Unit: Million Pesos

Item	First Stage	Second Stage	Total
Financial Cost	1,977.3	1,918.4	3,895.7
Economic Cost	1,628.3	1,678.6	3,306.9

Tables 4.4.5 - 4.4.8 show the breakdown of the financial project cost according to construction stretch and stage.

4.4.3 Construction Schedule

The Proposed Priority Projects are each split into two stages. The construction time schedules of the Upper Agno River Project and the Pantal-Sinocalan River are shown in Figure 4.4.1 and Figure 4.4.2 respectively. These schedules are prepared in accordance with the two stage implementation schedule described in Section 4.6, and will be subject to change for further elaboration.

4.5 Project Evaluation

4.5.1 Project Benefit

(1) Framework of Benefit Analysis

There are two types of flood control benefits: (a) direct benefits stemming from reduction or prevention of flood damages (deterrent effects); and (b) other benefits arising from positive effects of flood control.

Direct benefits refer to prevention or reduction of direct and indirect damages due to flood. Direct damage consists of: (a) agricultural damage to crops, livestock and aquaculture; and (b) non-agricultural damage to houses, buildings and infrastructures. Indirect damage arises from suspension of economic activity; (c) additional transport expenditures owing to traffic blockades; and (d) costs of rescue and relief activities. The flood damage analysis provides a quantification of these benefits.

Other benefits also arise as a result of flood control. In the short run, these include: (a) land enhancement; (b) greater agricultural production; and (c) improved agricultural productivity. The long run

effects include: (d) development of agro-industries and aqua-based industries; (e) changes in economic and employment structures; (f) increase in per capita income and consumption; and (g) improvement in the quality of life. These effects can be attributed to flood protection in the sense that it makes possible, enhances, or accelerates their occurrence or development.

(2) Direct Benefits

The annual average flood control direct benefit in the 1991 price level is estimated to be ₱283.4 million and ₱207.0 million for the Upper Agno and Pantal-Sinocalan projects, respectively, or some ₱490.4 million for the two projects.

(3) Estimation of Other Benefits

The results of the I/O analysis and the "what-if" cases indicate that such growth is significant as seen in the linkage effects and in the measured monetary impact. Potential values that can be created are conservatively estimated at ₱1.1 billion annually, exceeding the direct benefits derived in the flood damage analysis. Hence, it is deemed conservative to use a growth factor for the benefit flow to reflect future development in an area that would benefit from flood control. This growth factor is assumed at 4.9% in real terms, the same rate as the projected real growth of GRDP (refer to Section 2.3.5).

4.5.2 Economic Benefit Cost Analysis

(1) Methodology

Economic evaluation reviews the economic justification of the flood control projects by use of the cost-benefit analysis. A project is considered acceptable (a) if the Economic Internal Rate of Return (EIRR) equals or exceeds the social discount rate; or (b) if the Net Present Value (NPV) is greater than zero. The social discount rate is defined as the opportunity cost of capital or the rate of return. This is obtained from NEDA who currently sets it at 15%.

(2) Project Economic Costs

Summarized below are the economic cost estimates of the proposed Priority Projects:

	Summary of Economic Cost (Unit: Million Pesos) Upper Agno	Pantal-Sinocalan
Main Construction Costs	2,324	2,246
Other Costs		
Compensation	246	195
Administration	129	122
Physical Contingency	405	384
Engineering Services	372	359
Total Project Costs	3,476	3,307

(3) Conditions of Cost-Benefit Analysis

Case of Analysis and Benefit Flows

Four cost-benefit runs are made on:

(i) Case A: Upper Agno project alone;

(ii) Case B: Pantal-Sinocalan project alone;

(iii) Case C: Upper Agno and Pantal-Sinocalan projects together (Simultaneous Implementation); and

(iv) Case D: Upper Agno and Pantal-Sinocalan combination but with the former project implemented ahead of the latter project by 5 years as is recommended in Section 4.6.

The most likely project implementation scenario is Case D: Combination/ Stepwise Implementation.

The study assumes the benefit flow in the future development condition increases annually at 4.9%, the same rate as the likely GRDP growth rate.

Conditions of Cost-Benefit Analysis

The cost-benefit analysis are made under the following conditions:

(i)	Base Year	Beginning of 1990.
(ii)	Project Life	50 years (from 1995-2044).
(iii)	Economic Life	50 years (from 1995-2044).
(iv)	Construction Period	10 years (starting 1995).
(v)	Annual Operation and Maintenance Costs	0.5% of main construction cost and physical contingency of completed works.
(vi)	Price Levels	Projections of costs and benefits based on 1991 price levels.
(vii)	Growth Factor (GF) of Benefit Flow	GRDP Growth (GF = 1.049).
(viii)	Social Discount Rate	15%.
(ix)	Foreign Currency Conversion Rates	US$1.00 = ₱ 27.80 = ¥ 137.

(4) Results of the Cost-Benefit Analysis

Case of Analysis	Costs and Benefits
Case A: Upper Agno	
Costs (Million Pesos)	3,476
Benefits (Million Pesos/year)	283
EIRR (%)	20.58
NPV (Million Pesos)	976
Case B: Pantal-Sinocalan	
Costs (Million Pesos)	3,307
Benefits (Million Pesos/year)	207
EIRR (%)	16.96
NPV (Million Pesos)	318
Case C: Combination/ Simultaneous Implementation	
Costs (Million Pesos)	6,783
Benefits (Million Pesos/year)	490
EIRR (%)	18.83
NPV (Million Pesos)	1,295
Case D: Combination/ Stepwise Implementation	
Costs (Million Pesos)	6,783
Benefits (Million Pesos/year)	490
EIRR (%)	20.47
NPV (Million Pesos)	1,393

Case A has the highest EIRR at 20.58%. Case B has a lower EIRR at 16.96%. Flood conditions warrant implementing the Upper Agno project before Pantal-Sinocalan project.

Case D: Stepwise Implementation shows an EIRR of 20.47%, higher than the 18.83% EIRR of Case C: Simultaneous Implementation. The cost-benefit analysis appears to validate the stepwise implementation, considering that it has the second highest EIRR but the highest NPV. Case D is also the most appropriate from the viewpoint of GOP's budget considerations. Therefore, it will be the best choice for GOP.

(5) Sensitivity Analysis

The sensitivity of Case D to possible changes in future economic conditions is summarized below:

Sensitivity Analysis	EIRR (%)
Base Case	20.47
Case 1: 10% Increase in Costs	19.07
Case 2: Reduction in Growth Factor to 3.9%	18.10

4.5.3 Evaluation of the Socio-Economic Impacts of The Project

(1) Impacts on Socio-Economic Conditions

a) Social Costs

The social costs involved in implementing the Priority Projects include encroachment of land, inundation of land, social conflicts arising from land acquisition and resettlement, damage to infrastructures, incident of diseases, water rights conflicts, and seawater intrusion, and are described in Section 5.2.

b) Social Benefits

The social benefits are assessed to outweigh these social costs.

Effect on Human Settlements

With the flood control works, river basin communities will be less troubled by the onset of the typhoon season. Flood damage analysis reveals that estimates of persons affected by floods range from 61,000 to 1,589,000 depending on the flood return period. Flood protection will reduce casualty, mortality, and morbidity rates significantly. Economic activity will also greatly stabilize.

Effect on Labor and Employment

Flood protection will have several effects on labor and employment. The first run effect is on construction work opportunities arising from the flood control projects. During project implementation, a large number of skilled and unskilled workers will be needed. After construction, authorities need to hire additional staff to operate and maintain the facilities.

The second run effect is on work opportunities stemming from increased farm production, although this should be weighed against the loss of jobs arising from encroachment of certain farmlands and fishponds. But the third run and perhaps the most significant effect is on jobs arising from changes in the economic and job structures.

(2) Spread Effects: Impact on the Regional and Macro Economies

a) Impact on the Regional Economy

If flood control succeeds in containing damages, the Pangasinan basin economy will become more productive. With the province generating agricultural surpluses, the economic base for processing and trading of farm produce will become stronger. The spread effects of flood protection will come in terms of stronger intra-regional links for the production, processing, and distribution of goods.

In short, flood protection allows Pangasinan's river basin economy to achieve its potentials and this, in turn, makes it possible for the province

to set a faster growth for the Ilocos Region. The regional economy will then be able to meet, and perhaps even exceed, the projected GRDP growth.

b) Impact on the National Economy

Stronger Pangasinan-led regional economic growth will contribute to attainment of national development goals, as Ilocos will then be able to cast off its lagging performance. This will allow Ilocos to bridge the development gap with the more advanced regions of the country. Inter-regional commerce and trade should increase. The expanded consumer markets will redound to the benefit of the national economy.

The river basins, in addition, straddle the vital North-South trunkline roads passing through Urdaneta and Dagupan City and link points of Northern Luzon with points in the southern part of the island. Given this spatial dimension, the impact of flood control is likely to be felt beyond the confines of the region and to the other regions of Luzon.

4.6 Project Implementation Schedule

4.6.1 Two Stage Implementation Schedule

The financial project cost is estimated to be 3,913 million pesos for the Upper Agno River Project and 3,896 million pesos for the Pantal-Sinocalan River Project. If the two projects are implemented simultaneously from 1995 in a 5 year period, required annual average project fund is 1,560 million Pesos, corresponding to 3.8% of the projected GRDP 40.8 billion pesos (at 1990 price) in 1995 in the Study Area. In Ilocos Region, the public investment to the infrastructures was recorded at about 1.9% of the GRDP in 1990.

Given the first priority on the Upper Agno River, and the second priority on the Pantal-Sinocalan River, each project is planned to be implemented in two stages in each 10 year period. All the projects are planned to be completed in 15 years. In this case the annual investment fund would stay at the level of 1% of the region's GRDP. The project implementation schedule, shown in Figure 4.6.1, is prepared with the target construction commencement of the Upper Agno River in 1995 and that of the Pantal-Sinocalan River in 2000. This schedule assumes:

1) Detailed design of the first stage of Upper Agno Project will begin following submission of the Final Report (the Feasibility Study).

2) The project will be financed by international financing organizations which will require time for negotiation and agreement.

3) Loan agreement between the Government of the Republic of the Philippines and the financing agencies will be made by the time of completing the detail design.

4) Land acquisition and compensation payment will be completed before commencement of construction works.

The first stage of the Upper Agno River Project aims primarily to restore and reinforce the existing diking system against a 10-year design flood discharge, together with construction of the new Poponto floodway and natural retarding basin. The second stage consists of excavating low water channels, installing revetments and other remaining works. Location of the two stage works is illustrated in Figure 4.6.2.

The financial costs of the first and the second stages are 2,923 million pesos and 890 million pesos respectively. The breakdowns of these project costs and work quantities are shown in Table 4.4.5 and Table 4.4.6.

The first stage of the Pantal-Sinocalan River Project aims to protect the three municipalities, Dagupan city, Calasiao, and Santa Barbara, from a 10-year design flood discharge with provision of the proposed by-pass channel, the diking system from the river mouth to the upstream of Santa Barbara on the right bank of the Sinocalan River, the diking system for the Santa Barbara stretch on the left bank of the Sinocalan River, and bank protection on both banks of the Pantal River. The second stage consists of the remaining diking systems for the Sinocalan, Dagupan, and Ingarela Rivers, low water channel improvement, revetments, and other remaining works. Location of the two stage works is illustrated in Figure 4.6.3.

The financial costs of the first and the second stages are 1,977 million pesos and 1,918 million pesos respectively. The breakdown of these

project costs and work quantities are shown in Table 4.4.7 and Table 4.4.8.

As discussed in Section 4.1, construction of a new diking system in the upstream stretch confines flood runoff inside the new river area and induces a significant increase of flood discharge in the downstream reaches. Special care needs to be paid to implementing the first stage works of these projects, in particular to the Upper Agno River, to avoid adverse flood incidence due to such increase in flood discharge. In short, the stretches of the Bayambang-Alcala including the Poponto floodway and retarding basin, Alcala-Asingan, and Asingan-San Manuel shall be implemented simultaneously.

4.6.2 Project Fund Required

The project cost is estimated at the price level as of May, 1991 and the preliminary annual disbursement schedule is prepared for the Upper Agno River Project (see Table 4.6.1) and the Pantal-Sinocalan River Project (see Table 4.6.2) based on the foregoing two stage implementation schedule.

5. ENVIRONMENTAL ASSESSMENT

5.1 IEE on Master Plan Study Area

5.1.1 Objectives of the Environmental Study

The objectives of the Environmental Study on the Agno River Basin Flood Control in the Master Plan stage are as follows;

1) To identify items of impacts on the environment concerned by the Project,

2) To evaluate the magnitude/significance of the impacts,

3) To judge whether the proposed projects need further environmental study, and if so, to point out the effects to be studied in the Feasibility Study Stage.

5.1.2 Initial Environmental Impact Assessment in the Master Plan Stage

(1) Methodology of EIA

To attain the objectives of this environmental study in the Master Plan stage, an Initial Environmental Examination (IEE) was conducted. The IEE is a first approach of EIA by screening and scooping, needing to be carried out at a depth only so as to determine whether an EIA will be required in the next Feasibility Study stage through the IEE.

A checklist method was applied as a basic tool of IEE in this environmental study. The expected effects were evaluated by significance ranging from A to C for each project component and classified as either positive or negative. The checklist items were selected by the Study Team taking into consideration the feature of the Project and the guidelines prepared by the Government of the Philippines (GOP) and the Asian Development Bank (ADB).

(2) Results of IEE for the Project

The results of the Initial Environmental Examination of the Framework Plan and the Long Term Plan are presented in Table 5.1.1.

Agno River

The major project components of flood control in the Agno River are the San Roque dam, the Moriones-O'Donnell dam, the river improvement works along the Agno River, and the Poponto retarding basin. All of these components could be expected to cause relatively significant effects on the environment, in particular, social impact due to land acquisition and resettlement.

First of all, resettlement issues on the local people are expected especially in the inundation areas of the San Roque dam and the Moriones-O'Donnel dam. Agricultural lands in the prospective reservoir areas are also affected by inundation. Secondly, Erosion problems in the upstream and downstream areas are expected because the San Roque and Moriones-O'Donnel dams are located in an erosion susceptible area with slopes of 8° - 15°. Water quality deterioration may not be caused by these dams, but eutrophication and saline water intrusion might be expected.

As for the river improvement works in the Agno River and the Poponto retarding basin, there might give significant social impacts due to the right-of-way required for the new dike construction and inundation by the retarding basin.

Pantal-Sinocalan River

The major schemes of the Pantal-Sinocalan River flood control are the river improvement works and Binalonan floodway.

The river improvement works might have significant social impacts due to the right-of-way required for the new dike construction.

Although no crucial natural environmental issues are expected by the project, water quality deterioration in the downstream area of the Sinocalan

River might be caused by the diversion of flood water from the Tuboy River to the Angalacan River through the Binalonan floodway.

Cayanga-Patalan River

The major schemes of the Cayanga-Patalan River flood control are the river improvement works and the Bued closing dike. The river improvement works might have significant social impact due to the right-of-way required for the new dike construction. The Bued closing dike is not planned to be constructed inside the river channel. It can be, therefore, considered that the natural and social environmental impacts caused by the closing dike are similar to those of the river improvement works except flood flow increase downstream of the dike.

Several environmental impacts are identified in those three project areas. The degree of social impacts due to the location might be significant. The natural environmental impacts could be reduced by taking proper countermeasures.

5.1.3 Principal Conclusions of IEE

- According to the EIA guideline of DPWH, the project shall be requested to prepare an EIA report because it includes two large scale dams in the Framework Plan and the project area is considered prime agricultural land.

- Among the proposed schemes of the Framework Plan, the San Roque dam, the Moriones-O'Donnell dam, the provision of new dikes, and the extension of Poponto retarding basin may have environmentally significant impacts, such as resettlement problems and the encroachment of agricultural lands. Thus, the most careful attention shall be paid to those prospective social impacts.

- As for the other schemes, no significant environmental effects may be expected for both the Framework Plan and Long Term Plan. However, some natural environmental impacts having low or medium level of significance may be expected. Further environmental study shall, therefore, be required to visualize the expected impacts, and to find proper and possible countermeasures.

5.2 Preliminary EIA on Priority Project

5.2.1 Methodology of EIA for the Projects

To attain the objectives of this environmental study in the Feasibility Study stage, an Initial Environmental Examination (IEE) was conducted for the parameters identified in the Master Plan Study at first. A preliminary Environmental Impact Assessment (EIA) is conducted only for the parameter items which were scooped by the IEE.

5.2.2 Results of the Preliminary EIA

The results of the preliminary Environmental Impact Assessment (EIA) are presented in Table 5.2.1. The parameter items for which impact is assessed to be significant are:

Parameter Item	Upper Agno River	Pantal-Sinocalan River
A) Problems due to the location		
. Resettlement	-/A	-/A to -/C
. Land value changes	= to +/A	+/A
. Encroachment of agricultural and aquacultural lands	-/A to -/B	-/A to -/C
. Effects on groundwater hydrology	0	-/C to 0
. Impairment of Navigation	0	-/C to 0
. Loss of community and recreation areas	-/B to -/C	-/C
B) Problems in Construction Stage		
. Hazards to workers and nearby residents	-/C	-/C
. Deterioration of water quality	-/C to 0	-/C to 0
C) Problems in Operation Stage		
. Deterioration of water quality	0	-/C to 0
. Intrusion of saline water	0	-/C to 0
. Vector disease hazards	-/C to +/C	0 to +/C
. Public health hazards	-/C to +/C	0 to +/C

Note: (1) + : Positive effect, - : Negative effect, 0 : No effect,
= : Neutral effect
(2) A : High level of significance, B : Medium level of significance,
C : Low level of significance

Among the environmental parameter items identified as significant, social environments are weighted higher negative impact than natural environments in both the upper Agno River and Pantal-Sinocalan River projects.

	Upper Agno River	Pantal-Sinocalan River
Natural Environment		
. Effects on groundwater	no effect	low
. Deterioration of water quality	low	low
. Intrusion of saline water	no effect	low
Social Environment		
. Resettlement	high	high
. Encroachment of lands	high to medium	high to low
. Impair of navigation	no effect	low
. Loss of community	medium to low	low
. Hazards to workers and nearby residents	low	low
. Vector disease hazards	low	no effect
. Public health hazards	low	no effect

Expected positive impacts are land value change (high), vector disease hazards (low) and public health hazards (low).

5.2.3 Principal Conclusions of the Preliminary EIA

Upper Agno River Project

The project components of flood control in the upper Agno River are river improvement works along the main stream; mainly construction of diking systems, excavation of low water channels, construction of Poponto floodway, and expansion of the Poponto retarding basin. Among them, construction of new dikes and the Poponto floodway, and expansion of the Poponto retarding basin are expected to impose significant impact on the social environment in terms of resettlement and encroachment of agricultural and residential lands. Loss of community is also an adverse effect due to the resettlement.

The identified municipalities to be affected are:

a) Poponto floodway and retarding basin; Bayambang, Bautista, Alcala, San Manuel, Moncada, Paniqui and Ramos
b) Carmen stretch; Vilasis and Rosales
c) Asingan-San Manuel stretch; Santa Maria, Asingan, San Manuel and Tayug.

The impacts due to problems during construction and the impacts on vector disease and public health are all at a low level of significance and are expected to be mitigated to a satisfactory level.

Pantal-Sinocalan River

The project components of flood control in the Pantal-Sinocalan River are construction of the Dagupan bypass and river improvement works along the main stream and its tributaries, the Dagupan and the Ingalera; namely, the construction of diking systems, and excavation of low water channels. Among them, construction of the bypass and new dikes in the areas of Dagupan city and towns of Calasiao and Santa Barbara are expected to impose significant impact on the social environment in terms of resettlement and encroachment of agricultural and residential lands. Loss of community is also an adverse effect due to the resettlement.

The identified cities and municipalities to be affected are:

a) Pantal-Sinocalan River stretches; Dagupan, Binmaley, Calasiao, Santa Barbara, Urdaneta, San Carlos, and Malasiqui
b) Dagupan bypass; Dagupan and Calasiao

The impact due to problems during construction and intrusion of saline water, and the impact on navigation, vector disease and public health are all at a low level of significance. Although the expected impact on water quality in the urban stretch of the Sinocalan River and fishponds along the Dagupan River is assessed to be low level, further detailed study will be required in order to clarify some unknowns involved due to insufficient records.

For the identified parameter items listed under problems due to the location whose impact level of significance is high, particular conditions are described in the next section.

5.2.4 Problems Due to the Location

(1) Resettlement

Planned new setback levees of the upper Agno River and Poponto floodway, new diking systems of the Pantal-Sinocalan River and the Dagupan bypass confine land, buildings and houses inside the new river areas. The Poponto retarding basin extends inundation area around the existing Poponto swamp.

The number of affected buildings and houses, and riparians and residents who are to be evacuated and resettled is estimated as follows:

River	No. of Building /Houses	Population
Upper Agno River		
- Upper Agno River	920	5,520
- Poponto retarding basin	3,960	23,760
Total	4,880	29,280
Pantal-Sinocalan River		
- Main Pantal-Sinocalan River	1,790	10,740
- Ingarela River	504	3,024
- Dagupan River	481	2,886
- Bypass channel	103	618
Total	2,878	17,268

Negative impact on these assets and people is assessed at a high level of significance in the upper Agno River and the Pantal-Sinocalan River, while it is assessed at low level in the Dagupan bypass. These impacts differs from other right-of-way issues because the subject land, assets, and people are located mostly in flood prone areas. Namely, the riparians and residents to be resettled are also beneficiaries on account of flood protection.

(2) Land Value Change

Positive impact on land value change is assessed at a high level in

both the upper Agno River and the Pantal-Sinocalan River except in the area around the Poponto retarding basin. Impact on the Poponto area is assessed to be neutral because negative impact due to an increase in inundation area might be involved.

(3) Encroachment of Agriculture and Aquacultural Lands

In the upper Agno River project, realignment of dikes, and construction of new levees and a floodway will encroach on some agricultural and residential lands in the municipalities of San Manuel, Asingan, Villasis and Alcala. In the Pantal-Sinocalan River project, the proposed bypass channel in Dagupan city will occupy cropland as well as residential areas. Likewise, construction of new dikes along the river course will encroach on agriculture, fish pond and residential land in and around Dagupan city and the towns of San Carlos, Calasiao, and Santa Barbara. A total of 2,006 ha is required to be acquired for the right-of-ways as estimated below:

River	Acquisition Area (ha)
Upper Agno River	
- Upper Agno River	1,041
- Poponto retarding basin	166
Total	1,207
Pantal-Sinocalan River	
- Main Pantal-Sinocalan River	467
- Ingarela River	121
- Dagupan River	146
- Bypass channel	65
Total	799

Negative impact on these land encroachment is assessed at a high to medium level in the upper Agno River, while it is assessed at a high to low level in the Pantal-Sinocalan River.

