties and, to the contrary, lacks of necessary action. In this Study, "one river, one plan and one management" constitutes the most basic principle for the water resources development and management planning.

As shown above, NWRB, as a coordinating agency of water resources sector, will be responsible across-the-board for development/management of Agos River Basin. And the power and responsibility will be delegated from NWRB to each agency that is responsible for its related sector. Demarcation and interface of responsible areas will be clarified and adjusted by NWRB through Committee coordination.

All the substantial matters related to water resources development and management in the Agos River Basin will be discussed in the Committee. Recommendation and proposal will be delivered to the upper authority that will be established in the near future. Based on the approval of the upper authority, the decision of the Committee will be implemented by NWRB through delegation procedures.

Actually, coordination and/or regulation are required in many aspects of water resources sector in Agos River. Quezon Province has been planning to develop a hydropower station utilizing Kanan River water; municipalities of Infanta and General Nakar have to prepare for flood water every year; irrigation water for paddy field is to be secured in the lower reaches; water appropriation should be agreed upon and secured among water users. In 1997 and 1998, irrigation farmers were heavily damaged by lack of irrigation water due to prioritized water appropriation of Angat dam water to Metro Manila water supply. These matters would be solved most efficiently and effectively through discussion at a river-basin-wide committee like ARBC.

10.4.3 Relationship between ARBC and River Basin Authority

In case the River Basin Authority (RBA) is established in the near future, the role and function of NWRB designated above will be transferred to the RBA. The ARBC will also be transferred to the RBA as one of its functional organs and all the activities of the Committee member agencies will continue same as before.

10.5 Recommendation for Water Resources Sector Reform

Several item of recommendation are presented in Chapter 11 of Volume IV, Feasibility Study - Main Report.

Table 10.1 Key Organizations concerned with Metro Manila Water Supply

	NEDA	DPWH	DENR	NWRB	MWSS	MWCI	MWSI
	National Economic and Development Authority	Department of Public Works and Highways	Department of Environment and Natural Resources	National Water Resources Board	Metropolitan Waterworks and Sewerage System	Manila Water Company Inc.	Maynilad Water and Service Inc.
Time of establishment	1972/1986	1956/1987		1974, 1987	1971	1997	1997
Charter	EO 5/ EO 230	RA 1192/ EO 124	EO 192	PD 424, EO 124-A	RA 6234	Concession Agreement	Concession Agreement
Status	Govt Authority	Department	Department	Govt agency	Govt corporation	Private company	Private company
Supervisory agency	-	-	-	DENR	DPWH	MWSS	MWSS
Board							
Chairman	President	-	-	Sec. of DENR	Sec. of DPWH	-	-
Vice Chairman	DG of NEDA			Sec. of Soci-economic Planning	Admnstr. of MWSS		
Members	Exec. Sec.				Four appointed by President		
	Sec. of DOF			Sec. of Justice			
	Sec. of DTI			Sec. of Finance	A legal adviser		
	Sec. of DA			DG of Health			
	Sec. of DENR			Directors. of NHRC			
	Sec. of DBM			Ex. Dir NWRB			
	Sec. of DPWH						
	Sec. of DILG						
	Sec. of DOH						
	Sec. of DOFA						
	Sec. of DAR						
	Sec. of DTC						
	DG of BSP						
No. of employees				108	172	1,560	3,000(estimated)
Financial performance(mil.Peso;FY 2000)							
Revenue						1,500	2,635
Expenditures						1,377	5,076
Net profit						123	-2,441
Principal roles/functions	- Coordination of social and economic development planning and policy at national level	- Responsible for planning, design, construction and maintenance of infrastructure facilities	- Responsible for sustainable development of the country's natural resources and ecosystem	-Coordination of water resources development and management Board was restructured in September 2002.	-Providing water works/sewerage in Metro Manila and surrounding area	-Responsible for water supply and sewerage in its concession area	-Responsible for water supply and sewerage in its concession area