6. RECOMMENDATIONS

6.1 Recommended Projects

Both the Long Term Plan and the Priority Projects are highly justifiable economically with EIRRs of:

Long Term Plan	EIRR (%)
a) Agno River with Tarlac	16.6
b) Agno River Tributaries	15.3
c) Allied Rivers	33.8
d) All the Study Area	20.5

Priority Project	
a) Upper Agno River	20.6
b) Pantal-Sinocalan River	17.0
c) Combination/stepwise Implementation	20.5

If the Study Area's flood control succeeds in containing damages with implementation of the proposed Long Term Plan, the basin economy of Pangasinan and Tarlac will become more productive. With the province generating agricultural surpluses and spread effects, flood protection will come in terms of stronger inter-regional links for the production, processing and distribution of goods. In short, flood protection allows the basin economy of Pangasinan and Tarlac to achieve its potentials and this, in turn, makes it possible for the provinces to set a faster growth pace for the Ilocos Region. The regional economy will then be able to meet, and perhaps even exceed, the projected GRDP growth.

On the other hand the river basins straddle the vital North-South trunkline roads passing through Urdaneta and Dagupan City and link points of Northern Luzon with points in the southern part of the island. Given this special dimension, the positive impact of flood control is likely to be felt beyond the confines of the region and to the other points of Luzon.

Given the first priority on the Upper Agno River and, the second priority on the Pantal-Sinocalan River, the first stage of the Priority

Projects is recommended to be implemented as urgent flood protection measures.

The financial project costs of the first and second stages of the Priority Projects are:

Unit: Million Pesos

	Upper Agno River	Pantal-Sinocalan River
First stage	2,923.4	1,977.3
Second stage	989.8	1,918.4
Total	3,913.2	3,895.7

Following the Priority Projects, the Long Term Plan is recommended to be implemented with the target commission year 2020. The total project cost is estimated to be 15,974 million pesos at 1989 constant price level.

6.2 Recommendation for Further Study

(1) Environmental Impact Statement

The Government of the Philippines is recommended to conduct a detailed environmental impact assessment study to prepare the Environmental Impact Statement. The major items to be studied and assessed are:

1) Social impact with respect to land acquisition and resettlement issues especially in the following stretches:

   a) Upper Agno River
      - Poponto floodway and retarding basin
      - Carmen stretch
      - Asingan - San Manuel stretches
   b) Pantal-Sinocalan River
      - Pantal-Sinocalan River main stream and its tributaries
      - By-pass route

2) Water use, water quality and related issues in the dry and wet seasons especially in the following stretches:

a) Upper Agno River
   . Bayambang stretch
b) Pantal-Sinocalan River
   . Urban stretch of the Sinocalan River (Marasay River)
c) Fish ponds along the Dagupan River

(2) Laboratory Hydraulic Model Tests

The following laboratory hydraulic model tests are recommended to determine the alignment and detailed dimensions of the structures concerned and to confirm the stability of river channels and beds before the detailed design:

a) Upper Agno River
   . Alignment and dimension of the diversion dike and the channels leading to the Poponto Floodway and the Bayambang stretch and those of the floodway dikes.
   . Alignment and dimension of the setback levees in the Carmen and the San Manuel stretches.

b) Pantal-Sinocalan River
   . Alignment and dimension of the by-pass channel, and the intake channel and the watergate at the junction of the existing Sinocalan River.

(3) Seismic Resistance Design

The seismic resistance survey and design done in this Study is preliminary, and thus further detailed survey and design on this subject are recommended to be conducted in the detailed design stage.

(4) Monitoring of Sedimentation

In order to get reliable quantitative sediment records, monitoring of sedimentation in the Poponto swamp and the Tarlac River is recommended.

A P P E N D I X - A

CONTENTS OF MAIN REPORTS

Part 1: Master Plan

TABLES

Table 2.2.1 SOCIO-ECONOMIC PROFILE OF THE STUDY AREA

Parameter	Unit	1980						1987					
		Philippines	Region I Ilocos	Region II Cagayan Valley	Region III Central Luzon	Study Area Amount	Study Area Share (%)	Philippines	Region I Ilocos	Region II Cagayan Valley	Region III Central Luzon	Study Area Amount	Study Area Share (%)
I. Population													
1. Total	Thousand	48,098	3,541	2,216	4,803	2,046	4.3	57,356	4,056	2,648	5,726	2,324	4.1
2. Rural Population	Thousand	30,155	2,699	1,872	2,794	1,517	5.0						
Percent of Total	%	62.7	76.2	84.5	58.2	74.1	-						
3. Population 15 yrs. old & over	Thousand	28,967	2,158	1,316	2,880	1,242	4.3	34,840	2,496	1,576	3,519	1,429	4.1
Percent of Total	%	60.2	60.9	59.4	60.0	60.7	-	60.7	61.5	59.5	61.5	61.5	-
4. Total Labor Force	Thousand	17,308	1,202	867	1,624	694	4.0	22,984	1,558	1,108	2,189	892	3.9
Percent of Pop. 15 yrs. old & over	%	59.8	55.7	65.9	56.4	55.9	-	65.7	62.4	70.3	62.2	62.4	-
5. Employed Persons (total)	Thousand	16,434	1,169	833	1,529	670	4.1	20,795	1,411	1,054	1,909	800	3.8
-Agriculture, Fishery & Forestry	Thousand	8,453	706	589	586	369	4.4	9,940	768	689	733	405	4.1
-Industry	Thousand	2,554	156	80	312	101	4.0	3,045	198	77	358	121	4.0
-Service	Thousand	5,427	307	164	631	200	3.7	7,810	445	288	818	274	3.5
Total	Thousand	16,434	1,169	833	1,529	670	4.1	20,795	1,410	1,055	1,909	800	3.8
Agriculture as Percent of Total	%	51.4	60.4	70.7	38.3	55.1	-	47.8	54.5	65.3	38.4	50.6	-
Employment Rate	%	95.0	97.3	96.1	94.2	96.5	-	90.5	90.5	95.2	87.2	89.7	-
II. GDP													
1. Total at Current Prices	Million P	264,652	10,706	7,567	24,456	6,181	2.3	705,467	30,577	16,152	62,638	17,521	2.5
at 1972 Constant Prices	Million P	92,568	3,500	2,606	7,644	2,021	2.2	95,434	4,323	2,301	7,665	2,477	2.6
2. Per Capita at Current Prices	P	5,477	3,021	3,397	5,067	3,021	-	12,300	7,539	6,100	10,939	7,539	-
at 1972 Constant Prices	P	1,916	988	1,170	1,584	988	-	1,664	1,066	869	1,339	1,066	-
3. Contribution to GDP at Current Prices													
-Agriculture	Million P	36,332						95,516	8,224	5,200	7,373		
Palay	Million P	9,080						24,028	2,453	2,854	4,649		
Corn	Million P	3,481						11,551	281	972	28		
Other crops	Million P	23,771						59,937	5,490	1,373	2,696		
-Livestock & Poultry	Million P	7,488						28,028	2,368	1,496	4,219		
-Fishery	Million P	11,198						36,319	598	159	1,569		
-Forestry	Million P	6,743						10,907	125	1,468	13		
Total Agri., Fishery & Forestry	Million P	61,761	3,255	3,244	4,713			170,770	11,315	8,323	13,174		
Percent of GDP	%	23.3	30.4	42.9	19.3			24.2	37.0	51.5	21.0		
-Industry	Million P	96,723	3,515	2,048	10,843			229,683	8,080	1,809	24,917		
Percent of GDP	%	36.6	32.8	27.1	44.3			32.6	26.4	11.2	39.8		
-Service	Million P	106,168	3,936	2,275	8,900			305,014	11,182	6,020	24,547		
Percent of GDP	%	40.1	36.8	30.0	36.4			43.2	36.6	37.3	39.2		
4. Labor Productivity													
-Agriculture	P	7,306	4,610	5,508	8,043			17,180	14,733	12,080	17,973		
-Industry	P	37,871	22,532	25,600	34,753			75,430	40,808	23,494	69,601		
-Service	P	19,563	12,821	13,872	14,105			39,054	25,128	20,903	30,009		
III. Land Use													
1. Total Area	km2	300,000	21,568	36,403	18,231	8,305	2.8						
2. Agricultural Land													
-Temporary crops	km2	43,652	3,086	4,157	4,445	2,029	4.6						
-Permanent crops	km2	34,890	200	380	138	96	0.3						
-Pasture	km2	5,300	504	956	171	159	3.0						
-Others	km2	13,409	499	897	266	198	1.5						
Total	km2	97,251	4,309	6,390	5,020	2,482	2.6						
Percent of Total Area	%	32.4	20.0	17.6	27.5	29.9	-						

Table 3.3.1 FEATURES OF DESIGN CHANNEL OF AGNO RIVER FOR FRAMEWORK PLAN

River:Agno River
Design Flood: 100-yr

Item	Unit	Agno R.			
		RM - AG45	AG45 - AG65	AG65 - AG109	AG109 - AG177
Design Discharge	m3/s	13800	13800	13800	12700
Distance	m	6850	9050	15150	10500
Gradient of Channel Bed	-	1/6500	1/6500	1/3500	1/2000
River width	m	400-300	1500	1500	1500
Width of Channel Bed	m	100	300	240	200
Dike Height (Ave.)	m	4.9	5.5	6.6	6.0
Water Depth	m	8.73-9.75	9.75-11.1	11.1	11.1-9.74
Low Channel Depth (Ave.)	m	6.5	6.5	6.5	6.5

Item	Unit	Agno R	Retarding 1>	Floodway	Bayanbang 2>
		AG177 - AG181	AG181 - AG314	AG314 - AG320(b)	AG282(b)- AG307
Design Discharge	m3/s	11200	-	8200	1000
Distance	m	2200	7100	3800	9840
Gradient of Channel Bed	-	1/2000	1/1600	1/1600	1/1850
River width	m	1500	-	1200	250-1300
Width of Channel Bed	m	200	180	180	80-100
Dike Height (Ave.)	m	5.6	6.7	5.3	3.3
Water Depth	m	9.74-9.56	9.56-7.80	7.8	8.5-4.1
Low Channel Depth (Ave.)	m	6.0	4.0	4.0	5.0

1>:Retarding Basin stretch 2>:Bayanbang Stretchc of Agno R.

Item	Unit	Agno R.			
		AG320(b)- AG351	AG351 - AG367	AG367 - AG414	AG414 - AG453
Design Discharge	m3/s	9200	8200	8200	8200
Distance	m	15930	8170	8150	5330
Gradient of Channel Bed	-	1/1600	1/1300	1/665	1/440
River width	m	900-1900	1250-3000	3000-2000	2000-1200
Width of Channel Bed	m	180	180	180	150
Dike Height (Ave.)	m	5.3	4.6	3.9	3.4
Water Depth	m	7.8	7.8-5.4	5.4	4.9
Low Channel Depth (Ave.)	m	4.0	3.5	3.0	3.0

Item	nit	Agno R.			
		AG367 - AG460	AG460 - AG464	AG464 - AG469	AG469 - AG474
Design Discharge	m3/s	6400	6400	6400	6400
Distance	m	3120	1980	2420	2800
Gradient of Channel Bed	-	1/280	1/230	1/230	1/230
River width	m	1500-3000	3000-2200	2200-1100	1100-300
Width of Channel Bed	m	150	150	150	150
Dike Height (Ave.)	m	2.5	2.5	3.1	3.4
Water Depth	m	4.0	4.0	4.0-6.3	6.3-7.5
Low Channel Depth (Ave.)	m	3.0	3.0	3.5	5.0

Table 3.3.2 FEATURES OF DESIGN CHANNEL OF TARLAC RIVER AND TRIBUTARIES OF AGNO RIVER FOR FRAMEWORK PLAN (1/2)

River:Tarlac River
Design Flood: 100-yr

Item	Unit	Reterding Basin	Tarlac R.		
		AG180+0.8k - TA200	TA200 - TA227	TA227 - TA251	TA251 - TARIS DAM
Design Discharge	m3/s	-	2600	2600	1750
Distance	m	8100	13000	11800	4150
Gradient of Channel Bed	-	1/1650	1/1300	1/760	1/692
River width	m	-	1700-640	1600-600	600-270
Width of Channel Bed	m	160	160	160	140
Dike Height (Ave.)	m	8.2	3.9	3.5	1.5
Water Depth	m	8.9-4.82	4.82-4.0	4.0	4.0-3.5
Low Channel Height (Ave.)	m	5.0-2.0	2.0	2.0	3.5

River:Camiling River
Design Flood: 50-yr

Item	Unit	Camiling R.					
		AG143+1.0k CA156+0.3k	CA156+0.3k - CA162	CA162 - CA167	CA167 - CA172	CA172 - CA173	CA173 - CA175
Design Discharge	m3/s	2200	1550	1550	1550	1150	1150
Distance	m	3550	4650	4300	4950	1300	2050
Gradient of Channel Bed	-	1/2000	1/2000	1/1000	1/550	1/300	Existing
River width	m	250	180	180	180	130	130
Width of Channel Bed	m	60	50	50	50	35	Existing
Dike Height (Ave.)	m	5.3	4.2	3.6	2.8	1.8	1.8-0.0
Water Depth	m	8.86-7.71	7.71-7.5	7.5-7.1	7.1-5.42	5.42-5.22	5.22-4.8
Low Channel Height (Ave.)	m	4.7	4.7	4.7	4.5	4.5	4.0

River:Banila River
Design Flood: 50-yr

Item	Unit	Banila R.					
		AG349 - AG349+3.7k	AG349+3.7k - BN381	BN381 - BN386	BN386 - BN394	BN394 - BN397	BN397 - BN401
Design Discharge	m3/s	1400	1400	950	440	440	340
Distance	m	3700	8050	4550	7600	2900	4100
Gradient of Channel Bed	-	1/1295	1/835	1/520	1/265	Existing	Existing
River width	m	180	180	120	120	120	120
Width of Channel Bed	m	30	30	20	10	Existing	Existing
Dike Height (Ave.)	m	3.5	3.2	2.9	2.4	2.1	1.3
Water Depth	m	7.5	7.0	7.0-6.42	6.42-3.14	3.14-1.5	1.5
Low Channel Height (Ave.)	m	5.0	4.8	4.8	4.8-2.5	1.0	1.0

Table 3.3.2 FEATURES OF DESIGN CHANNEL OF TARLAC RIVER AND TRIBUTARIES OF AGNO RIVER FOR FRAMEWORK PLAN (2/2)

River:Viray-Dipalo River
Design Flood: 50-yr

Item	Unit	Viray-Dipalo R.			Viray R.		
		AG414 - VD425	VD425 - VD428	VD428 - VD430	VD430 - VD430+0.6k	VD430+0.6k - VD433	VD433 - VD434+0.5k
Design Discharge	m3/s	750	750	750	750	370	370
Distance	m	2800	3100	2000	600	2400	1450
Gradient of Channel Bed	-	1/375	1/300	1/250	1/127	1/127	1/75
River width	m	380-290	320-270	320-260	300	150	150
Width of Channel Bed	m	30	30	30	30	15	15
Dike Height (Ave.)	m	1.7	1.7	1.7	1.7	0.9	0.9
Water Depth	m	4.0	4.0	4.0	4.0	2.9	2.9
Low Channel Height (Ave.)	m	3.3	3.3	3.3	3.3	2.8	2.8

Item	Unit	Dipalo R.				
		VD430+0.6k - VD436	VD436 - VD437	VD437 - VD439	VD439 - VD441	VD441 - VD442
Design Discharge	m3/s	350	350	210	210	210
Distance	m	1500	700	1950	1950	1000
Gradient of Channel Bed	-	1/170	1/125	1/125	1/80	1/68
River width	m	100	100	100	100	100
Width of Channel Bed	m	15	15	10	10	10
Dike Height (Ave.)	m	2.6	2.6	2.3	2.1	1.9
Water Depth	m	3.8	3.0	2.5	2.3	2.1
Low Channel Height (Ave.)	m	2.0	1.2	1.0	1.0	1.0

River:Ambayoan River
Design Flood: 50-yr

Item	Unit	Ambayoan R.		
		AG461 - AM444+0.5k	AM444+0.5k - AM448	AM448 - AM451+0.4k
Design Discharge	m3/s	1750	1750	1750
Distance	m	1800	3550	3350
Gradient of Channel Bed	-	1/390	1/205	1/150
River width	m	400	400	400
Width of Channel Bed	m	50	50	50
Dike Height (Ave.)	m	4.2	2.2	2.0
Water Depth	m	5.5	3.7	3.5
Low Channel Height (Ave.)	m	2.8	2.5	2.5

Table 3.3.3 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR FRAMEWORK PLAN (1/4)

River:Cayanga-Patalan-Angalacan River
Design Flood: 50-yr (with Closure Dike)

Item	Unit	Cayanga R. R.M - Bued R.	Patalan R. Bued R. - Aloragat R.	Aloragat R. - 21.0k	Angalacan R. 21.0k - Maraboc	Maraboc - 27.0k	27.0k - Bugayong
Design Discharge	m3/s	3100	1850	1250	1250	500	500
Distance	m	6500	8300	6200	2800	3200	3300
Gradient of Channel Bed	-	1/1300	1/1100	1/650	1/460	1/460	1/230
River width	m	500	200	150	120	100	80
Width of Channel Bed	m	65	45	40	35	25	20
Dike Height (Ave.)	m	2.9	3.3	2.2	2.1	0.7	0.3
Water Depth	m	8.2	7.3	6.2	6.1	4.7	4.3
Low Channel Height (Ave.)	m	6.5	5.0	5.0	5.0	5.0	4.0

Item	Unit	Angalacan R. Bugayoung - Killo Br.	Killo Br. - 37.5k
Design Discharge	m3/s	370	370
Distance	m	2700	4500
Gradient of Channel Bed	-	1/190	1/140
River width	m	60	50
Width of Channel Bed	m	15	15
Dike Height (Ave.)	m	0.4	1.1
Water Depth	m	3.6	3.3
Low Channel Height (Ave.)	m	4.0	3.0

River:Bued River
Design Flood: 50-yr (with Closure Dike)

Item	Unit	Bued R. Junction - 2.0k	2.0k - 4.0k	4.0k - NIA Dam	NIA Dam - 11.9k	11.9k - 16.5k	16.5k - 19.7k
Design Discharge	m3/s	1300	1300	1300	1300	1000	1000
Distance	m	2000	2000	3300	4600	4600	3200
Gradient of Channel Bed	-	1/400	1/280	1/170	1/143	1/140	1/70
River width	m	400	400	400	400	400	400
Width of Channel Bed	m	30	20	20	20	20	20
Dike Height (Ave.)	m	4.4-2.0	2.1	2.1	1.9	1.6	1.4
Water Depth	m	8.2-5.8	5.6	3.3	2.4	2.1	1.9
Low Channel Height (Ave.)	m	5.0	3.5	2.0	1.5	1.5	1.5

Table 3.3.3 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR FRAMEWORK PLAN (2/4)

River:Aloragat River
Design Flood: 50-yr (with Closure Dike)

Item	Unit	Aloragat R. Junction - 7.0k	7.0k - 11.5k	11.5k - 17.0k	17.0k - 19.7k
Design Discharge	m3/s	470	470	250	170
Distance	m	7000	4500	5500	2700
Gradient of Channel Bed	-	1/680	1/355	1/355	1/185
River width	m	90	80	50	45
Width of Channel Bed	m	30	20	10	10
Dike Height (Ave.)	m	2.8-0.0	0	1.3	1.4
Water Depth	m	7.3-4.2	4.0	4.0	2.8
Low Channel Height (Ave.)	m	5.5	5.0	3.5	2.0

River:Pantal-Marusay-Sinocalan-Tuboy River
Design Flood: 50-yr (with Floodway)

Item	Unit	Pantal R. R.M. - Dagupan R.	Marusay R. Dagupan R. - 4.0k	4.0k - Ingalera R.	Sinocalan R. Ingalera R. - 18.0k	18.0k - 25.5k	25.5k - Mitura R.
Design Discharge	m3/s	2700	1650	1650	1000	650	650
Distance	m	2500	1500	4300	9700	7500	5500
Gradient of Channel Bed	-	1/1750	1/1750	1/1750	1/1750	1/1450	1/1100
River width	m	400	120	220	220	150	100
Width of Channel Bed	m	70	60	50	30	30	25
Dike Height (Ave.)	m	3.7-3.4	3.0	3.0	2.6	2.4	2.0
Water Depth	m	8.0-7.7	7.5	7.5	7.1	6.8	6.0
Low Channel Height (Ave.)	m	5.5	5.5	5.5	5.5	5.5	5.0

Item	Unit	Tagumising R. Mitura R. - 36.7k	36.7k - Sta.Maria	Sta.Maria - 43.5k
Design Discharge	m3/s	160	160	120
Distance	m	5700	4700	2100
Gradient of Channel Bed	-	1/700	1/430	1/350
River width	m	100	80	80
Width of Channel Bed	m	10	10	10
Dike Height (Ave.)	m	0	0	0
Water Depth	m	4.0	3.3	3.0
Low Channel Height (Ave.)	m	5.0	4.5	4.5

Table 3.3.3 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR FRAMEWORK PLAN (3/4)

River:Dagupan River
Design Flood: 50-yr

Item	Unit	Dagupan R. Junction - 7.5k	San Juan R. 7.5k - 12.7k	San Juan R. 12.7k - Elang R.	Elang R. San Juan - 27.6k
Design Discharge	m3/s	1100	900	650	310
Distance	m	7500	5200	9000	5900
Gradient of Channel Bed	-	1/5000	1/5000	1/5000	1/5000
River width	m	250	100	100	50
Width of Channel Bed	m	60	30	30	20
Dike Height (Ave.)	m	3.2	3.6	4.1	3.3
Water Depth	m	7.7	7.6	7.6	7.0
Low Channel Height (Ave.)	m	5.5	5.0	4.5	4.5

River:Ingalera River
Design Flood: 50-yr

Item	Unit	Ingalera R. Junction-Malasigui	Malasigui - 26.0k	26.0k - 32.0k	32.0k - San Nicolas	San Nicolas - 37.5k
Design Discharge	m3/s	600	460	260	260	150
Distance	m	13300	12700	6000	4000	1500
Gradient of Channel Bed	-	1/3600	1/1800	1/1000	1/700	1/700
River width	m	100	60	50	50	40
Width of Channel Bed	m	25	15	15	10	10
Dike Height (Ave.)	m	3.0	2.2	1.3	1.7	1.3
Water Depth	m	7.5	6.9	5.5	4.9	4.2
Low Channel Height (Ave.)	m	5.5	5.5	5.0	4.0	3.5

River:Mitura-Magalong River
Design Flood: 50-yr

Item	Unit	Mitura R. Junction - 5.3k	Magalong R. 5.3k - Taboy	Magalong R. Taboy - 19.0k	Magalong R. 19.0k-21.0k
Design Discharge	m3/s	250	250	180	140
Distance	m	5300	8900	4800	2000
Gradient of Channel Bed	-	1/800	1/460	1/460	1/250
River width	m	50	40	35	30
Width of Channel Bed	m	10	8	6	4
Dike Height (Ave.)	m	2.0-1.0	1.5	1.4	1.3
Water Depth	m	6.0-5.2	4.7	4.3	3.7
Low Channel Height (Ave.)	m	5.0	4.0	3.5	3.0

Table 3.3.3 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR FRAMEWORK PLAN (4/4)

River:Binalonan Floodway/Tuboy River
Design Flood: 50-yr

Item	Unit	Binalonan Floodway		Tuboy R.	
		Junction - 1.8k	1.8k - 6.7k	6.7k - 10.6k	10.6k - 12.2k
Design Discharge	m3/s	650	650	550	550
Distance	m	1800	4900	3900	2000
Gradient of Channel Bed	-	1/400	1/355.5	1/190	1/143-1/67
River width	m	60	60	60	60
Width of Channel Bed	m	15	15	15	15-10
Dike Height (Ave.)	m	2.5	2.4	1.7	1.7-0.3
Water Depth	m	6.1-6.0	6.0-5.7	4.7	4.7-3.3
Low Channel Height (Ave.)	m	4.5	4.5	4.0	4.0

Table 3.3.4 FEATURES OF DESIGN CHANNEL OF AGNO RIVER FOR LONG TERM PLAN

River:Agno River
Design Flood: 25-yr

Item	Unit	Agno R.			
		RM - AG45	AG45 - AG65	AG65 - AG109	AG109 - AG177
Design Discharge	m3/s	10100	10100	10100	9300
Distance	m	6850	9050	15150	10500
Gradient of Channel Bed	-	1/6500	1/6500	1/3500	1/2000
River width	m	1500	(1500)	(1500)	(1500)
Width of Channel Bed	m	360-250	240	200	200
Dike Height (Ave.)	m	4.2	4.8	5.4	4.8
Water Depth	m	8.2-9.2	9.2-10.4	10.4	10.4-9.1
Low Channel Depth (Ave.)	m	6.5	6.5	6.5	6.5

Item	Unit	Agno R	Retarding 1>	Floodway	Bayanbang 2>
		AG177 - AG181	AG181 - AG314	AG314 - AG320(b)	AG282(b)- AG307
Design Discharge	m3/s	8400	-	5200	600
Distance	m	2200	7100	3800	9640
Gradient of Channel Bed	-	1/2000	1/1600	1/1600	1/1850
River width	m	(1500)	-	1200	250-1300
Width of Channel Bed	m	200	180	180	80-100
Dike Height (Ave.)	m	4.4	4.7	4.2	2.3
Water Depth	m	9.1-8.7	8.7-6.7	6.7	7.8-3.8
Low Channel Depth (Ave.)	m	6.0	4.0	4.0	5.0

1>:Retarding Basin stretch 2>:Bayanbang Stretchc of Agno R.

Item	Unit	Agno R.			
		AG320(b)- AG351	AG351 - AG367	AG367 - AG414	AG414 - AG453
Design Discharge	m3/s	5800	5100	5100	5100
Distance	m	15930	8170	8150	5330
Gradient of Channel Bed	-	1/1600	1/1300	1/665	1/440
River width	m	900-1900	1250-3000	3000-2000	2000-1200
Width of Channel Bed	m	180	180	180	150
Dike Height (Ave.)	m	4.2	3.7	3.2	2.9
Water Depth	m	6.7	6.7-4.7	4.7	4.4
Low Channel Depth (Ave.)	m	4.0	3.5	3.0	3.0

Item	nit	Agno R.			
		AG367 - AG460	AG460 - AG464	AG464 - AG469	AG469 - AG474
Design Discharge	m3/s	3800	3800	3800	3800
Distance	m	3120	1990	2420	2800
Gradient of Channel Bed	-	1/280	1/230	1/230	1/230
River width	m	1500-3000	3000-2200	2200-1100	1100-300
Width of Channel Bed	m	150	150	150	150
Dike Height (Ave.)	m	1.8	1.8	2.2	2.0
Water Depth	m	3.6	3.6	3.6-5.4	5.4-6.3
Low Channel Depth (Ave.)	m	3.0	3.0	3.5	5.0

Table 3.3.5 FEATURES OF DESIGN CHANNEL OF TARLAC RIVER AND TRIBUTARIES OF AGNO RIVER FOR LONG TERM PLAN (1/2)

River:Tarlac River
Design Flood: 25-yr

Item	Unit	Reterding Basin	Tarlac R.		
		AG160+0.8k - TA200	TA200 - TA227	TA227 - TA251	TA251 - TARIS DAM
Design Discharge	m3/s	-	2600	2600	1750
Distance	m	8100	13000	11800	4150
Gradient of Channel Bed	-	1/1650	1/1300	1/760	1/692
River width	m	-	1700-640	1600-600	600-270
Width of Channel Bed	m	160	160	160	140
Dike Height (Ave.)	m	7.2	3.9	3.5	1.5
Water Depth	m	7.9-4.82	4.82-4.0	4.0	4.0-3.5
Low Channel Height (Ave.)	m	5.0-2.0	2.0	2.0	3.5

River:Camiling River
Design Flood: 25-yr

Item	Unit	Camiling R.					
		AG143+1.0k CA156+0.3k	CA156+0.3k - CA162	CA162 - CA167	CA167 - CA172	CA172 - CA173	CA173 - CA175
Design Discharge	m3/s	1650	1150	1150	1150	850	850
Distance	m	3550	4650	4300	4950	1300	2050
Gradient of Channel Bed	-	1/2000	1/2000	1/1000	1/550	1/300	Existing
River width	m	250	180	180	180	130	130
Width of Channel Bed	m	50	40	40	40	30	Existing
Dike Height (Ave.)	m	5.0-3.2	3.1	2.8	2.0	1.0	1.0-0.0
Water Depth	m	8.2-6.9	6.9-6.7	6.7-6.3	6.3-4.8	4.8-4.4	4.4-4.2
Low Channel Height (Ave.)	m	4.7	4.7	4.7	4.5	4.5	4.0

River:Banila River
Design Flood: 25-yr

Item	Unit	Banila R.					
		AG349 - AG349+3.7k	AG349+3.7k - BN381	BN381 - BN386	BN386 - BN394	BN394 - BN397	BN397 - BN401
Design Discharge	m3/s	1000	1000	650	300	300	230
Distance	m	3700	8050	4550	7600	2900	4100
Gradient of Channel Bed	-	1/1295	1/835	1/520	1/265	Existing	Existing
River width	m	180	180	120	120	120	120
Width of Channel Bed	m	20	20	15	8	Existing	Existing
Dike Height (Ave.)	m	3.1	2.8	2.5	2.1	1.9	1.1
Water Depth	m	7.1	6.6	6.6-6.0	6.6-2.8	2.8-1.3	1.3
Low Channel Height (Ave.)	m	5.0	4.8	4.8	4.8-2.5	1.0	1.0

Table 3.3.5 FEATURES OF DESIGN CHANNEL OF TARLAC RIVER AND TRIBUTARIES OF AGNO RIVER FOR LONG TERM PLAN (2/2)

River:Viray-Dipalo River
Design Flood: 25-yr

Item	Unit	Viray-Dipalo R.			Viray R.		
		AG414 - VD425	VD425 - VD428	VD428 - VD430	VD430 - VD430+0.6k	VD430+0.6k - VD433	VD433 - VD434+0.5k
Design Discharge	m3/s	550	550	550	550	270	270
Distance	m	2800	3100	2000	600	2400	1450
Gradient of Channel Bed	-	1/375	1/300	1/250	1/127	1/127	1/75
River width	m	380-290	320-270	320-260	300	150	150
Width of Channel Bed	m	30	30	30	30	15	15
Dike Height (Ave.)	m	1.4	1.4	1.4	1.4	0.75	0.75
Water Depth	m	3.7	3.7	3.7	3.7	2.75	2.75
Low Channel Height (Ave.)	m	3.3	3.3	3.3	3.3	2.8	2.8

Item	Unit	Dipalo R.				
		VD430+0.6k - VD436	VD436 - VD437	VD437 - VD439	VD439 - VD441	VD441 - VD442
Design Discharge	m3/s	250	250	150	150	150
Distance	m	1500	700	1950	1950	1000
Gradient of Channel Bed	-	1/170	1/125	1/125	1/80	1/68
River width	m	100	100	100	100	100
Width of Channel Bed	m	15	15	10	10	10
Dike Height (Ave.)	m	2.4	2.4	1.95	1.75	1.55
Water Depth	m	3.6	2.8	2.35	2.15	1.95
Low Channel Height (Ave.)	m	2.0	1.2	1.0	1.0	1.0

River:Ambayoan River
Design Flood: 25-yr

Item	Unit	Ambayoan R.		
		AG461 - AM444+0.5k	AM444+0.5k - AM448	AM448 - AM451+0.4k
Design Discharge	m3/s	1350	1350	1350
Distance	m	1800	3550	3350
Gradient of Channel Bed	-	1/390	1/205	1/150
River width	m	400	400	400
Width of Channel Bed	m	50	50	50
Dike Height (Ave.)	m	3.9	1.8	1.7
Water Depth	m	5.2	3.4	3.2
Low Channel Height (Ave.)	m	2.8	2.5	2.5

Table 3.3.6 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR LONG TERM PLAN (1/3)

River:Cayanga-Patalan-Angalacan River
Design Flood: 10-yr (with Closure Dike)

Item	Unit	Cayanga R. R.M - Bued R.	Patalan R. Bued R. - Aloragat R.	Aloragat R. - 21.0k	Angalacan R. 21.0k - Maraboc	Maraboc - 27.0k	27.0k - Bugayong
Design Discharge	m3/s	1500	800	400	400	280	280
Distance	m	6500	8300	6200	2800	3200	3300
Gradient of Channel Bed	-	1/1300	1/1100	1/650	1/460	1/460	1/230
River width	m	500	200	150	120	100	80
Width of Channel Bed	m	40	30	25	25	20	20
Dike Height (Ave.)	m	1.9	2.1	0.3	0	0	0
Water Depth	m	7.4	6.1	4.5	4.1	3.8	3.2
Low Channel Height (Ave.)	m	6.5	5.0	5.0	5.0	5.0	4.0

Item	Unit	Angalacan R. Bugayoung - Killo Br.	Killo Br. - 37.5k
Design Discharge	m3/s	190	190
Distance	m	2700	4500
Gradient of Channel Bed	-	1/190	1/140
River width	m	60	50
Width of Channel Bed	m	15	15
Dike Height (Ave.)	m	0	0
Water Depth	m	3.0	2.4
Low Channel Height (Ave.)	m	4.0	3.0

River:Bued River
Design Flood: 10-yr (with Closure Dike)

Item	Unit	Bued R. Junction - 2.0k	2.0k - 4.0k	4.0k - NIA Dam	NIA Dam - 11.9k	11.9k - 16.5k	16.5k - 19.7k
Design Discharge	m3/s	750	750	750	750	500	500
Distance	m	2000	2000	3300	4600	4600	3200
Gradient of Channel Bed	-	1/400	1/280	1/170	1/143	1/140	1/70
River width	m	400	400	400	400	400	400
Width of Channel Bed	m	30	20	20	20	20	20
Dike Height (Ave.)	m	1.9-1.1	2.1	1.9	1.4	1.2	1.1
Water Depth	m	7.4-5.1	4.6	2.9	1.9	1.7	1.6
Low Channel Height (Ave.)	m	5.0	3.5	2.0	1.5	1.5	1.5

Table 3.3.6 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR LONG TERM PLAN (2/3)

River:Aloragat River
Design Flood: 10-yr (with Closure Dike)

Item	Unit	Aloragat R. Junction - 7.0k	7.0k - 11.5k	11.5k - 17.0k	17.0k - 19.7k
Design Discharge	m3/s	300	300	150	100
Distance	m	7000	4500	5500	2700
Gradient of Channel Bed	-	1/680	1/355	1/355	1/185
River width	m	90	80	50	45
Width of Channel Bed	m	30	20	10	10
Dike Height (Ave.)	m	1.6-0.0	0	0.3	0.8
Water Depth	m	6.1-3.2	3.2	3.2	2.2
Low Channel Height (Ave.)	m	5.5	5.0	3.5	2.0

River:Pantal-Marusay-Sinocalan-Tuboy River
Design Flood: 10-yr (without Floodway)

Item	Unit	Pantal R. R.M. - Dagupan R.	Marusay R. Dagupan R. - 4.0k	4.0k - Ingalera R.	Sinocalan R. Ingalera R. - 18.0k	18.0k - 25.5k	25.5k - Mitura R.
Design Discharge	m3/s	1900	1250	1250	900	650	650
Distance	m	2500	1500	4300	9700	7500	5500
Gradient of Channel Bed	-	1/1750	1/1750	1/1750	1/1750	1/1450	1/1100
River width	m	400	120	220	220	150	100
Width of Channel Bed	m	60	60	40	30	30	25
Dike Height (Ave.)	m	2.7	2.6	2.6	2.4	2.4	2.0
Water Depth	m	7.2	7.1	7.1	6.9	6.9	6.0
Low Channel Height (Ave.)	m	5.5	5.5	5.5	5.5	5.5	5.0

Item	Unit	Tagumising R. Mitura R. - 36.7k	36.7k - Sta.Maria	Sta.Maria - 43.5k
Design Discharge	m3/s	160	160	120
Distance	m	5700	4700	2100
Gradient of Channel Bed	-	1/700	1/430	1/350
River width	m	100	80	80
Width of Channel Bed	m	10	10	10
Dike Height (Ave.)	m	0	0	0
Water Depth	m	4.0	3.3	3.0
Low Channel Height (Ave.)	m	5.0	4.5	4.5

Table 3.3.6 FEATURES OF DESIGN CHANNEL OF ALLIED RIVERS FOR LONG TERM PLAN (3/3)

River:Dagupan River
Design Flood: 10-yr

Item	Unit	Dagupan R. Junction - 7.5k	San Juan R. 7.5k - 12.7k	San Juan R. 12.7k - Elang R.	Elang R. San Juan - 27.6k
Design Discharge	m3/s	700	550	390	190
Distance	m	7500	5200	9000	5900
Gradient of Channel Bed	-	1/5000	1/5000	1/5000	1/5000
River width	m	250	100	100	50
Width of Channel Bed	m	60	30	30	20
Dike Height (Ave.)	m	2.7	3.2	3.3	2.3
Water Depth	m	7.2	7.2	7.0	6.0
Low Channel Height (Ave.)	m	5.5	5.0	4.5	4.5

River:Ingalera River
Design Flood: 10-yr

Item	Unit	Ingalera R. Junction-Malasigui	Malasigui - 26.0k	26.0k - 32.0k	32.0k - San Nicolas	San Nicolas - 37.5k
Design Discharge	m3/s	360	260	150	150	80
Distance	m	13300	12700	6000	4000	1500
Gradient of Channel Bed	-	1/3600	1/1800	1/1000	1/700	1/700
River width	m	100	60	50	50	40
Width of Channel Bed	m	15	12	8	8	6
Dike Height (Ave.)	m	2.4	0.5	0.0	0.6	0.3
Water Depth	m	7.1	5.8	4.3	4.0	3.2
Low Channel Height (Ave.)	m	5.5	5.5	5.0	4.0	3.5

River:Mitura-Magalong River
Design Flood: 10-yr

Item	Unit	Mitura R. Junction - 5.3k	Magalong R. 5.3k - Taboy	Magalong R. Taboy - 19.0k	Magalong R. 19.0k-21.0k
Design Discharge	m3/s	130	130	90	70
Distance	m	5300	8900	4800	2000
Gradient of Channel Bed	-	1/800	1/460	1/460	1/250
River width	m	50	40	35	30
Width of Channel Bed	m	10	8	6	4
Dike Height (Ave.)	m	2.0-0.0	0.3	0.4	0.5
Water Depth	m	6.0-3.8	3.7	3.3	2.9
Low Channel Height (Ave.)	m	5.0	4.0	3.5	3.0

Table 3.3.7 COST ESTIMATE OF AGNO RIVER INTEGRATED FFWS

Unit : Million Pesos

Item No.	Description	Equipment Cost	Civil Works	Total
1. Construction Cost				
1.1 Direct Cost				
(1)	Agno River FFWS	107.45	14.06	121.51
(2)	San Roque FOS	67.83	5.78	73.61
(3)	Moriones FOS	71.73	6.25	77.98
(4)	Balog-Balog FOS	71.73	6.25	77.98
(5)	Mt.Ampucao Repeater Station	14.00	0.08	14.08
(6)	Mt.Malabobo Repeater Station	11.74	1.57	13.31
(7)	St.Ignacia Repeater Station	9.79	0.63	10.42
(8)	Binga Dam Office	2.40	0.03	2.43
(9)	Cabanatuan Repeater Station	0.30	0.02	0.32
(10)	NIA FFWS Center	0.77	0.03	0.80
(11)	PAGASA FFWS Center (DIC)	3.74	0.08	3.82
(12)	OCD Monitor Station	0.97	0.03	1.00
(13)	DPWH FFWS Center	3.58	0.08	3.66
(14)	Municipal Warning System	14.54	0.60	15.14
(15)	Measuring Equipment	5.34	0.77	6.11
(16)	Spare Parts	31.51	0.77	32.28
	Total of Direct Cost	417.42	37.03	454.45
1.2 Indirect Cost		97.97	24.75	122.72
	Total of Construction Cost	515.39	61.78	577.17
2. Engineering Service				115.38
3. Contingency				103.85
	Ground Total			796.40

Table 3.3.8 COST ESTIMATE OF AGNO RIVER LONG TERM FFWS

Unit : Million Pesos

Item No.	Description	Equipment Cost	Civil Works	Total
1. Construction Cost				
1.1 Direct Cost				
(1)	Agno River FFWS	81.67	8.32	89.99
(2)	Mt.Ampucao Repeater Station	14.00	0.08	14.08
(3)	Mt.Malabobo Repeater Station	11.74	1.57	13.31
(4)	Binga Dam Office	2.40	0.03	2.43
(5)	PAGASA FFWS Center (DIC)	3.74	0.08	3.82
(6)	DPWH FFWS Center	3.58	0.08	3.66
(7)	Municipal Warning System	14.54	0.60	15.14
(8)	Measuring Equipment	5.34	0.77	6.11
(9)	Spare Parts	13.17	1.07	14.24
	Total of Direct Cost	150.18	12.60	162.78
1.2 Indirect Cost		37.55	3.15	40.70
	Total of Construction Cost	187.73	15.75	203.48
2. Engineering Service				40.70
3. Contingency				36.63
	Ground Total			280.81

Table 3.5.1 PROJECT FINANCIAL COST OF LONG TERM PLAN FOR AGNO RIVER

Unit : 1,000 Pesos

River	Length (km)	F.C.	L.C.	Total
I. Agno River				
1. Lower Agno River				
(1) RM-AG045	6.9	993,833	706,350	1,700,183
(2) AG045-AG122	25.1	2,036,375	1,001,638	3,038,013
(3) AG122-AG282	11.9	1,018,226	539,801	1,558,027
Sub-total of 1	43.9	4,048,434	2,247,789	6,296,223
2. Poponto Stretch				
(1) Bayambang Stretch	10.5	76,139	53,450	129,589
(2) Poponto Floodway	10.7	685,298	312,500	997,798
Sub-total of 2	21.2	761,437	365,950	1,127,387
3. Upper Agno River				
(1) AG309-AG351	14.3	299,418	225,551	524,969
(2) AG351-AG405	10.6	222,559	155,322	377,881
(3) AG405-AG473	19.5	871,344	429,655	1,300,999
Sub-total of 3	44.4	1,393,321	810,528	2,203,849
Total of I	109.5	6,203,192	3,424,267	9,627,459
II. Tarlac River				
(1) AG180-TA200	8.1	456,111	184,589	640,700
(2) TA200-TA265	29.0	446,532	333,839	780,371
Total of II	37.1	902,643	518,428	1,421,071
III. Agno River Tributary				
(1) Camiling River	20.0	225,737	161,015	386,752
(2) Banila River	30.9	459,202	314,534	773,736
(3) Viray-Dipalo River	20.1	150,801	149,433	300,234
(4) Ambayoan River	8.7	101,274	78,013	179,287
Total of III	79.7	937,014	702,995	1,640,009
GRAND TOTAL (I+II+III)	226.3	8,042,849	4,645,690	12,688,539

Table 3.5.2 PROJECT FINANCIAL COST OF LONG TERM PLAN FOR ALLIED RIVERS

Unit : 1,000 Pesos

River	Length (km)	F.C.	L.C.	Total
I. Pantal-Sinocalan River				
(1) Pantal-Sinocalan River	49.8	539,589	376,417	916,006
(2) Dagupan River	27.6	379,441	207,483	586,924
(3) Ingalera River	37.5	334,582	219,499	554,081
(4) Macalong River	22.0	57,757	45,235	102,992
(5) Binalonan Floodway	-	-	-	-
Total of I	136.9	1,311,369	848,634	2,160,003
II. Cayanga-Patalan River				
(1) Cayanga-Patalan River	37.5	338,684	262,748	601,432
(2) Bued River	19.0	214,179	161,985	376,164
(3) Aloragat River	21.3	61,882	86,802	148,684
Total of II	77.8	614,745	511,535	1,126,280
Total of I and II	214.7	1,926,114	1,360,169	3,286,283

Table 3.6.1 ASSESSMENT OF PRIORITY FLOOD CONTROL AREAS

	10-year Flood Protection					
	Project Cost (million pesos)	Annual Benefit (million pesos)	EIRR (%)	Order of Flood Control Efficiency	Selected Priority Project Area	Weight of River Importance
AGNO MAIN STREAM						1
Case 1: Lower Agno (RM-AG282)	5,069 (4,685)	95.5	9.3	7		
Case 2: Poponto Stretch (AG180-AG309) and Upper Agno (AG309-AG473)	3,102 (2,728)	250.4	23.6	2	No.1	
Case 3: The Whole River (RM-AG473)	8,170 (7,413)	345.9	15.5	4		
TARLAC RIVER (AG180-TA265)	1,221 (923)	25.8	11.3	6		2
AGNO TRIBUTARIES	1,455 (1,330)	58.1	14.9	5		5
. Camiling River	303 (278)	9.3	12.7			
. Banila River	694 (636)	31.3	16.0			
. Viray-Dipalo River	291 (264)	12.1	15.3			
. Ambayoan River	167 (152)	5.4	13.1			
PANTAL-SINOCALAN RIVER	2,160 (2,000)	391.0	39.9	1	No.2	3
CAYANGA-PATALAN RIVER	1,126 (1,020)	79.7	21.3	3	No.3	4

Remarks :
(1) The project cost is the financial cost at 1989 constant price level.
The project cost in the parentheses is the economic cost.
(2) Annual benefit is the economic price at 1989 constant level.
(3) EIRR is the economic internal rate of return for the case of future increase of benefit under lower economic growth.