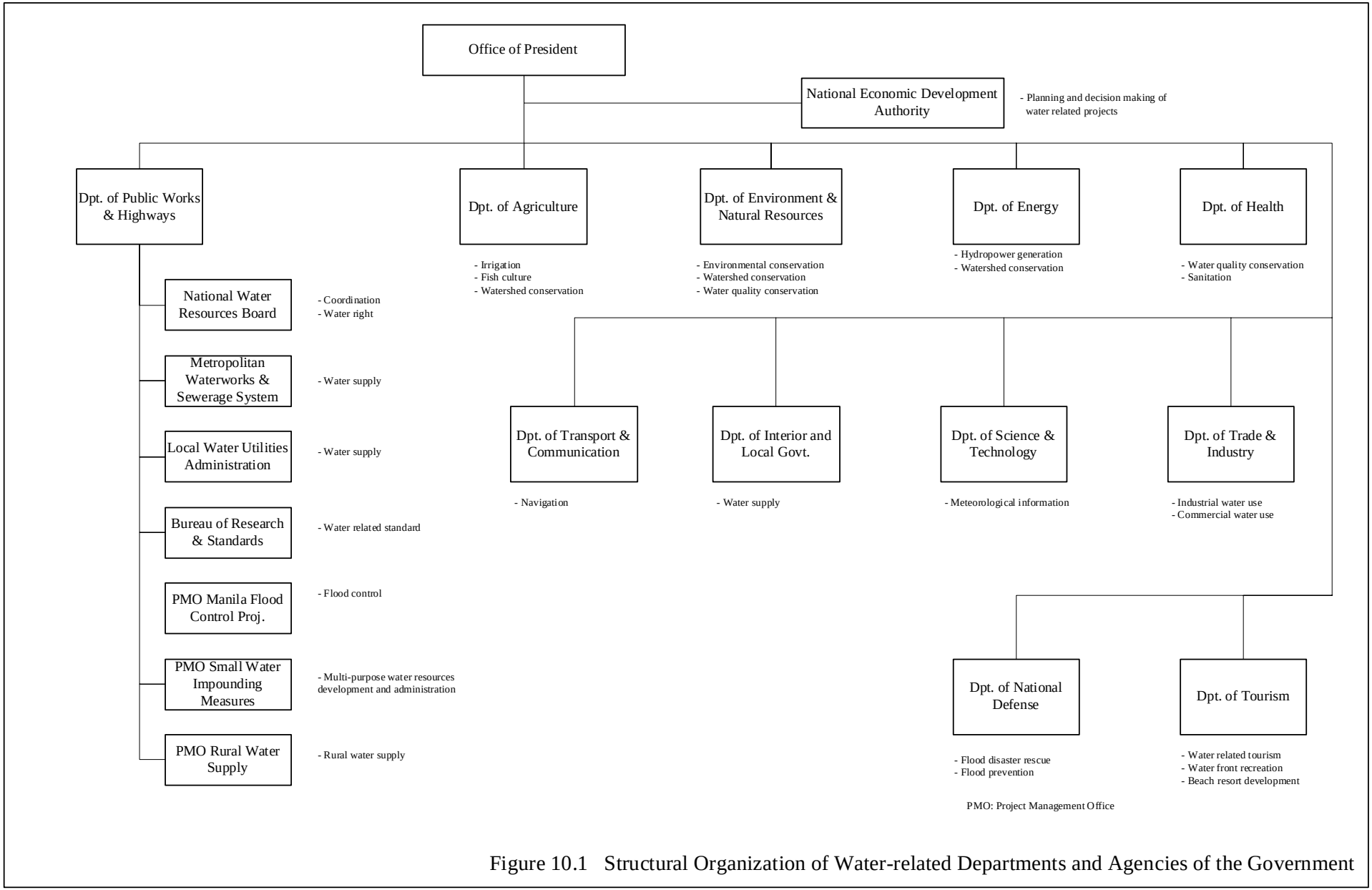


Figure 10.1 Structural Organization of Water-related Departments and Agencies of the Government