Table 4.1.1 CHANNEL DESIGN FEATURES OF UPPER AGNO RIVER

River:Agno River
Design Flood: 10-yr

Item	Unit	Retarding	Floodway	Bayambang	Agno R
		AG.181-FW.314	FW.314-FW.320B	AG.282B-AG.307	FW.320B-AG.351
Discharge	m3/s	-	3500	500	4000
Length of Stretch	m	7100	3800	9640	15930
Gradient of Channel Bed	-	1/1600	1/1600	1/1850	1/1600
River width	m	-	1200	250-1300	900-1900
Width of Channel Bed	m	150	150	80-100	150
Gradient of H.W.L	-	Level	1/1600	1/1680	1/1600
Dike Height (Ave.)	m	4.00	3.05	2.05	3.05
Water Depth	m	8.78-5.85	5.85	5.85	5.85
Low Channel Depth (Ave.)	m	4.00	4.00	5.00	4.00

Item	Unit	Agno R			
		AG.351-AG.367	AG.367-AG.414	AG.414-AG-453	AG.453-AG.460
Discharge	m3/s	3500	3500	3500	2400
Length of Stretch	m	8170	8150	5330	3120
Gradient of Channel Bed	-	1/1300	1/665	1/440	1/280
River Width	m	1250-3000	3000-2000	2000-1200	1500-3000
Width of Channel Bed	m	150	150	100/Exist.	Existing
Gradient of H.W.L	-	1/1300	1/665	1/440	1/280
Dike Height (Ave.)	m	2.80	2.50	2.20	1.50
Water Depth	m	5.85-430	4.30	4.00	3.30
Low Channel Depth (Ave.)	m	3.50	3.00	3.00	3.00

Item	Unit	Agno R.		
		AG.460-AG.464	AG.464-AG.469	AG.469-AG.474
Discharge	m3/s	2400	2400	2400
Length of Stretch	m	1990	2420	2800
Gradient of Channel Bed	-	1/230	1/230	1/230
River Width	m	3000-2200	2200-1100	1100-300
Width of Channel Bed	m	Existing	Existing	Existing
Gradient of H.W.L	-	1/230	1/180	1/230
Dike Height (Ave.)	m	1.50	1.70	1.20
Water Depth	m	3.30	3.30-4.70	4.70-5.30
Low Channel Depth (Ave.)	m	3.00	3.50	5.00

Table 4.1.2 SUMMARY OF DIKE CONSTRUCTION AND LOW-WATER CHANNEL IMPROVEMENT WORKS IN UPPER AGNO RIVER

(Unit: km)

STRETCH	BAYAMBANG-ALCALA		ALCALA-ASINGAN	ASINGAN-SAN MANUEL	WHOLE
	Bayambang (L=9.64)	Floodway (L=12.30)	AG321 - AG405 (L=26.25)	AG405 - AG474 (L=20.26)	(L=68.45)
DIKE CONSTRUCTION					
(Right Dike)					
New Dike	4.80	9.50 (SB=2.4)	7.25 (SB=2.8)	12.25	38.80
Heightening	0.00	2.40	10.00	3.55	15.95
Existing	7.45	0.65	10.90	2.85	21.85
No Diking Sys.	0.00	0.00	0.00	0.00	0.00
(Left Dike)					
New Dike	4.90	2.50 (SB=2.5)	12.50 <1	0.00	19.90
Heightening	0.00	0.00	10.15	5.90	16.05
Existing	4.00	3.00	12.90	0.50	20.40
No Diking Sys.	0.00	0.00	0.00	14.31	14.31
(Total)					
New Dike	9.70	12.00 (SB=4.9)	19.75	12.25	53.70
Heightening	0.00	2.40	20.15	9.45	32.00
Existing	11.45	3.65	23.80	3.35	42.25
No Dike Sys.	0.00	0.00	0.00	14.31	14.31
LOW-WATER CHANNEL IMPROVEMENT					
New channel	2.50	5.50	0.00	0.00	8.00
Enlargement	1.20	6.80	25.35	5.05	38.40
Cut off	0.00	0.00	0.90	0.90	1.80
Existing	5.94	0.00	0.00	14.31	20.25

Note SB: Set Back LEVEE
<1: Including Back water Dike of Tributaries (L=9.50)

Table 4.2.1 PRINCIPAL DESIGN FEATURES OF PANTAL-SINOCALAN RIVER (1/2)

River: Main Pantal-Sinocalan R.
Design Flood: 10-yr

Item	Unit	Pantal R.	By-Pass		Sinocalan R.
		R.M-D.O	D.O-P.1	P.1-S.21+0.4k	S.21+0.4k-S.47+0.3k
Discharge	m3/s	2000	1850	1250	900
Length of Stretch	m	2840	1910	4000	10950
Gradient of H.W.L	-	1/2350	1/2350	1/2350	1/1850
River Width	m	600-400	400	220	200
Width of Channel Bed	m	60	40	40	30
Gradient of H.W.L	m	1/2350	1/2350	1/2350	1/1850
Dike Height (Ave.)	m	3.0	3.8	4.0	3.8
Water Depth	m	6.6	6.6	6.6	6.6
Low Channel Depth (Ave.)	m	4.8	4.0	3.8	3.8

Item	Unit	Sinocalan R		
		S.47+0.3k-S.58+1.0k	S.58+1.0k-S.65	S.65-S.70
Discharge	m3/s	650	650	350
Length of Stretch	m	7780	5270	4500
Gradient Channel Bed	-	1/1600	1/1150	1/900
River Width	m	150	100	100
Width of Channel Bed	m	30	30	20
Gradient of H.W.L	-	1/1850	1/1150	1/1150
Dike Height (Ave.)	m	2.8	2.5	2.3
Water Depth	m	6.6-5.95	5.95	5.95-5.14
Low Channel Depth (Ave.)	m	4.5	4.5	4.0

Table 4.2.1 PRINCIPAL DESIGN FEATURES OF PANTAL-SINOCALAN RIVER (2/2)

River: Dagupan R
Design Flood: 10-yr

Item	Unit	Dagupan R.		
		D.3-D.12B+0.3k	D.12B+0.3k -D16+0.3k	D.16+0.3k -D.27+0.45k
Discharge	m3/s	700	550	400
Length of Stretch	m	5250	4500	9750
Gradient of Channel Bed	-	1/10000	1/10000	1/10000
River Width	m	450-250	250-150	100
Width of Channel Bed	m	Existing	Existing	25
Gradient of H.W.L	-	Level	1/10000	1/5800
Dike of Height (Ave.)	m	2.8	2.8	2.8
Water Depth	m	6.5	6.5	6.0
Low Channel Depth (Ave.)	m	Existing	Existing	4.0

River: Ingalera R.
Design Flood: 10-yr

Item	Unit	Ingalera R.		
		I.1-I.8	I.8-I.13	I.13-I.18
Discharge	m3/s	360	360	260
Length of Channel Bed	m	9920	4690	4390
Gradient of Channel Bed	-	1/5000	1/2500	1/1800
River Width	m	120	120	100
Width of Channel Bed	m	20	20	15
Gradient of H.W.L	m	1/5000	1/3400	1/1800
Dike of Height (Ave.)	m	0.9	0.6	0.5
Water Depth	m	6.6	6.3	6.1
Low Channel Depth (Ave.)	m	6.5	6.5	6.4

Table 4.4.1 SUMMARY OF FINANCIAL PROJECT COST FOR UPPER AGNO RIVER PROJECT

Work Items		1st Stage		2nd Stage		Total	
		Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)
Excavation	1000m3	4,784.0	213.0	3,634.0	243.5	8,418.0	456.5
Dredging	1000m3	0.0	0.0	0.0	0.0	0.0	0.0
Embankment	1000m3	4,852.0	466.0	446.0	34.8	5,298.0	500.8
Revetment	km	32.0	343.0	20.0	175.7	52.0	518.7
Groin	pcs	54.0	12.2	61.0	13.8	115.0	26.0
Sluiceway	pcs	32.0	72.7	6.0	10.2	38.0	82.9
Water Gate	pcs	0.0	0.0	0.0	0.0	0.0	0.0
Bridge	m2	8,524.0	126.6	2,046.0	30.4	10,570.0	157.0
Others	Lot	1.0	178.8	1.0	54.2	1.0	233.0
Preparatory Works	Lot	1.0	141.1	1.0	56.2	1.0	197.3
Miscellaneous W.	Lot	1.0	232.9	1.0	92.7	1.0	325.6
Main Construction			1,786.3		711.5		2,497.8
Compensation			398.0		14.0		412.0
Adminstration			109.2		36.3		145.5
Contingency			344.0		114.3		458.3
Engneering Services			285.8		113.8		399.6
Project Cost			2,923.4		989.8		3,913.2

Table 4.4.2 SUMMARY OF ECONOMIC PROJECT COST FOR UPPER AGNO RIVER PROJECT

Work Items		1st Stage		2nd Stage		Total	
		Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)
Excavation	1000m3	4,784.0	210.6	3,634.0	240.6	8,418.0	451.2
Dredging	1000m3	0.0	0.0	0.0	0.0	0.0	0.0
Embankment	1000m3	4,852.0	456.2	446.0	33.9	5,298.0	490.1
Revetment	km	32.0	294.3	20.0	149.7	52.0	444.0
Groin	pcs	54.0	10.9	61.0	12.3	115.0	23.2
Sluiceway	pcs	32.0	68.0	6.0	9.5	38.0	77.5
Water Gate	pcs	0.0	0.0	0.0	0.0	0.0	0.0
Bridge	m2	8,524.0	115.6	2,046.0	27.7	10,570.0	143.3
Others	Lot	1.0	155.3	1.0	53.2	1.0	208.5
Preparatory Works	Lot	1.0	131.1	1.0	52.6	1.0	183.7
Miscellaneous W.	Lot	1.0	216.2	1.0	86.8	1.0	303.0
Main Construction mil.P			1,658.2		666.3		2,324.5
Compensation			236.0		10.0		246.0
Adminstration			94.7		33.8		128.5
Contingency			298.3		106.5		404.9
Engneering Services			265.3		106.6		371.9
Project Cost			2,552.6		923.3		3,475.9

Table 4.4.3 SUMMARY OF FINANCIAL PROJECT COST FOR PANTAL-SINOCALAN RIVER PROJECT

Work Items		1st Stage		2nd Stage		Total	
		Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)
Excavation	1000m3	1,243.0	35.5	2,105.0	82.2	3,348.0	117.7
Dredging	1000m3	160.0	5.6	20.0	0.7	180.0	6.3
Embankment	1000m3	1,806.0	189.6	2,482.0	260.6	4,288.0	450.2
Revetment	km	12.0	171.0	12.0	141.2	24.0	312.2
Groin	pcs	0.0	0.0	39.0	5.2	39.0	5.2
Sluiceway	pcs	14.0	32.4	30.0	87.8	44.0	120.2
Water Gate	pcs	4.0	236.5	5.0	178.5	9.0	415.0
Bridge	m2	11,048.0	164.1	8,609.0	127.8	19,657.0	291.9
Others	Lot	1.0	76.0	1.0	80.5	1.0	156.5
Preparatory Works	Lot	1.0	91.1	1.0	96.4	1.0	187.5
Miscellaneous W.	Lot	1.0	150.2	1.0	159.1	1.0	309.4
Main Construction			1,151.9		1,220.0		2,371.9
Compensation			333.0		207.0		540.0
Adminstration			74.2		71.4		145.6
Contingency			233.9		224.8		458.6
Engneering Services			184.3		195.2		379.5
Project Cost			1,977.3		1,918.4		3,895.7

Table 4.4.4 SUMMARY OF ECONOMIC PROJECT COST FOR PANTAL-SINOCALAN RIVER PROJECT

Work Items		1st Stage		2nd Stage		Total	
		Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)	Work Quantity	Cost (mill. P)
Excavation	1000m3	1,243.0	35.1	2,105.0	81.2	3,348.0	116.2
Dredging	1000m3	160.0	5.1	20.0	0.6	180.0	5.7
Embankment	1000m3	1,806.0	185.6	2,482.0	255.2	4,288.0	440.8
Revetment	km	12.0	153.3	12.0	126.2	24.0	279.5
Groin	pcs	0.0	0.0	39.0	4.6	39.0	4.6
Sluiceway	pcs	14.0	30.2	30.0	82.3	44.0	112.5
Water Gate	pcs	4.0	238.7	5.0	180.1	9.0	418.8
Bridge	m2	11,048.0	149.8	8,609.0	116.7	19,657.0	266.5
Others	Lot	1.0	63.8	1.0	67.1	1.0	130.9
Preparatory Works	Lot	1.0	86.2	1.0	91.4	1.0	177.6
Miscellaneous W.	Lot	1.0	142.2	1.0	150.8	1.0	293.0
Main Construction			1,089.9		1,156.2		2,246.0
Compensation			114.2		80.8		195.0
Adminstration			60.2		61.8		122.0
Contingency			189.6		194.8		384.4
Engneering Services			174.4		185.0		359.4
Project Cost			1,628.3		1,678.6		3,306.9

Table 4.4.5 SUMMARY OF FINANCIAL PROJECT COST OF EACH STRETCH FOR UPPER AGNO RIVER PROJECT (1ST STAGE)

Work Items		Bayambang-Floodway		Alcala-Asingan		Asingan-Sanmanuel		Popont Swamp		Total	
		Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)
Excavation	1000m3	4,519.0	207.9	264.8	5.3	0.0	0.0	0.0	0.0	4,783.8	213.2
Dredging	1000m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Embankment	1000m3	1,487.5	156.2	1,161.0	121.9	501.4	78.6	1,405.4	109.6	4,555.3	466.3
Revetment	km	9.9	104.6	10.4	82.1	14.8	153.2	0.1	3.0	35.2	343.0
Groin	pcs	15.0	3.4	30.0	6.8	9.0	2.0	0.0	0.0	54.0	12.2
Sluiceway	pcs	0.0	33.1	7.0	19.9	3.0	6.2	28.0	13.5	38.0	72.7
Water Gate	pcs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bridge	m2	5,344.0	79.4	3,180.0	47.2	0.0	0.0	0.0	0.0	8,524.0	126.6
Others	Lot	1.0	42.5	1.0	93.3	1.0	9.0	1.0	33.6	1.0	178.3
Preparatory Works	Lot	1.0	62.7	1.0	37.7	1.0	24.9	1.0	15.9	1.0	141.2
Miscellaneous W.	Lot	1.0	103.5	1.0	62.1	1.0	41.1	1.0	26.3	1.0	232.9
Main Construction			793.2		476.4		315.0		201.8		1,786.3
Compensation			116.0		55.0		26.0		201.0		398.0
Adminstration			45.5		26.6		17.0		20.1		109.2
Contingency			143.2		83.7		53.7		63.4		344.0
Engneering Services			126.9		76.2		50.4		32.3		285.8
Project Cost			1,224.7		717.8		462.1		518.7		2,923.4

Table 4.4.6 SUMMARY OF FINANCIAL PROJECT COST OF EACH STRETCH FOR UPPER AGNO RIVER PROJECT (2ND STAGE)

Work Items		Bayambang-Floodway		Alcala-Asingan		Asingan-Sanmanuel		Popont Swamp		Total	
		Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)
Excavation	1000m3	1,419.9	95.1	2,209.1	148.0	0.0	0.0	4.8	0.3	3,633.8	243.5
Dredging	1000m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Embankment	1000m3	0.0	0.0	0.0	0.0	0.0	0.0	446.4	34.8	446.4	34.8
Revetment	km	0.2	1.9	16.6	126.9	2.7	43.8	0.6	3.0	20.1	175.7
Groin	pcs	0.0	0.0	61.0	13.8	0.0	0.0	0.0	0.0	61.0	13.8
Sluiceway	pcs	0.0	0.0	2.0	5.6	0.0	0.0	4.0	4.7	6.0	10.2
Water Gate	pcs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bridge	m2	1,171.0	17.4	0.0	0.0	0.0	0.0	875.0	13.0	2,046.0	30.4
Others	Lot	1.0	0.0	1.0	0.0	1.0	0.0	1.0	54.2	1.0	54.2
Preparatory Works	Lot	1.0	11.4	1.0	29.4	1.0	4.4	1.0	10.9	1.0	56.2
Miscellaneous W.	Lot	1.0	18.9	1.0	48.6	1.0	7.2	1.0	18.0	1.0	92.7
Main Construction			144.8		372.2		55.4		139.0		711.5
Compensation			0.0		0.0		0.0		14.0		14.0
Adminstration			7.2		18.6		2.8		7.7		36.3
Contingency			22.8		58.6		8.7		24.1		114.3
Engneering Services			23.2		59.5		8.9		22.2		113.8
Project Cost			198.0		509.0		75.8		207.0		989.8

Table 4.4.7 SUMMARY OF FINANCIAL PROJECT COST OF EACH STRETCH FOR PANTAL-SINOCALAN RIVER PROJECT (1ST STAGE)

Work Items		Pantal-Sinocalan		Dagupan River		Ingarela River		Total	
		Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)
Excavation	1000m3	1,243.3	35.5	0.0	0.0	0.0	0.0	1,243.3	35.5
Dredging	1000m3	159.8	5.6	0.0	0.0	0.0	0.0	159.8	5.6
Embankment	1000m3	1,705.7	179.1	99.8	10.5	0.0	0.0	1,805.5	189.6
Revetment	km	12.0	171.0	0.0	0.0	0.0	0.0	12.0	171.0
Groin	pcs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sluiceway	pcs	14.0	32.4	0.0	0.0	0.0	0.0	14.0	32.4
Water Gate	pcs	4.0	236.5	0.0	0.0	0.0	0.0	4.0	236.5
Bridge	m2	11,048.0	164.1	0.0	0.0	0.0	0.0	11,048.0	164.1
Others	Lot	1.0	76.0	1.0	0.0	1.0	0.0	1.0	76.0
Preparatory Works	Lot	1.0	90.0	1.0	1.0	1.0	0.0	1.0	91.1
Miscellaneous W.	Lot	1.0	148.5	1.0	1.7	1.0	0.0	1.0	150.2
Main Construction			1,138.7		13.3		0.0		1,151.9
Compensation			332.0		1.0		0.0		333.0
Adminstration			73.5		0.7		0.0		74.2
Contingency			231.6		2.2		0.0		233.9
Engneering Services			182.2		2.1		0.0		184.3
Project Cost			1,958.0		19.3		0.0		1,977.3

Table 4.4.8 SUMMARY OF FINANCIAL PROJECT COST OF EACH STRETCH FOR PANTAL-SINOCALAN RIVER PROJECT (2ND STAGE)

Work Items		Pantal-Sinocalan		Dagupan River		Ingarela River		Total	
		Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)	Work Quantity	Cost (mill.P)
Excavation	1000m3	254.7	5.3	663.7	13.3	1,187.0	63.5	2,105.4	82.2
Dredging	1000m3	0.0	0.0	0.0	0.0	20.0	0.7	20.0	0.7
Embankment	1000m3	608.8	63.9	1,580.3	165.9	293.2	30.8	2,482.2	260.6
Revetment	km	3.7	58.7	5.8	55.9	2.5	26.5	12.0	141.2
Groin	pcs	0.0	0.0	39.0	5.2	0.0	0.0	39.0	5.2
Sluiceway	pcs	3.0	6.6	24.0	68.1	3.0	13.2	30.0	87.8
Water Gate	pcs	1.0	48.9	3.0	110.7	1.0	18.9	5.0	178.5
Bridge	m2	0.0	0.0	4,889.0	72.6	3,720.0	55.2	8,609.0	127.8
Others	Lot	1.0	17.6	1.0	49.0	1.0	13.8	1.0	80.5
Preparatory Works	Lot	1.0	20.1	1.0	54.1	1.0	22.3	1.0	96.4
Miscellaneous W.	Lot	1.0	33.2	1.0	89.2	1.0	36.7	1.0	159.1
Main Construction			254.4		684.0		281.6		1,220.0
Compensation			64.0		63.0		80.0		207.0
Adminstration			15.9		37.4		18.1		71.4
Contingency			50.1		117.7		57.0		224.8
Engneering Services			40.7		109.4		45.1		195.2
Project Cost			425.1		1,011.5		481.7		1,918.4

Table 4.6.1 PRELIMINARY ANNUAL DISBURSEMENT SCHEDULE FOR UPPER AGNO RIVER PROJECT

Upper Agno River : 1st Stage — Unit : Mil. Pesos

Item	Detail Design			Compensation	1995			1996			1997			1998			1999			Total		
	L/C	F/C	Total	(L/C)	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Main Works			0	0	108	191	299	100	193	293	139	145	284	100	131	231	125	181	306	572	840	1,412
Prepara. Works			0	0	11	19	30	10	19	29	14	14	28	10	13	23	12	18	30	57	84	141
Misc. Works			0	0	18	31	49	17	32	49	23	24	47	16	22	38	21	30	51	94	139	233
Main Construction			0	0	137	241	378	127	244	371	176	183	359	126	166	292	158	229	387	723	1,063	1,786
Compensation			0	398	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	398	0	398
Physical Cont.			0	63	23	36	59	22	37	59	29	27	56	21	25	46	27	34	61	185	159	344
Administration			0	20	19	0	19	19	0	19	18	0	18	15	0	15	19	0	19	109	0	109
E/S	15	135	150	0	4	34	38	4	33	37	4	32	36	3	26	29	4	35	39	33	296	329
G. Total	15	135	150	481	183	311	494	172	314	486	227	242	469	165	217	382	208	298	506	1,448	1,518	2,966

Upper Agno River : 2nd Stage — Unit : Mil. Pesos

Item	D/D Stage			Comp. Stage	2000			2001			2002			2003			2004			Total		
	L/C	F/C	Total	(L/C)	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Main Works			0	0	31	83	114	58	56	114	49	65	114	44	66	110	35	75	110	217	345	562
Prepara. Works			0	0	3	8	11	6	6	12	5	6	11	4	7	11	3	8	11	22	34	56
Misc. Works			0	0	5	14	19	10	9	19	8	11	19	7	11	18	6	12	18	36	57	93
Main Construction			0	0	39	105	144	74	71	145	62	82	144	55	84	139	44	95	139	275	436	711
Compensation			0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	14
Physical Cont.			0	2	7	16	23	12	11	23	10	12	22	9	13	22	8	14	22	49	65	114
Administration			0	1	7	0	7	7	0	7	7	0	7	7	0	7	7	0	7	36	0	36
E/S	0	0	0	0	1	13	14	1	13	14	1	13	14	1	13	14	1	13	14	7	64	71
G. Total	0	0	0	17	54	134	188	94	95	189	80	107	187	72	110	182	60	122	182	381	565	946

1,829	2,083	3,912

Table 4.6.2 PRELIMINARY ANNUAL DISBURSEMENT SCHEDULE FOR PANTAL-SINOCALAN RIVER PROJECT

Pantal-Sinocalan River : 1st Stage — Unit : Mil. Pesos

Item	Detail Design			Compensation	2000			2001			2002			2003			2004			Total		
	L/C	F/C	Total	(L/C)	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Main Works			0	0	47	112	159	52	163	215	71	115	186	80	119	199	40	111	151	290	620	910
Prepara. Works			0	0	5	11	16	5	16	21	7	11	18	8	12	20	4	11	15	29	62	91
Misc. Works			0	0	8	19	27	9	27	36	12	19	31	13	20	33	7	18	25	48	102	150
Main Construction			0	0	60	142	202	66	206	272	90	145	235	101	151	252	51	140	191	367	784	1,151
Compensation			0	333	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	333	0	333
Physical Cont.			0	52	10	21	31	12	31	43	15	22	37	17	23	40	9	21	30	116	118	234
Administration			0	17	10	0	10	14	0	14	12	0	12	13	0	13	10	0	10	74	0	74
E/S	14	128	142	0	2	18	20	3	25	28	2	21	23	3	23	26	2	17	19	26	232	258
G. Total	14	128	142	402	82	181	263	95	262	357	119	188	307	134	197	331	72	178	250	916	1,134	2,050

Pantal-Sinocalan River : 2nd Stage — Unit : Mil. Pesos

Item	D/D Stage			Comp. Stage	2005			2006			2007			2008			2009			Total		
	L/C	F/C	Total	(L/C)	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Main Works			0	0	57	148	205	72	114	186	69	133	202	50	156	206	64	103	167	311	654	965
Prepara. Works			0	0	6	15	21	7	11	18	7	13	20	5	16	21	6	10	16	31	65	96
Misc. Works			0	0	9	24	33	12	19	31	11	22	33	8	26	34	11	17	28	51	108	159
Main Construction			0	0	72	187	259	91	144	235	87	168	255	63	198	261	81	130	211	393	827	1,220
Compensation			0	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	207	0	207
Physical Cont.			0	33	13	28	41	15	22	37	15	25	40	11	30	41	14	19	33	101	124	225
Administration			0	10	13	0	13	12	0	12	13	0	13	13	0	13	11	0	11	71	0	71
E/S	0	0	0	0	3	23	26	2	21	23	3	23	26	3	23	26	2	19	21	12	110	122
G. Total	0	0	0	250	101	238	339	120	187	307	118	216	334	90	251	341	108	168	276	784	1,061	1,845
																				1,700	2,195	3,895

Table 5.1.1 RESULT OF IEE FOR THE PROJECT

Checklist Item	Agno River				Pantal-Sinocalan River		Cayanga-Patalan River	
	San Roque Dam	Moriones-O'Donnell Dam	River Improvement	Poponto Reterding Basin	River Improvement	Binalonan Floodway	River Improvement	Bued Closing Dike
A) Problems due to the Location								
1. Resettlement/evacuation	-/B	-/A	-/A	-/A	-/A	-/A	-/A	-/B
2. Encroachment of cultural tribes	o	o	o	o	o	o	o	o
3. Land value changes	+/A	+/A	+/A	+/A	+/A	+/A	+/A	+/A
4. Encroachment of agricultural lands	-/B	-/A	-/A	-/B	-/A	-/B	-/A	-/C
5. Depreciation of forestry	o	o	o	o	o	o	o	o
6. Inundation of mineral resources	-/C	o	o	o	o	o	o	o
7. Encroachment of historical/cultural values	o	o	-/C	o	o	o	o	o
8. Watershed erosion/silt runoff	-/C	-/C	o	o	o	o	o	o
9. Effects on groundwater hydrology	=	=	o	o	o	-/C	o	o
10. Impairment of navigation	o	o	-/C	o	-/C	o	-/C	o
11. Encroachment of precious ecology	o	o	o	o	o	o	o	o
12. Migrating valuable fish species	o	o	o	o	o	o	o	o
B) Problems related to the Design								
1. Road erosion	-/B	-/B	o	o	o	o	o	o
2. Water right conflicts	-/C	o	o	o	o	o	o	o
3. Loss of community and recreation areas	o	-/B	-/C	-/B	-/C	-/C	-/C	-/C
4. Intensification of traffic congestion	o	o	o	o	o	o	o	o
5. Aesthetic and landscape	o	o	o	o	o	o	o	o
6. Prevention of accessibility	-/C	-/C	o	o	o	o	o	o
C) Problems in Construction Stage								
1. Soil erosion and silt runoff	-/C	-/C	o	o	o	o	o	o
2. Hazards to workers and nearby residents	-/C	-/C	-/C	o	-/C	-/C	-/C	o
3. Spread of communicable diseases	o	o	o	o	o	o	o	o
4. Deterioration of water quality	o	o	o	o	o	o	o	o
D) Problems in Operation Stage								
1. Downstream erosion/aggradation	-/C	-/C	o	o	o	o	o	o
2. Deterioration of water quality	o	o	o	o	o	-/B	o	o
3. Intrusion of saline water	=	o	o	o	o	o	o	o
4. Eutrophication	-/B	-/C	o	o	o	o	o	o
5. Encroachment of precious ecology	o	o	o	o	o	o	o	o
6. Deperciation of fisheries	+/C	o	o	o	o	o	o	o
7. Vector disease hazards	o	o	+/C	-/C	+/C	o	+/C	+/C
8. Aesthetic and landscape	o	o	o	o	o	o	o	o

Note : (1) /: Upper side is the expected effect, and lower side is its significance.
(2) o : Noeffect expected,
+ : Positive effect expected,
- : Negative effect expected,
= : Neutral effect expected, i.e. there may be a change but such change will be neither benefical nor harmful,
(3) A : Effect which has relatively high level of significance,
B : Effect which has relatively medium level of significance,
C : Effect which has relatively low level of significance,

Table 5.2.1 PRELIMINARY RESULT OF EIA FOR THE PRIORITY PROJECTS

Checklist Item	Agno River		Pantal-Sinocalan River	
	River Improvement	Poponto Reter-ding Basin	River Improvement	Dagupan bypass
A) Problems due to the Location				
1. Resettlement	-/A	-/A	-/A	-/C
2. Encroachment of cultural tribes	o	o	o	o
3. Land value changes	+/A	=	+/A	+/A
4. Encroachment of agricultural lands	-/A	-/B	-/A	-/C
5. Depreciation of forestry	o	o	o	o
6. Inundation of mineral resources	o	o	o	o
7. Encroachment of historical/cultural values	o	o	o	o
8. Watershed erosion/silt runoff	o	o	o	o
9. Effects on groundwater hydrology	o	o	o	-/C
10. Impairment of navigation	o	o	-/C	o
11. Encroachment of precious ecology	o	o	o	o
12. Migrating valuable fish species	o	o	o	o
13. Road erosion	o	o	o	o
14. Water light conflicts	o	o	o	o
15. Loss of community and recreation areas	-/C	-/B	-/C	-/C
16. Intensification of traffic congestion	o	o	o	o
17. Aesthetic and landscape	o	o	o	o
18. Prevention of accessibility	o	o	o	o
B) Problems in Construction Stage				
1. Soil erosion and silt runoff	o	o	o	o
2. Hazards to workers and nearby residents	-/C	-/C	-/C	-/C
3. Spread to communicable diseases	o	o	o	o
4. Deterioration of water quality	-/C	o	-/C	o
C) Problems in Operation Stage				
1. Downstream erosion/aggradation	o	o	o	o
2. Deterioration of water quality	o	o	o	-/C
3. Intrusion of saline water	o	o	o	-/C
4. Eutrophication	o	o	o	o
5. Encroachment of precious ecology	o	o	o	o
6. Deperciation of fisheries	o	o	o	o
7. Aesthetic and landscape	o	o	o	o
8. Vector disease hazards	+/C	-/C	+/C	o
9. Public health hazards	+/C	-/C	+/C	o

Note : (1) / : Upper side is the expected effect, and lower side is its significance.
(2) o : Noeffect expected,
+ : Positive effect expected,
- : Negative effect expected,
= : Neutral effect expected, i.e. there may be a change but such change will be neither benefical and harmful,
(3) A : Effect which has relatively high level of significance,
B : Effect which has relatively medium level of significance,
C : Effect which has relatively low level of significance,

FIGURES

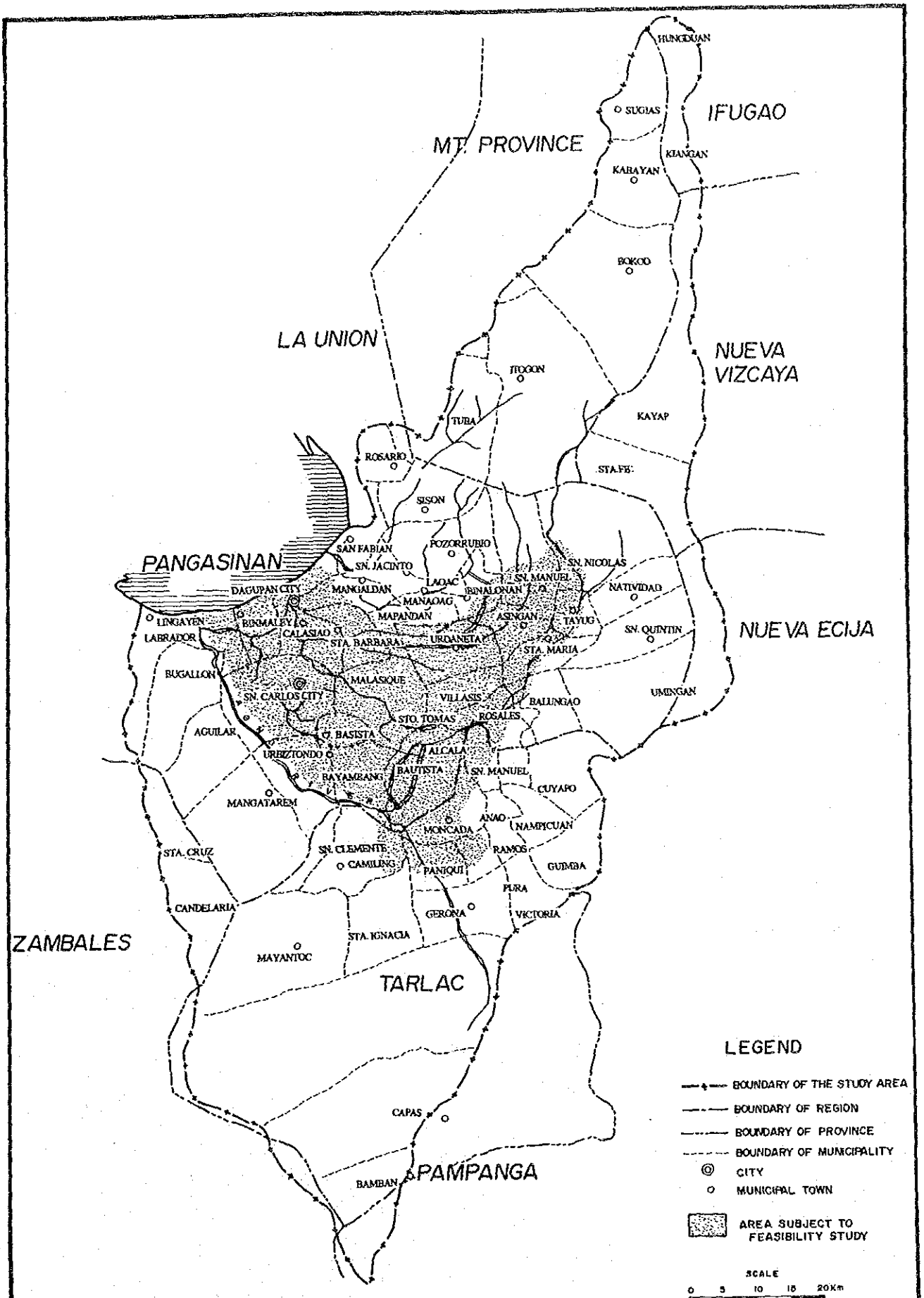


Fig. 2.1.1 DEFINITION OF STUDY AREA AND FEASIBILITY AREAS

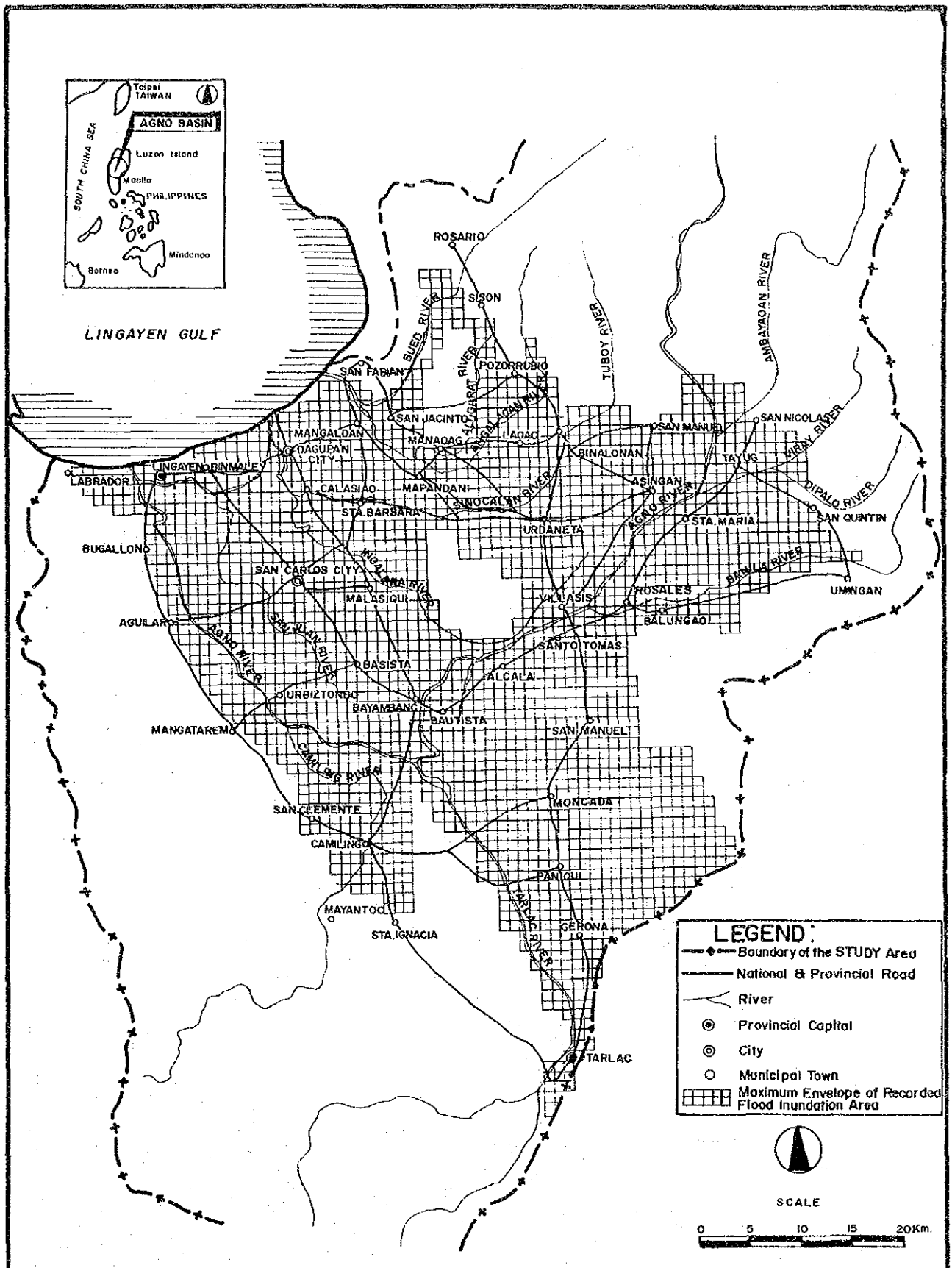


Fig. 2.3.1 MAXIMUM ENVELOP OF FLOOD INUNDATION AREA

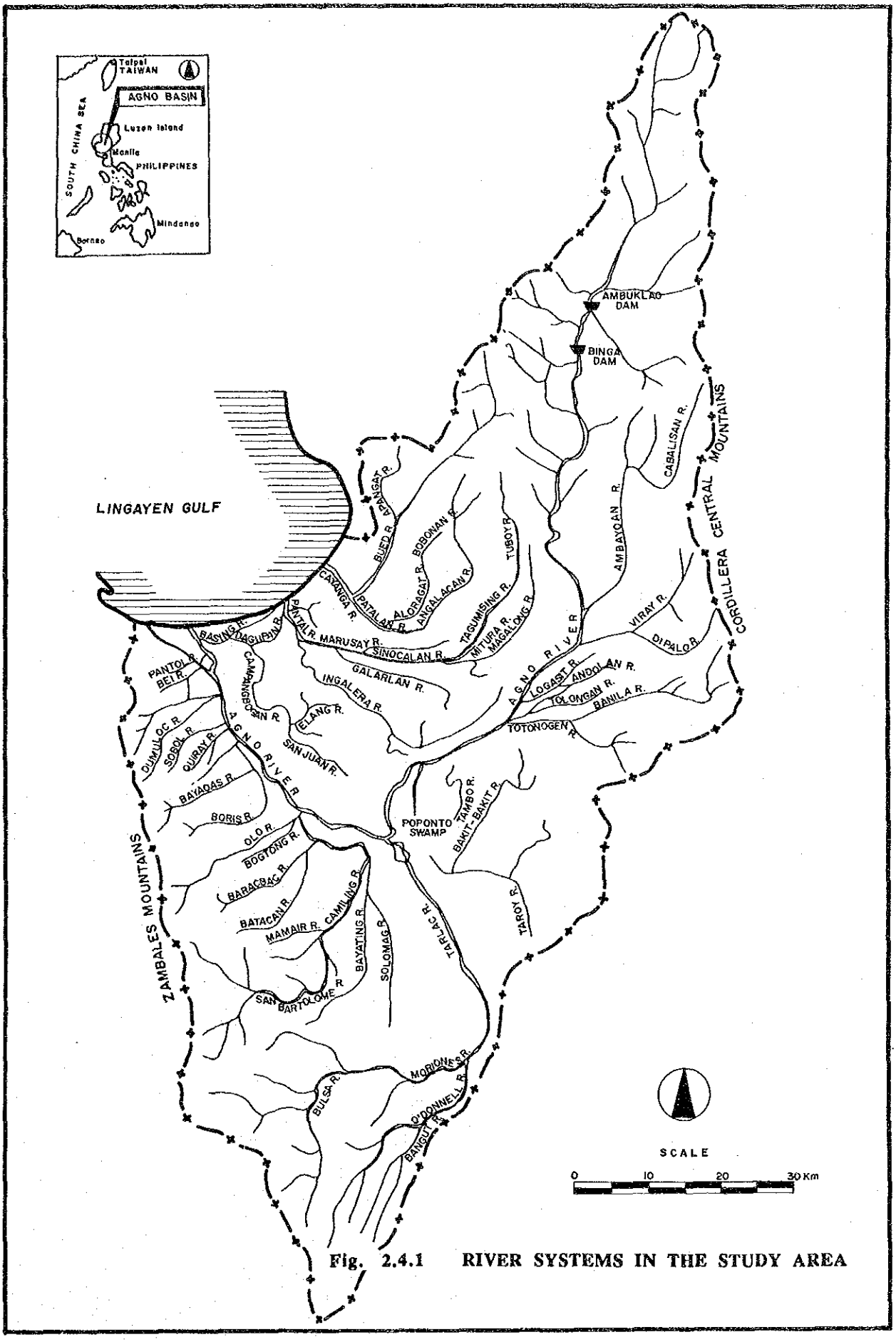
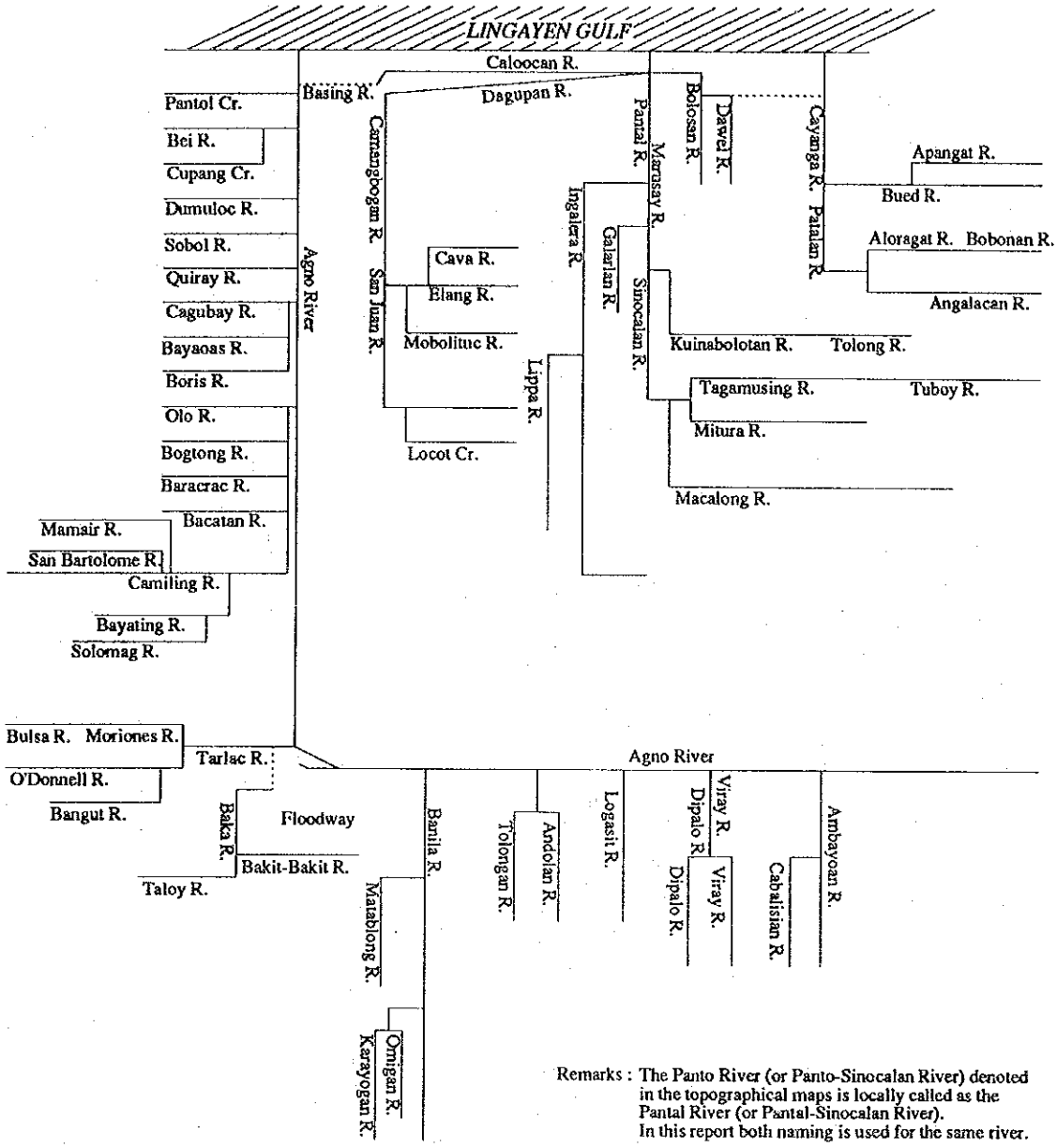


Fig. 2.4.1 RIVER SYSTEMS IN THE STUDY AREA



Remarks : The Panto River (or Panto-Sinocalan River) denoted in the topographical maps is locally called as the Pantal River (or Pantal-Sinocalan River). In this report both naming is used for the same river.

AGNO RIVER BASIN

River	Basin Area (km^2)	River Length (km)
Agno River		
Rivermouth	5,907	221.00
Floodway Site	2,477	165.00
Ambayoan River	367	62.20
Viray-Dipalo River	135	21.20
Banila River	309	39.00
Tarlac River	1,896	93.00
Camiling River	604	64.00

ALLIED RIVER BASIN

River	Basin Area (km^2)	River Length (km)
Cayanga-Patalan R.		
(whole)	618	61.00
Angalacan R.	144	25.50
Aloragat R.	116	31.00
Bued R.	286	54.00
Panto-Sinocalan R.		
(whole)	1,115	75.50
Tagumising R.	182	44.50
Mitura-Macalong R.	141	31.00
Ingalera R.	197	32.50
Dagupan R.	273	32.00

Fig. 2.4.2 RIVER SYSTEM DIAGRAM

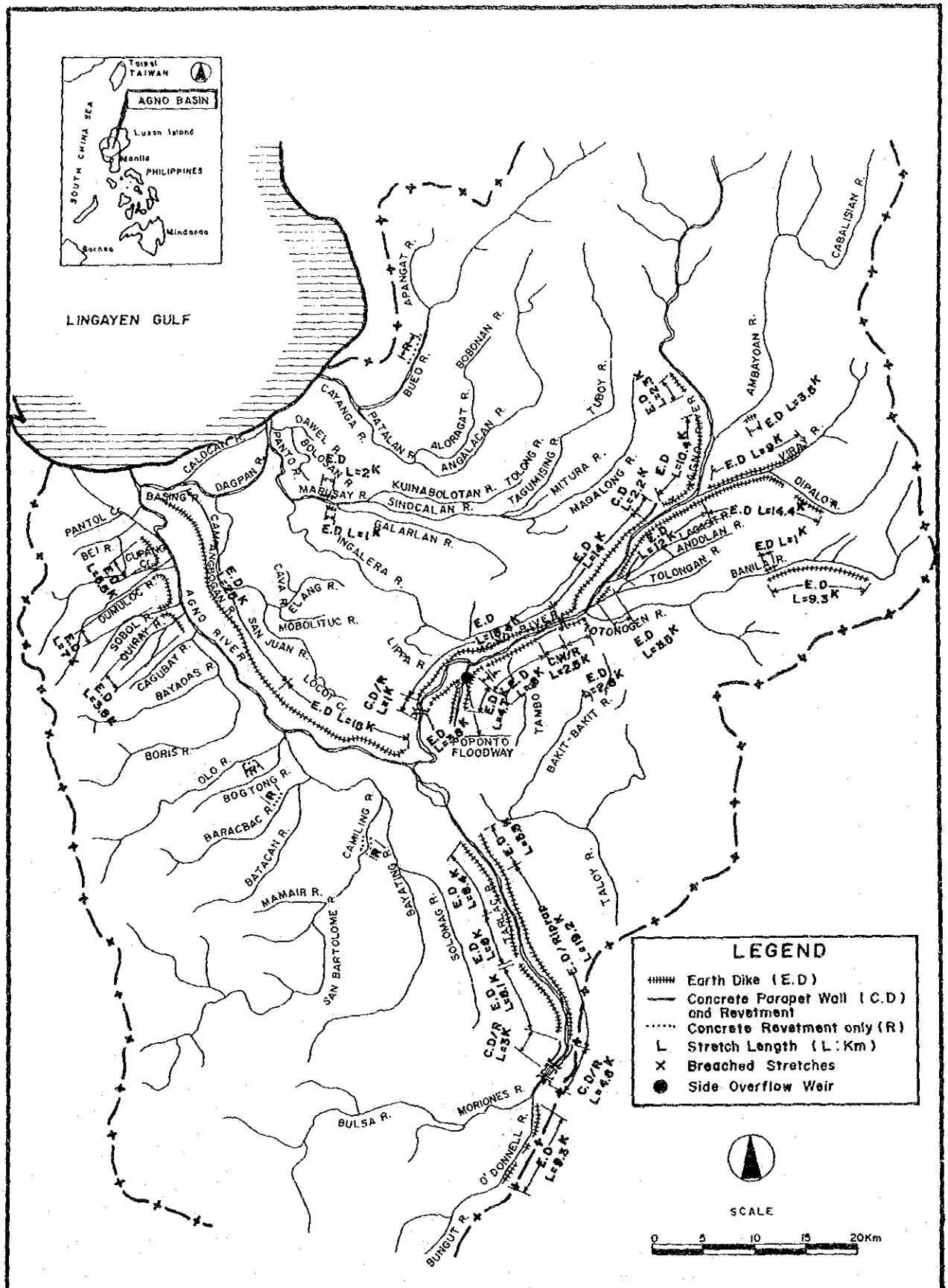


Fig. 2.4.3 LOCATION OF EXISTING FLOOD CONTROL FACILITIES

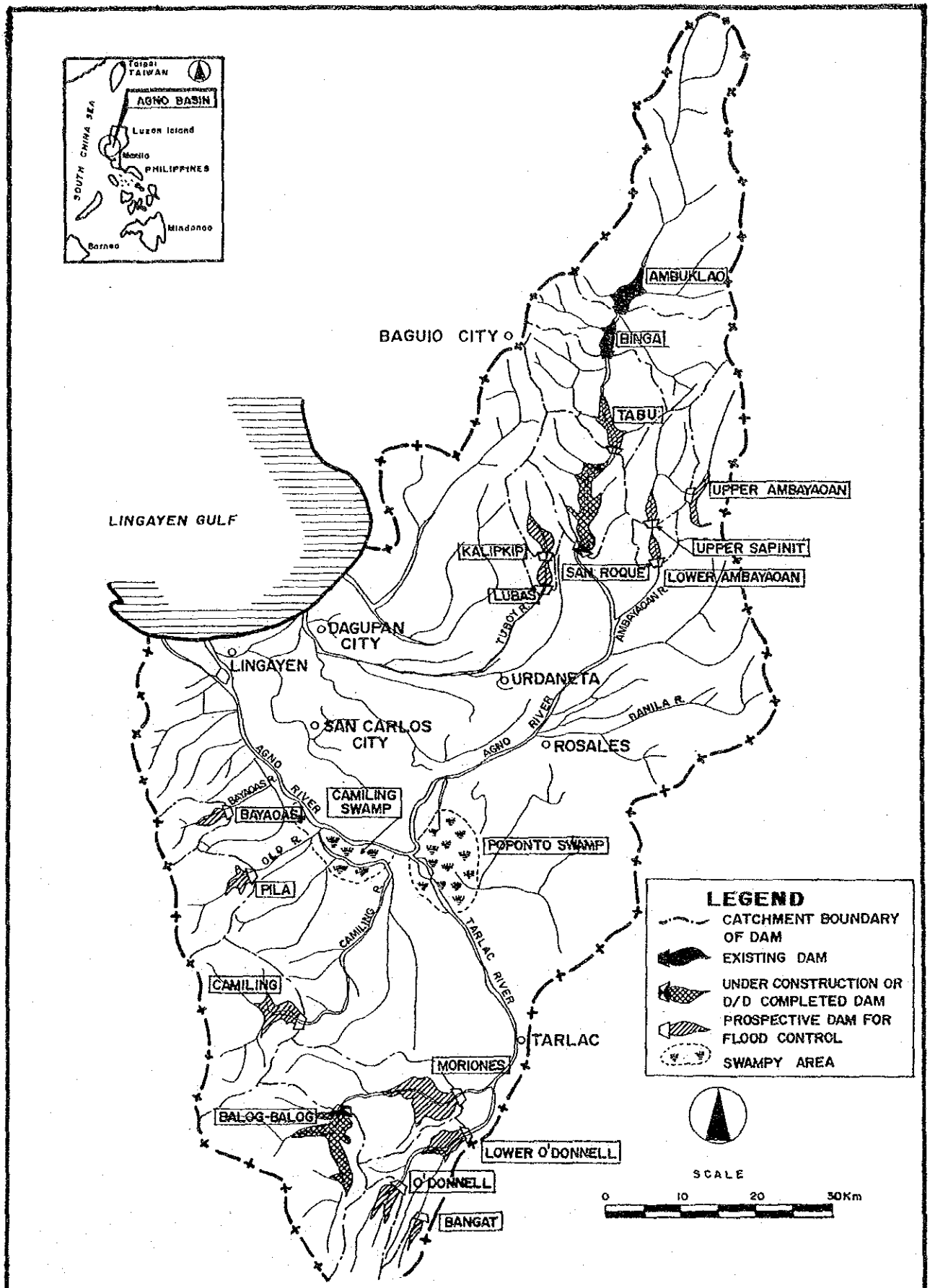


Fig. 3.2.1 LOCATION MAP OF DAM SITE AND SWAMPY AREA

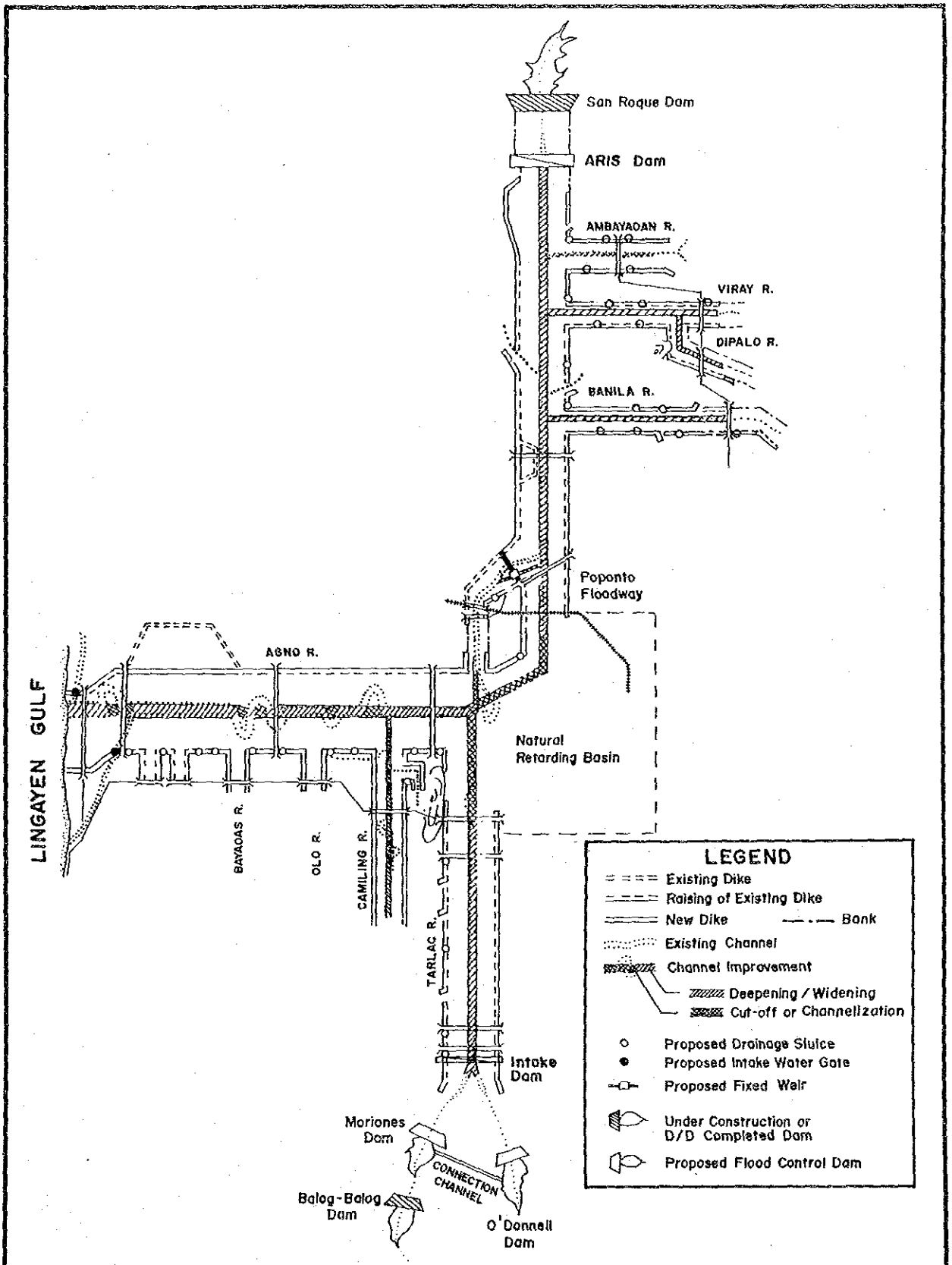


Fig. 3.3.1 GENERAL LAYOUT OF AGNO RIVER IMPROVEMENT FOR FRAMEWORK PLAN

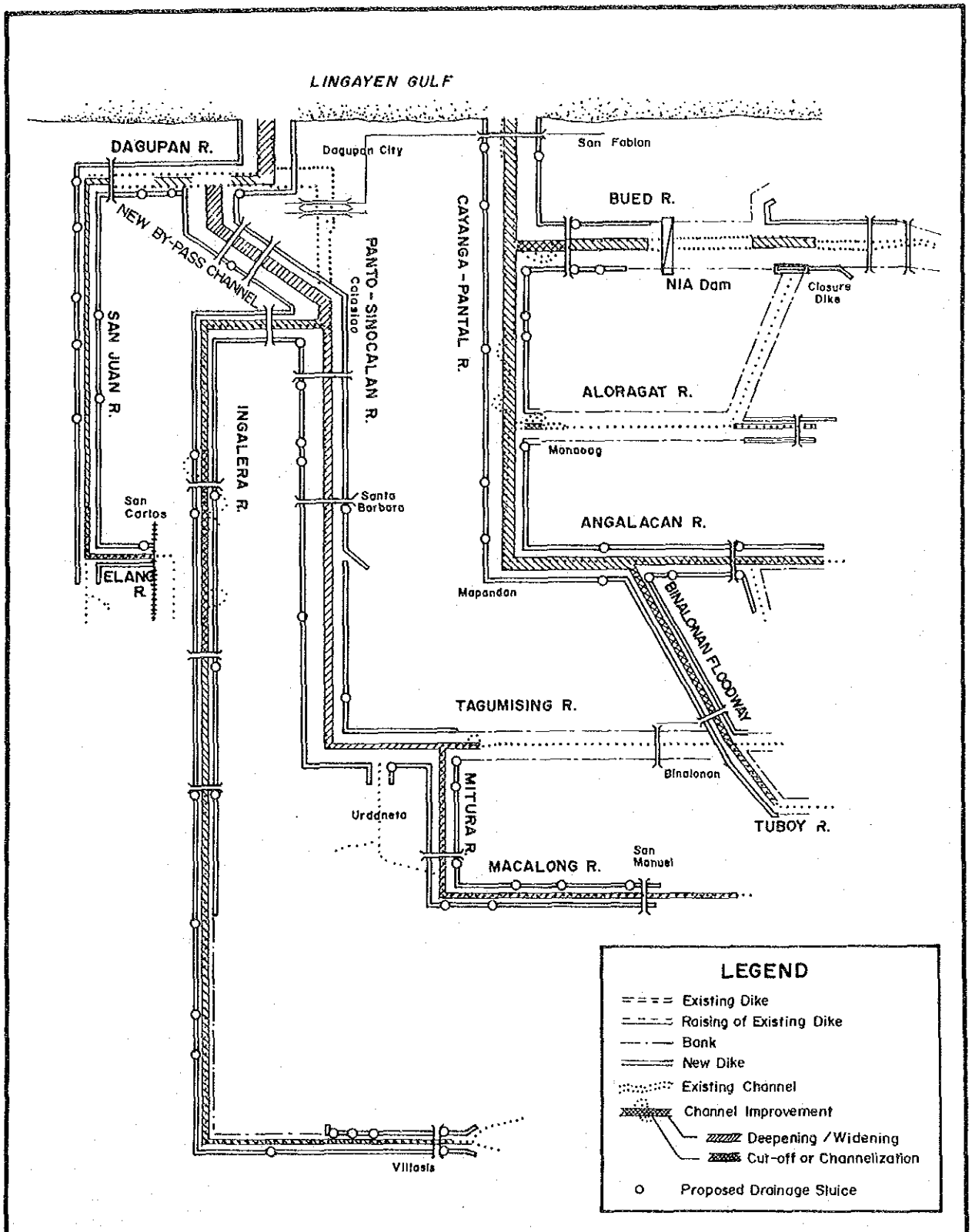


Fig. 3.3.2 GENERAL LAYOUT OF ALLIED RIVERS IMPROVEMENT FOR FRAMEWORK PLAN

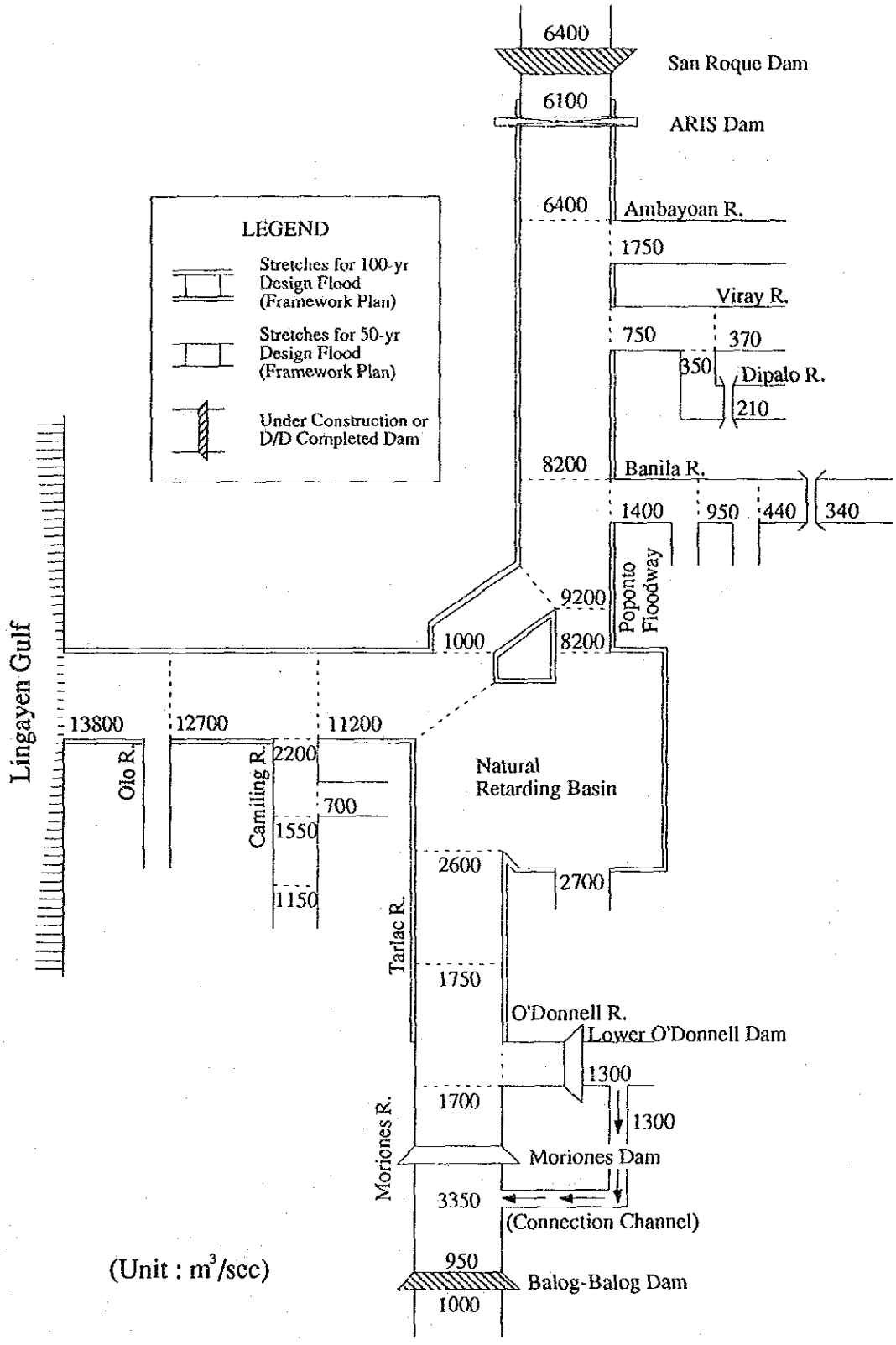


Fig. 3.3.3 DESIGN FLOOD DISTRIBUTION OF FRAMEWORK PLAN OF AGNO RIVER

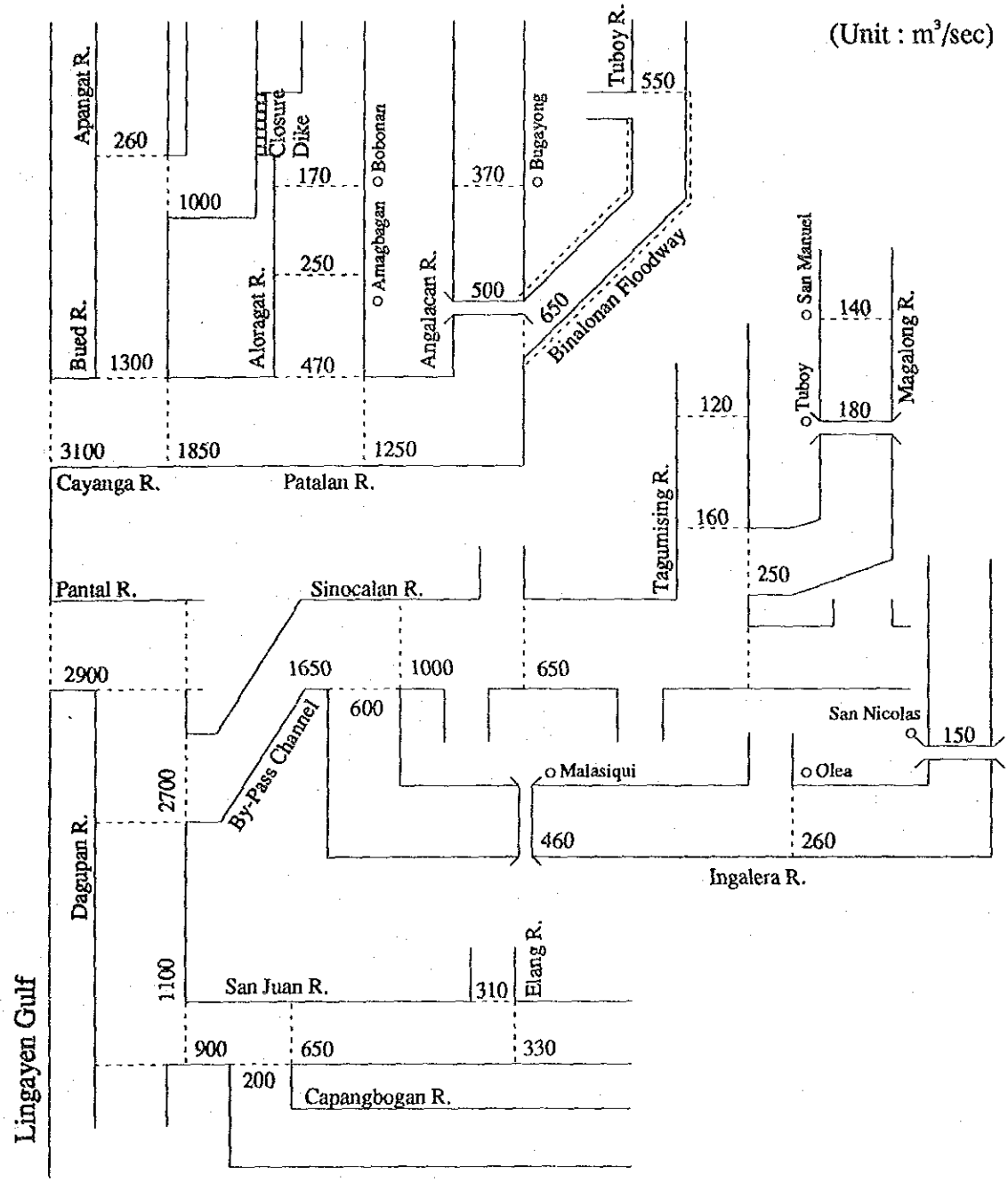


Fig. 3.3.4 DESIGN FLOOD DISCHARGE DISTRIBUTION OF FRAMEWORK PLAN (50-YR) OF ALLIED RIVERS

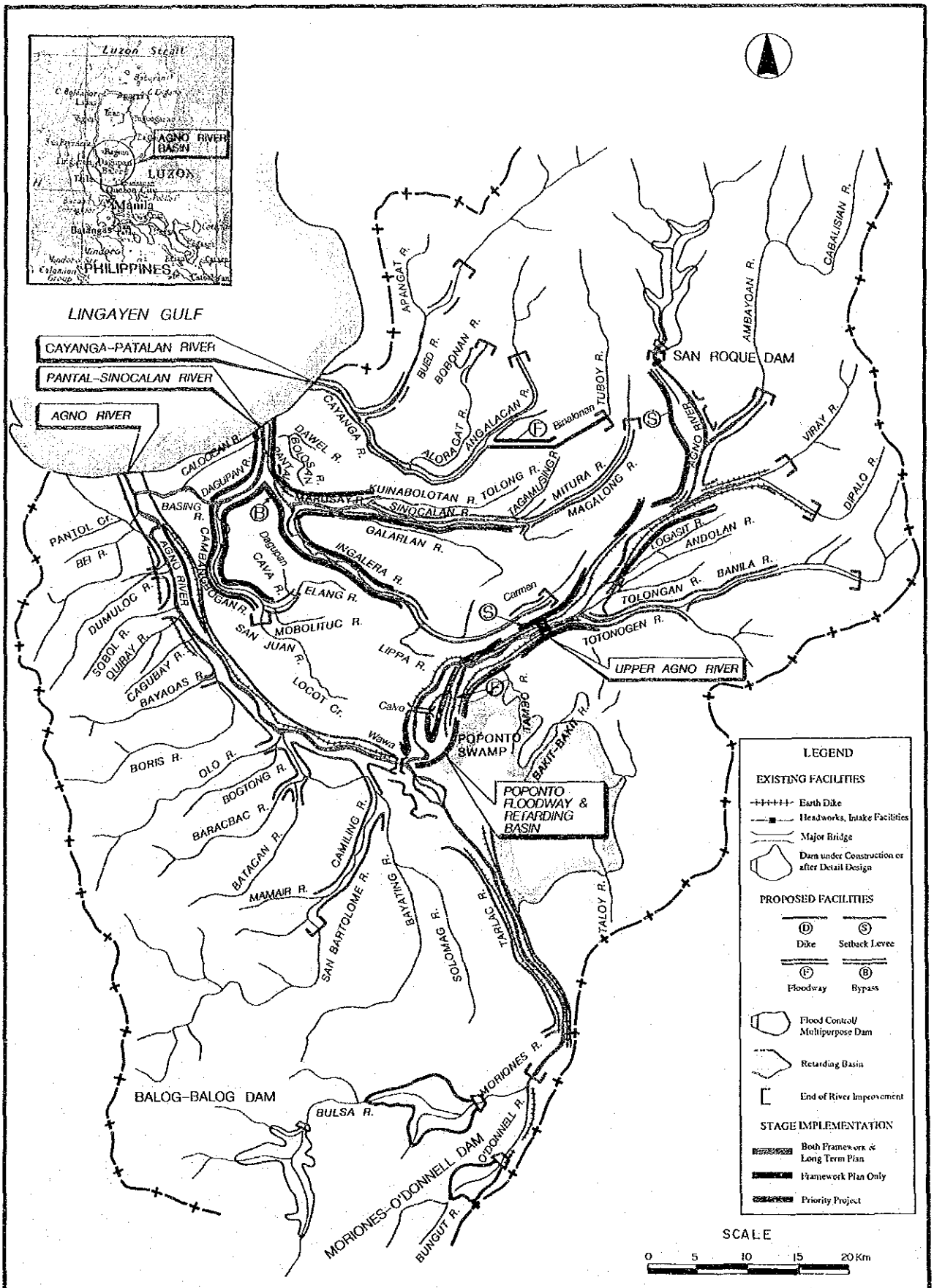


Fig. 3.3.5 GENERAL PLAN OF FRAMEWORK PLAN

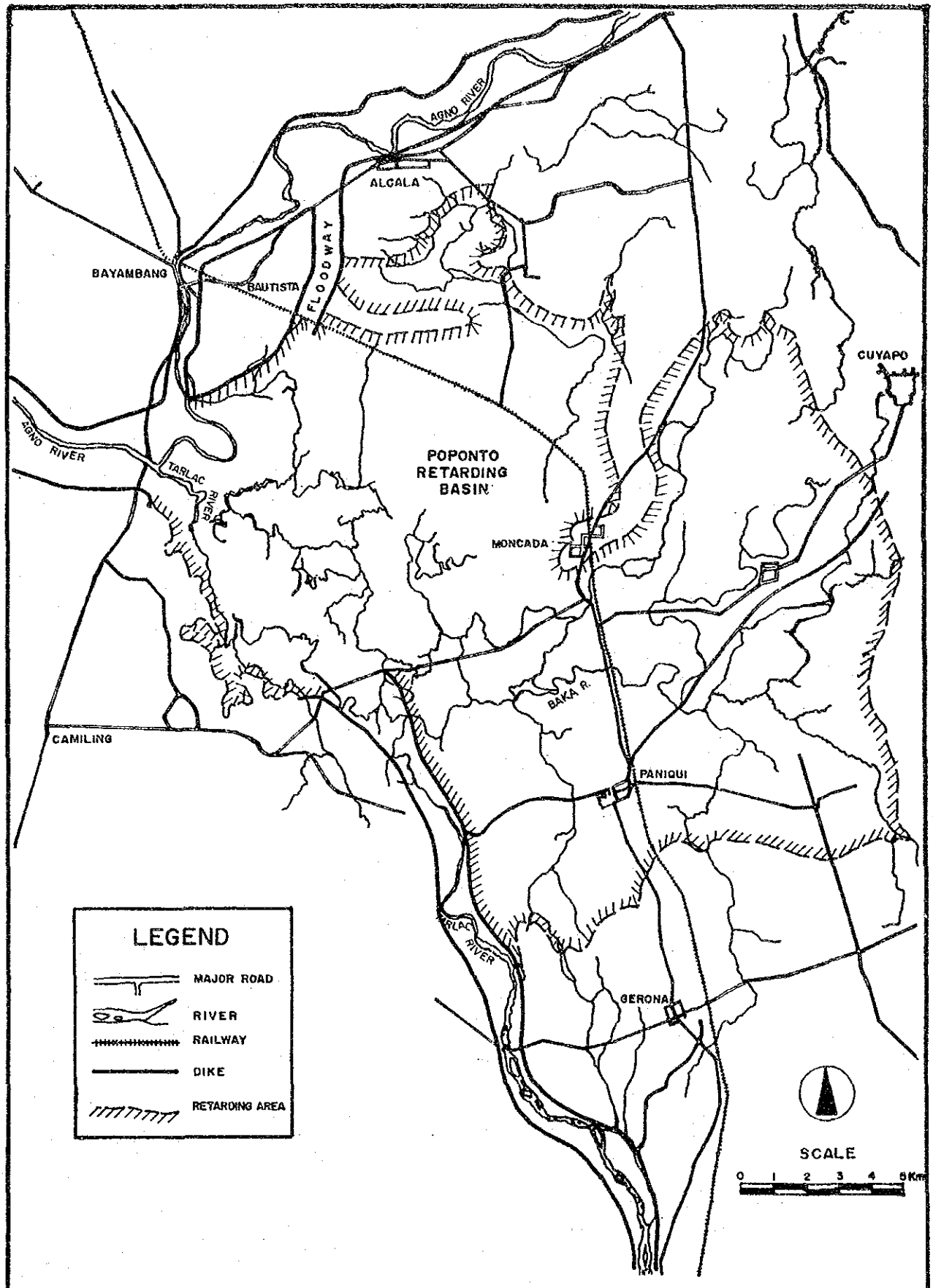


Fig. 3.3.6 GENERAL PLAN OF POPONTO RETARDING BASIN

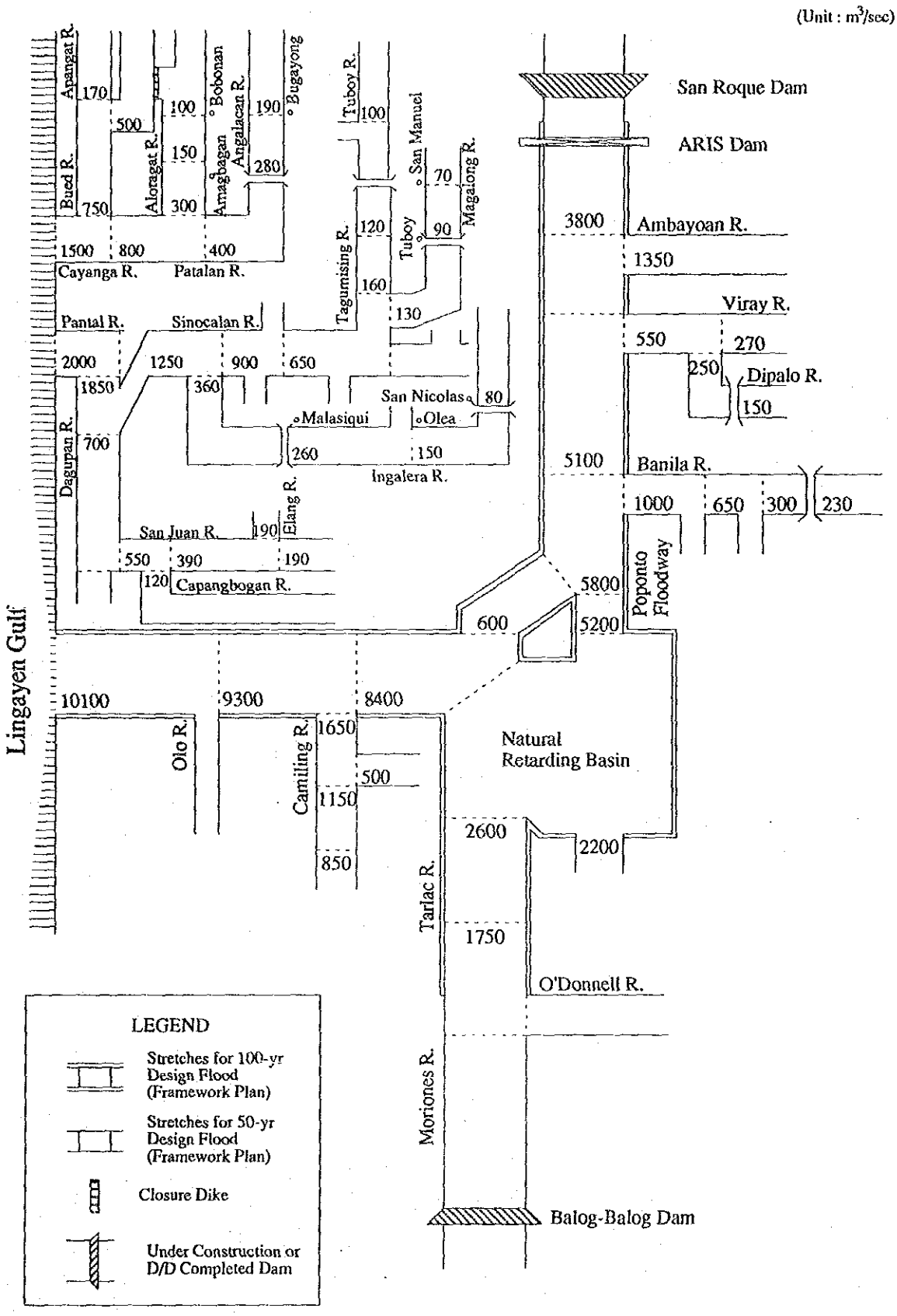


Fig. 3.3.7 DESIGN FLOOD DISCHARGE DISTRIBUTION OF LONG TERM PLAN

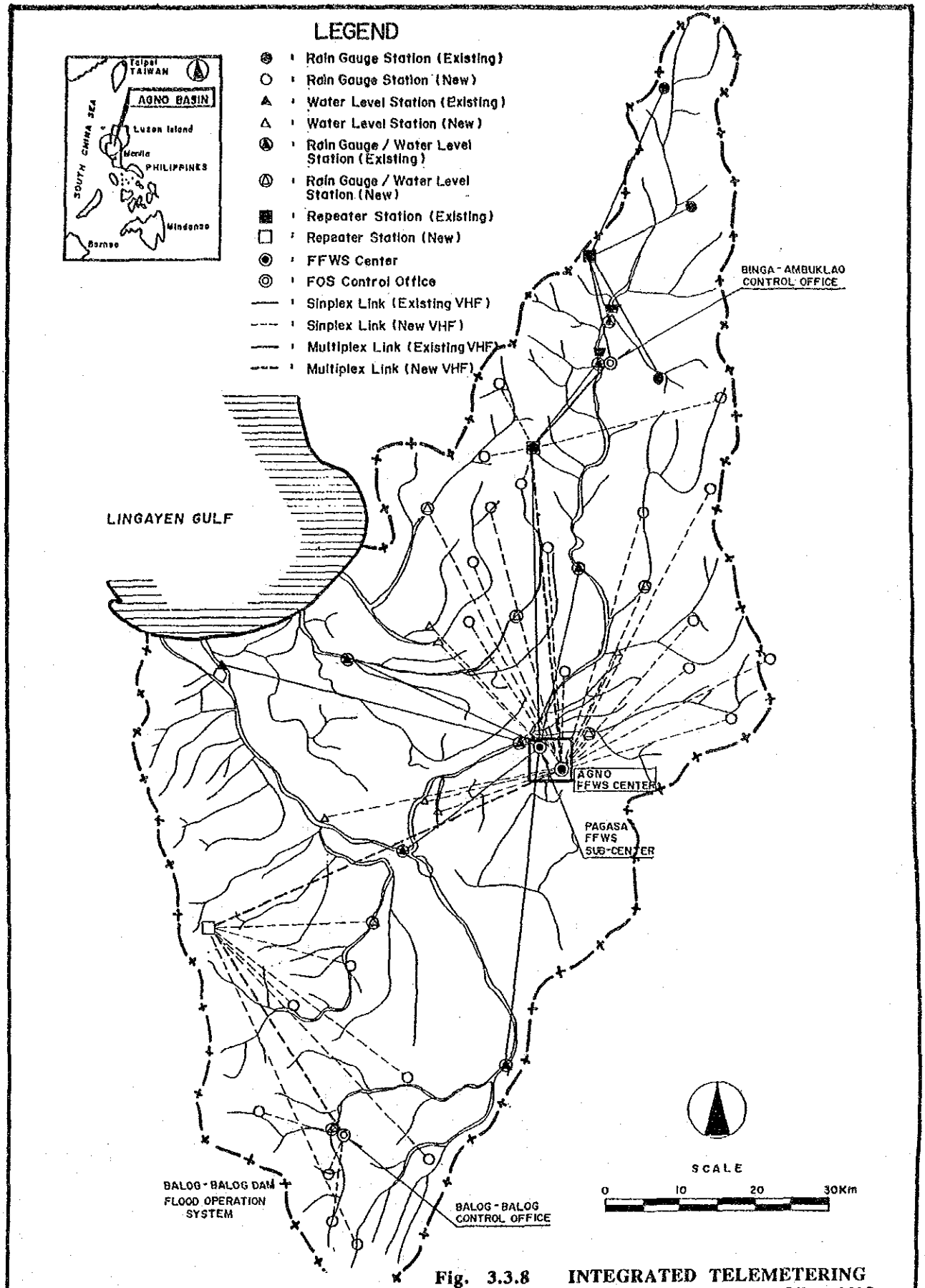


Fig. 3.3.8 INTEGRATED TELEMETERING NETWORK SYSTEM FOR AGNO RIVER FFWS

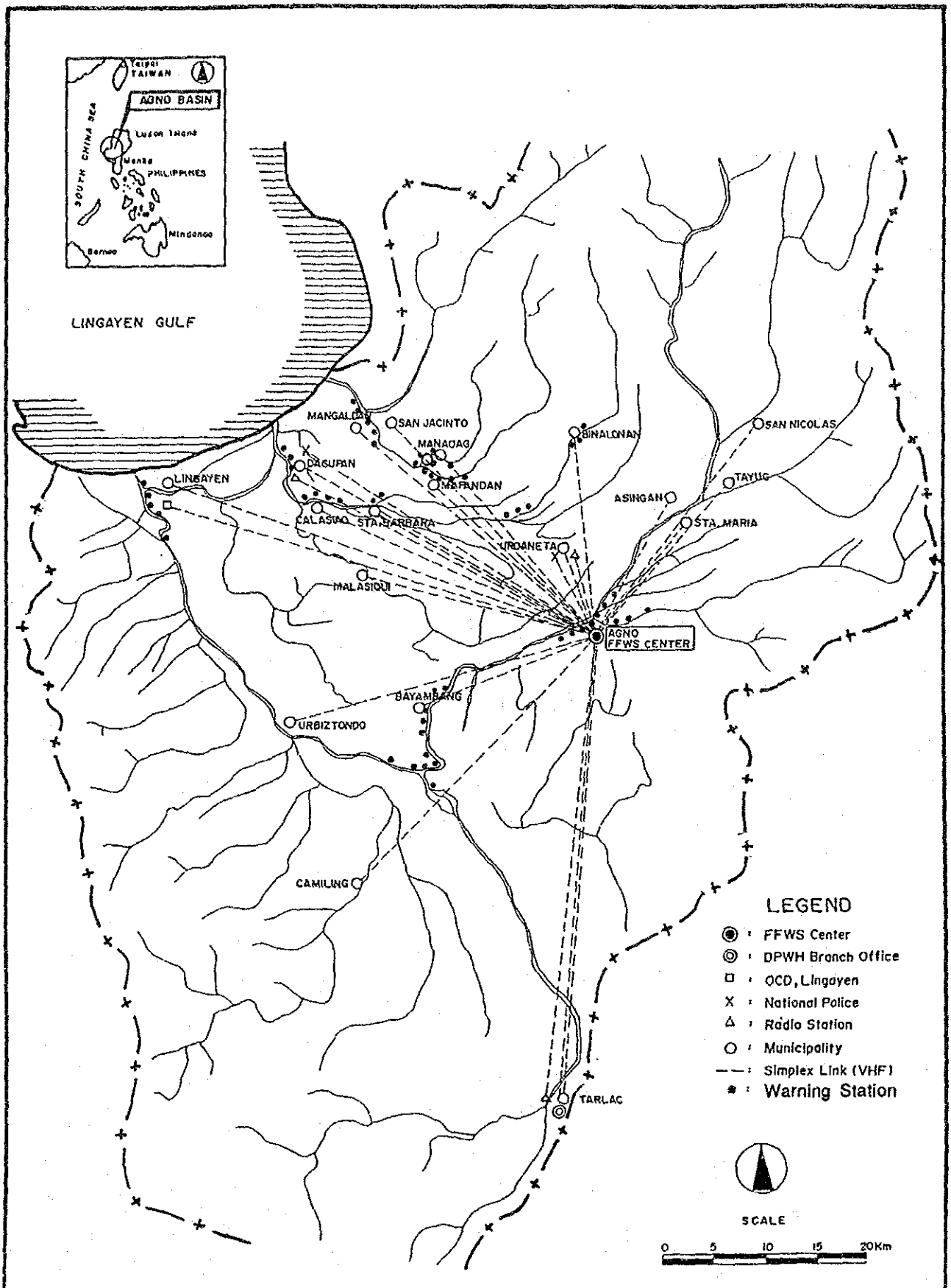


Fig. 3.3.9 INTEGRATED FLOOD WARNING NETWORK SYSTEM

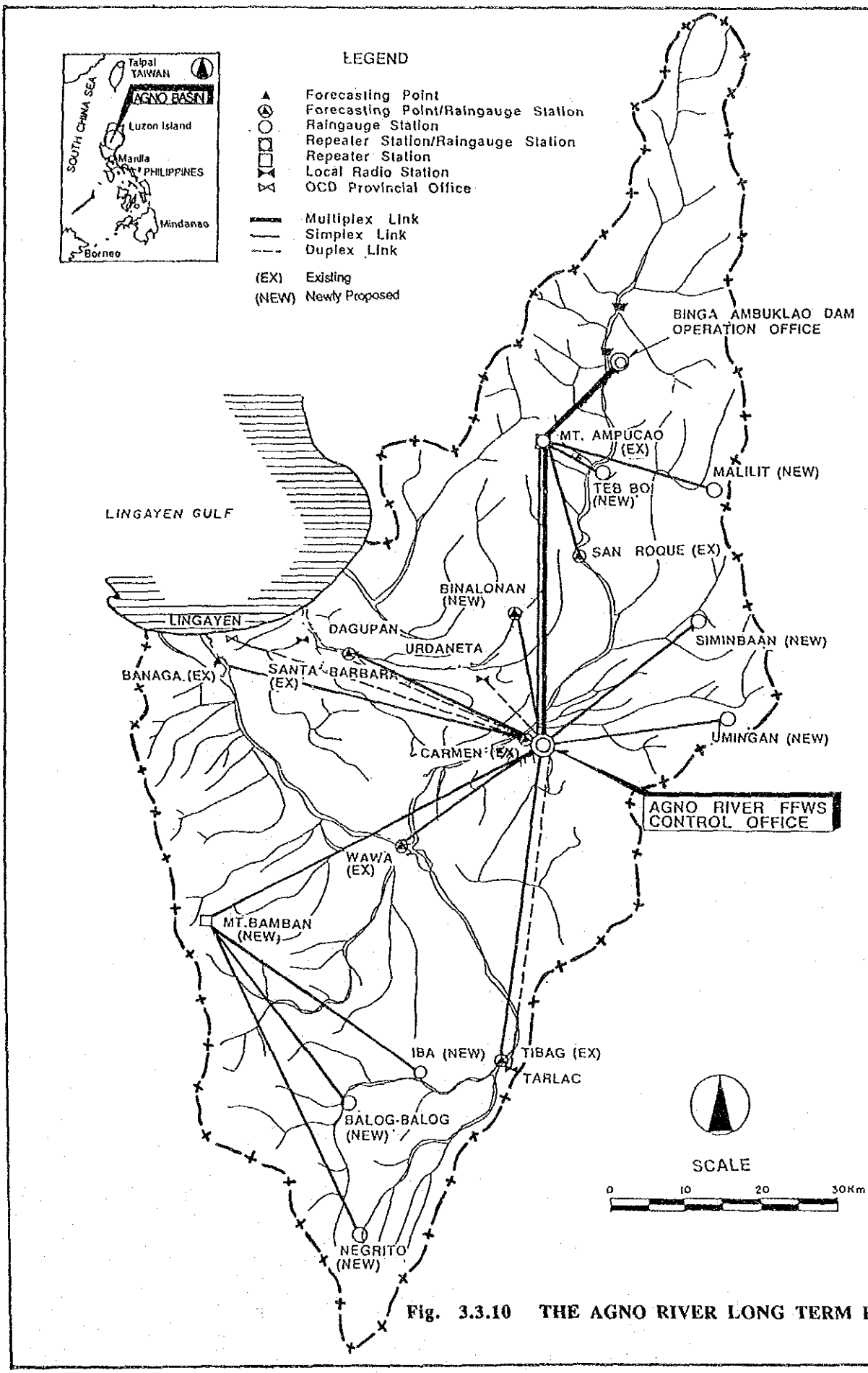


Fig. 3.3.10 THE AGNO RIVER LONG TERM FFWS

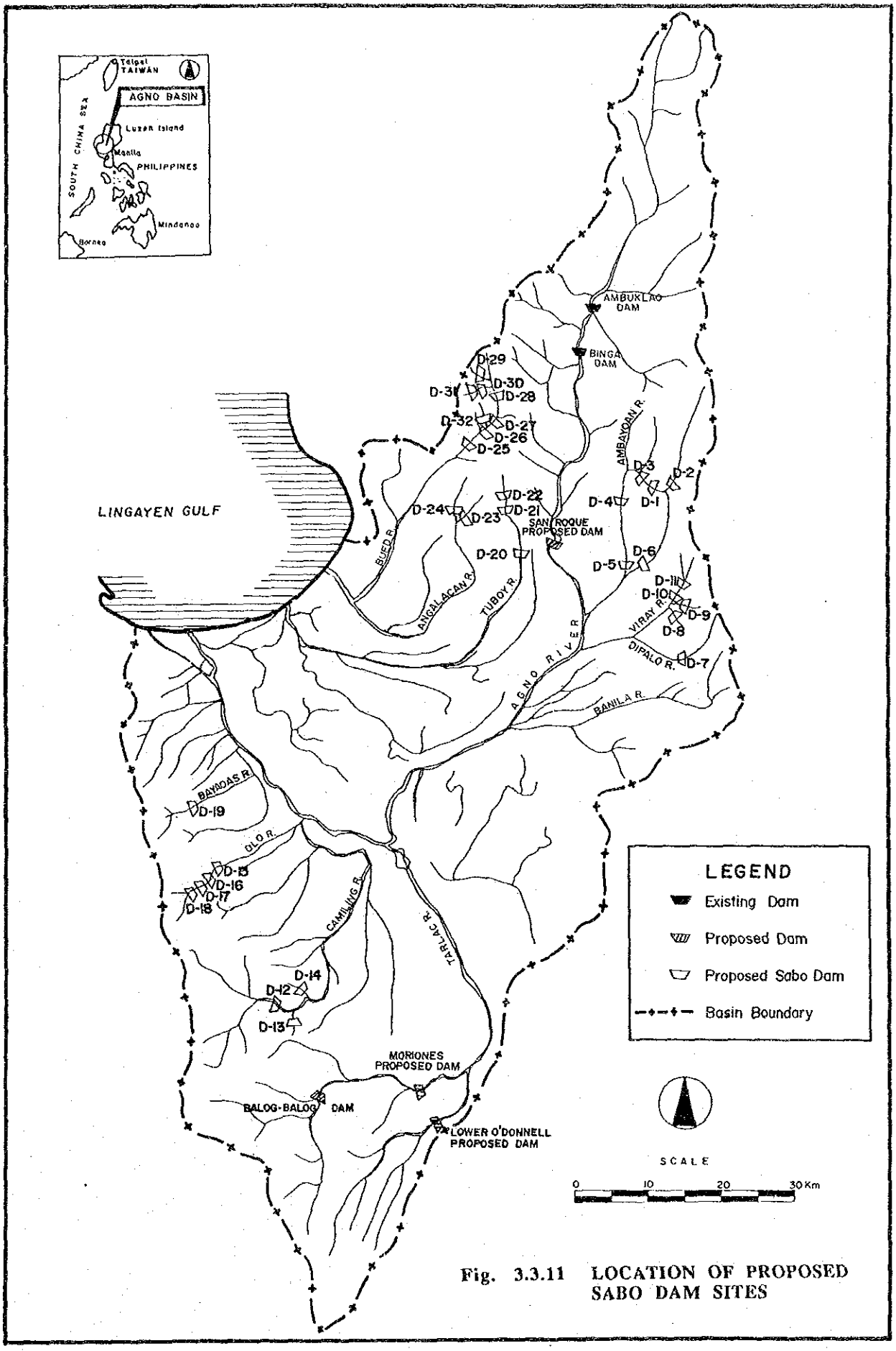


Fig. 3.3.11 LOCATION OF PROPOSED SABO DAM SITES

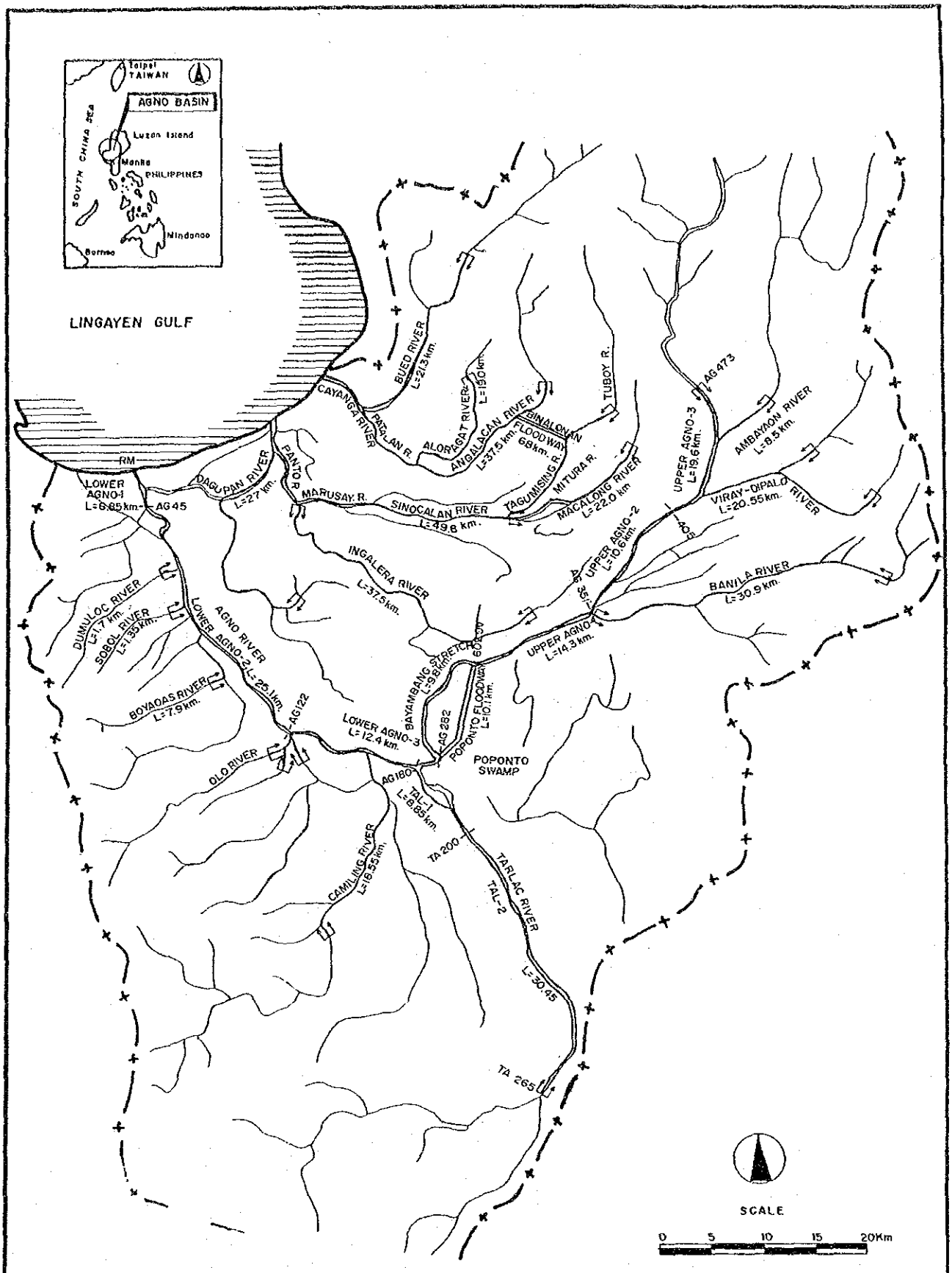


Fig. 3.4.1 LOCATION OF RIVER SYSTEMS/RIVER STRETCHES OF RIVER IMPROVEMENT WORKS

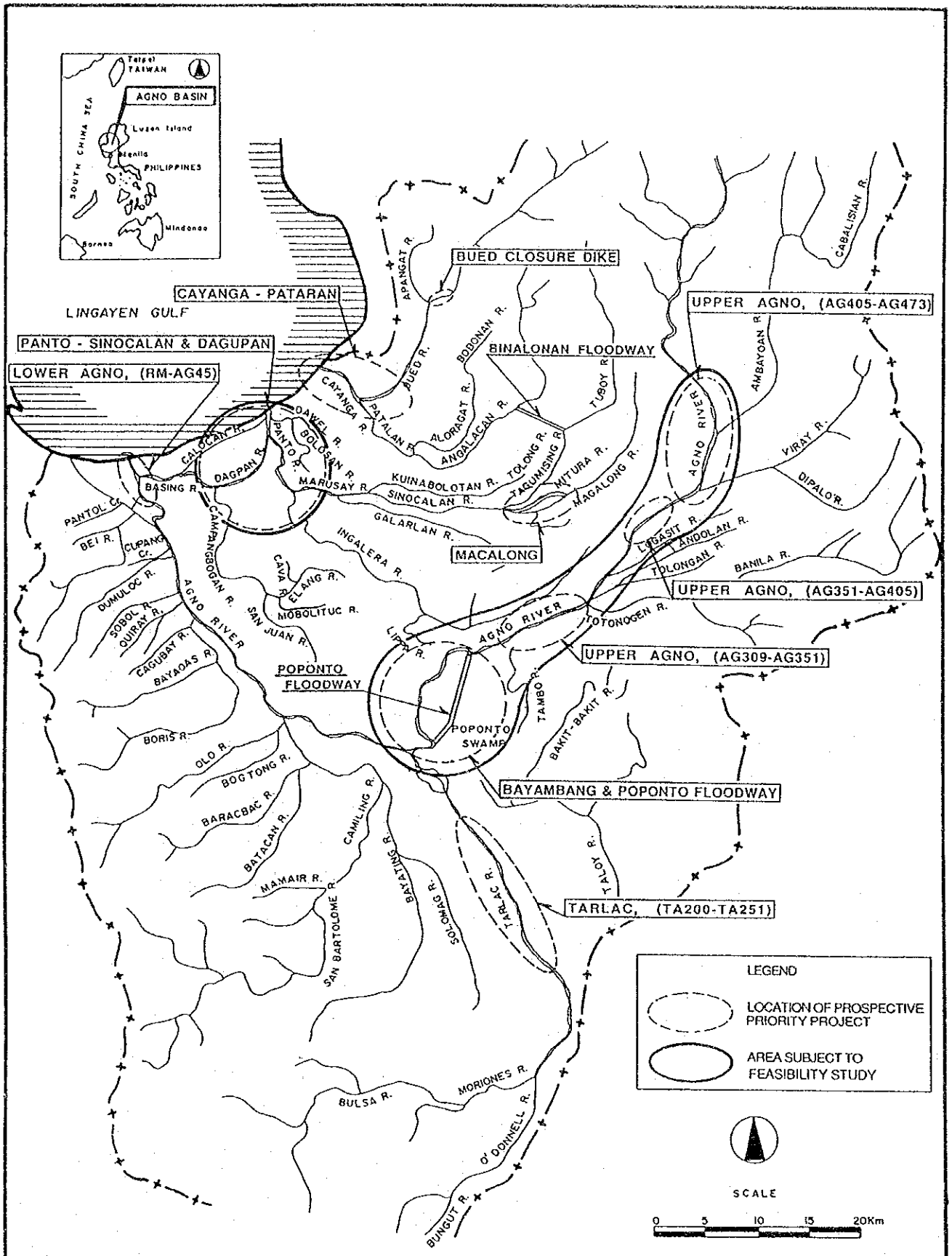


Fig. 3.6.1 LOCATION OF PROSPECTIVE PRIORITY AREAS FOR RIVER IMPROVEMENT WORKS

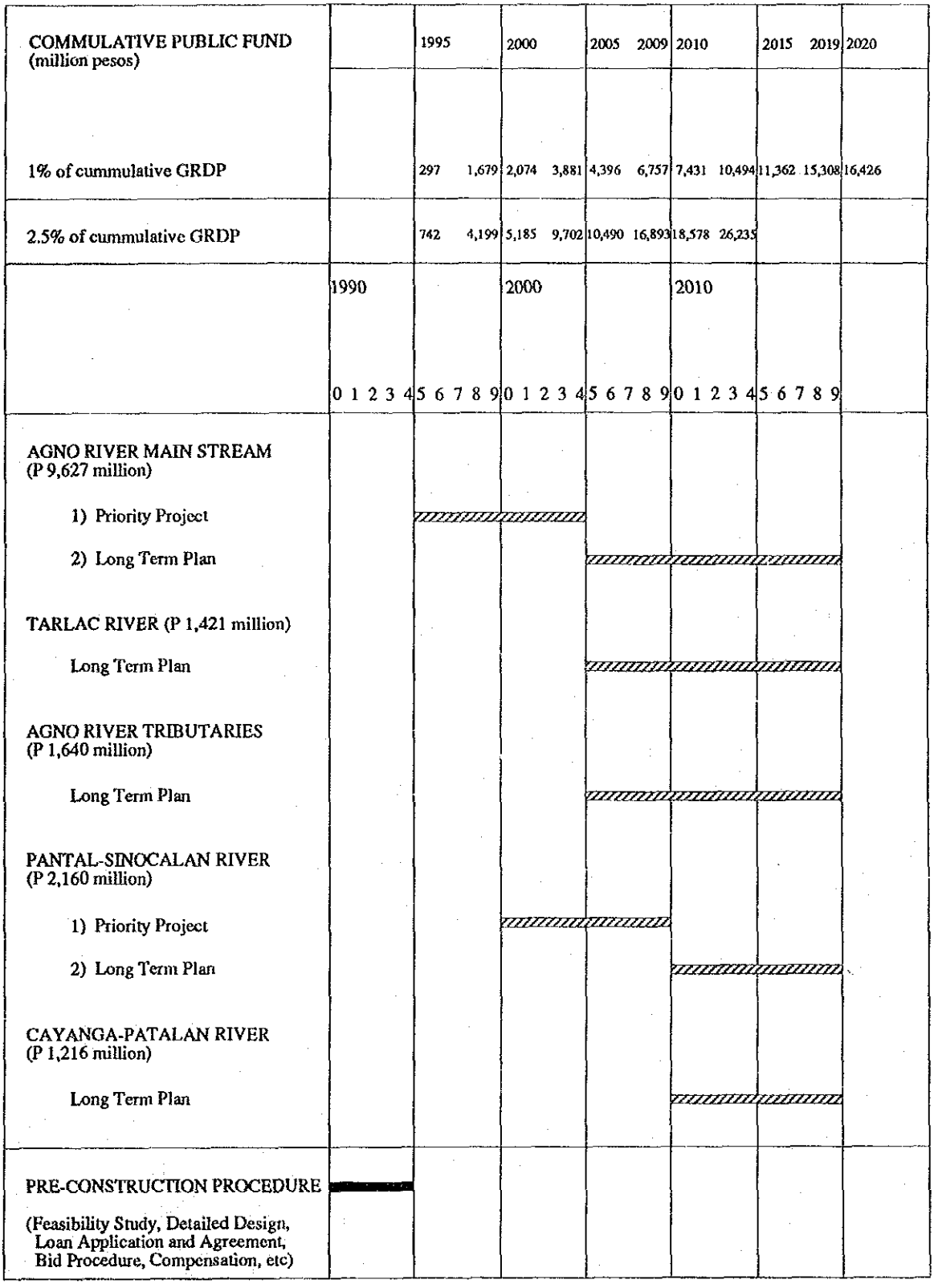


Fig. 3.6.2 PROPOSED IMPLEMENTATION PROGRAM OF LONG TERM PLAN

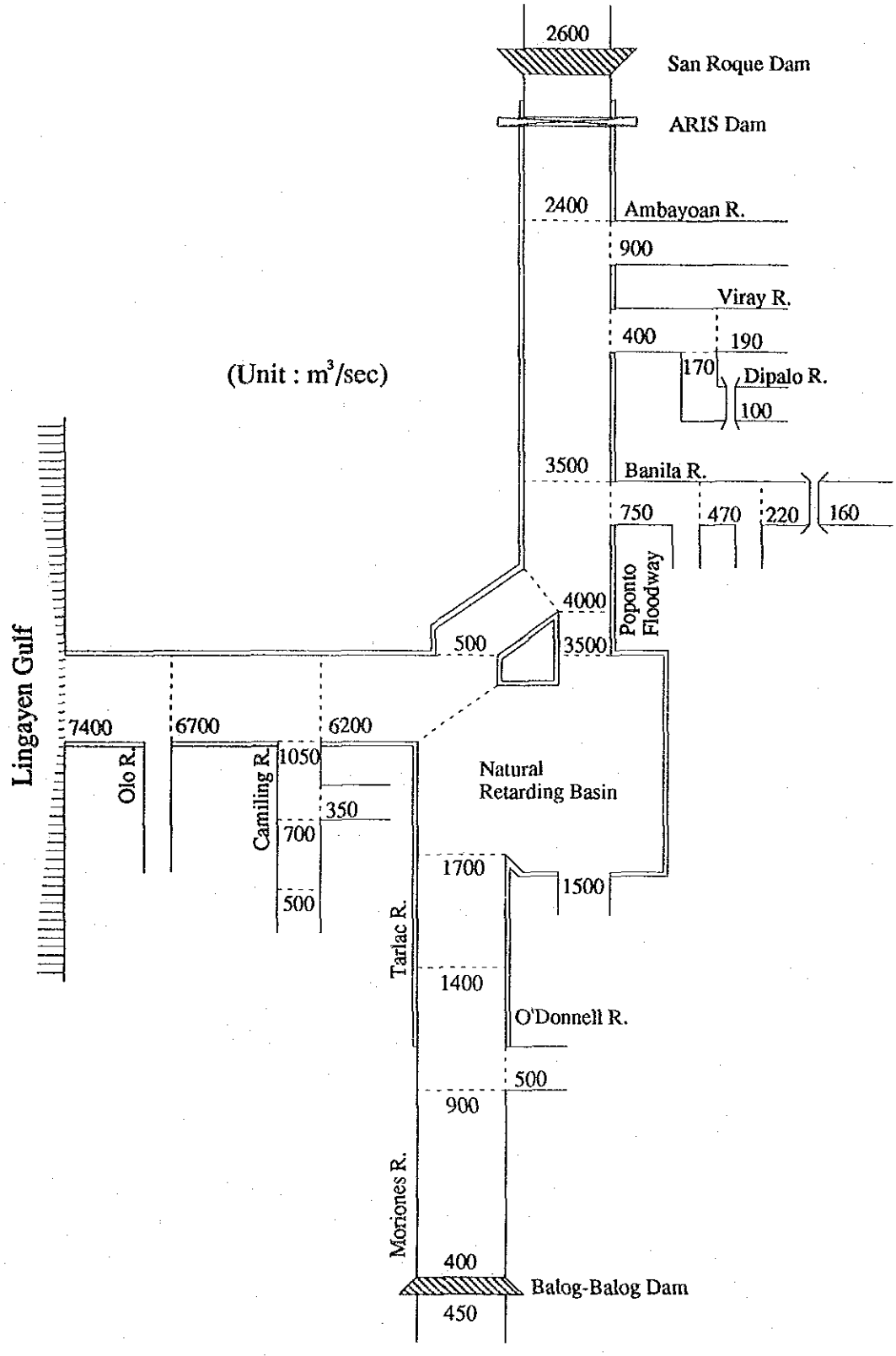


Fig. 4.1.1 DESIGN FLOOD DISTRIBUTION OF AGNO RIVER (10-YEAR FLOOD)

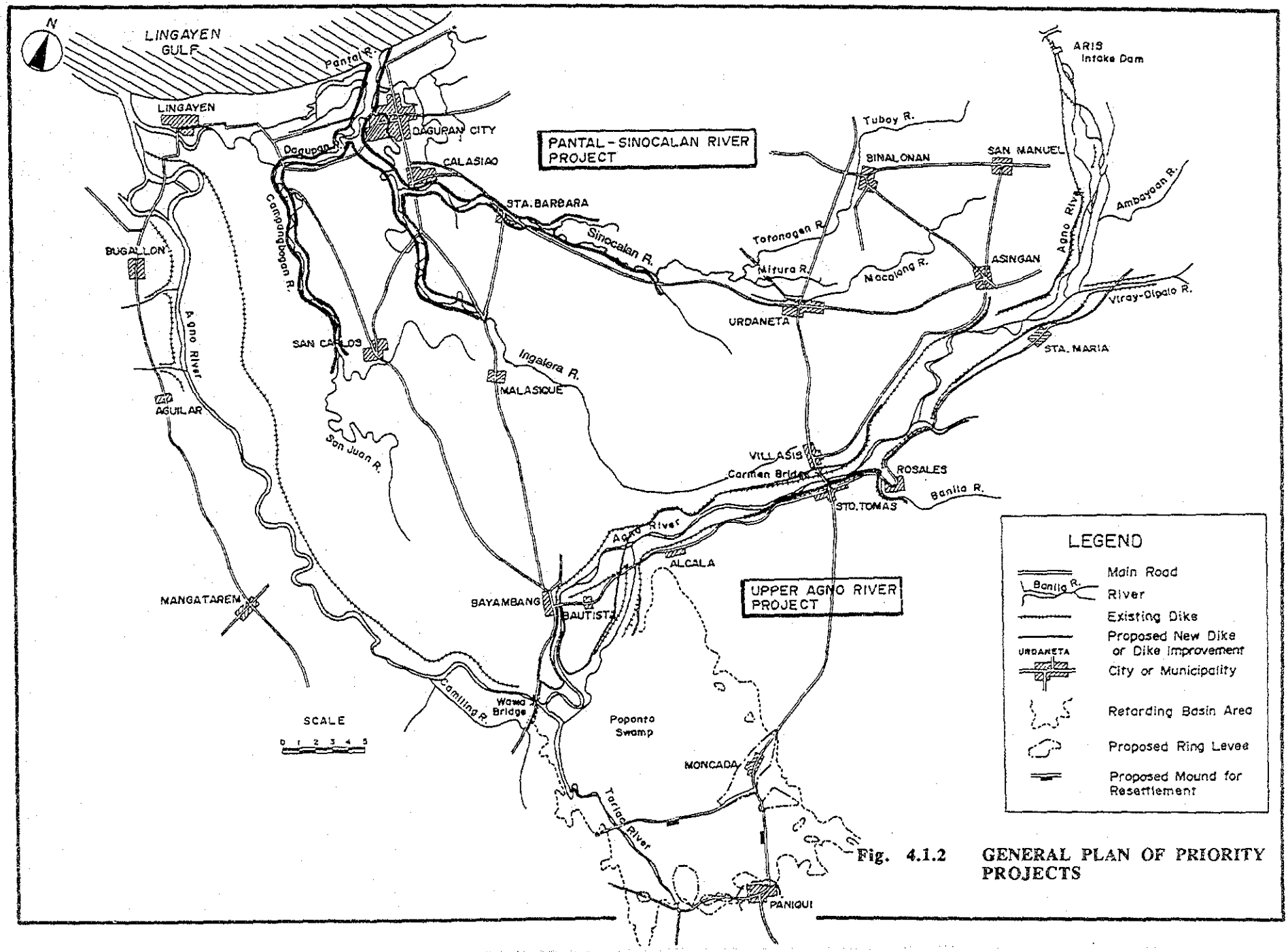


Fig. 4.1.2 GENERAL PLAN OF PRIORITY PROJECTS