APPENDIX H

NON-STRUCTURAL MEASURES AND INSTITUTIONAL ASPECTS

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CHAPTER I CONSTRUCTION AND OPERATION/MAINTENANCE OF SABO AND FLOOD CONTROL WORKS

1.1 Related Laws and Regulations

Pursuant to Section 3 of Executive Order No. 124, dated January 30, 1987, the Department of Public Works and Highways (DPWH) is responsible for the planning, design, construction and maintenance of infrastructure facilities especially national highways, flood control and water resources development system, and other public works in accordance with national development objectives.

With the approval of the Local Government Code of 1991 dated October 10, 1991 under Republic Act No. 7160, local government units through a system of decentralization are given more powers, authority, responsibilities, and resources. The process of decentralization shall proceed from the National Government to the Local Government units. These are provisions under Section 2 of this Code.

Subsection (a) of Section 17, also provides, that the Local Government units shall discharge the functions and responsibilities of national agencies and offices devolve to them pursuant to this Code. However Subsection (c) of Sec. 17 of the Code states "Notwithstanding the provisions of Subsection (b) hereof, public works and infrastructure projects and other facilities, programs and services funded by the National Government under the General Appropriations Act, other special laws, pertinent executive orders, and those wholly or partially funded from foreign sources, are not covered under this Section, except in those cases where the local government unit concerned is duly designated as the implementing agency for such projects, facilities, programs, and service."

1.2 Responsible Agencies

(1) Organization

As mandated by Executive Order No. 124, the DPWH is the principal agency responsible for the construction, operation and maintenance of flood control projects.

Under Section 17 of RA 7160, the local government units, i.e., the Municipality, Province, and the City governments are responsible for the construction and operation/maintenance of flood control and other related facilities located in their respective areas with some exceptions. With the passage of this Code, these local government units should provide funds for the purpose.

(2) Activities

(a) General Activities

The DPWH is the State's engineering and construction arm, responsible for the planning, design, construction and maintenance of infrastructure facilities. In the field of flood control and sabo works, the DPWH has constructed several systems of earthdikes, cut-off channels, bank protection works such as revetments, spurdikes, pile hurdles, and some sabo facilities involving groundsills, consolidation dams and other training works.

Some Local Government Units have also embarked on flood control and drainage works, but these are on a small scale, due to budgetary constraint.

(b) Activities in the Laoag River Basin in the Past

The major river improvement works in the Laoag River Basin consist of concrete

revetments and boulder spurdikes, as summarized below. The details of these structures are shown in Table H.1.1.

(i) Laoag River Control at Laoag City: 3,207 m. revetment/bank protection, 24 lines of boulder spurdike with an aggregate length of 797 m., and 40 m. gabion.

(ii) Sarrat River Control at Sarrat: 643 m. revetment/bank protection and 8 lines of boulder spurdike with an aggregate length of 352 m.

(iii) Apagang River Control at Piddig: 300 m, revetment/bank protection and 4 lines of boulder spurdike with an aggregate length of 60 m.

(iv) Guisit River Control at Piddig: 295 m. revetment/bank protection and 2 lines of boulder spurdikes with an aggregate length of 75 m.

(v) Tina River Control at Solsona: 2,430 m. cut-off channel, 770 m. closing dikes and 4 lines of boulder spurdike with an aggregate length of 544 m.

(vi) Laoag River Control at Sarrat: 655 m. revetment/bank protection and 5 lines of boulder spurdike with an aggregate length of 194 m.

(vii) Laoag River Control at Dingras: 115 m. revetment/bank protection and 32 lines of boulder spurdike with an aggregate length of 1,164 m.

(viii) Laoag River Control at Marcos: 4 lines of boulder spurdike with an aggregate length of 155 m.

(ix) Laoag River Control at San Nicolas: 80 m. revetment/bank protection and 2 lines of boulder spurdike with an aggregate length of 65 m.

(x) Cura River Control at Solsona: 1 line of boulder spurdike with a length of 200 m.

(xi) Mangato River Control at Laoag City: 890 m. cut-off/diversion channel.

In addition to the above, the National Irrigation Administration has constructed urgent disaster prevention works in the upper reaches of the river basin, financed from the balance of the OECF funds for the Ilocos Norte Irrigation Project. These structures consist of 55 kms. of levee with boulder facing, 63 units of dry boulder spurdike, 26 units of reinforced concrete pipes and 14 units of intake works or box culverts.

(3) Financial Expenses

(a) Medium Term Philippine Development Plan (1993-1998)

The Medium-Term Philippine Development Plan, 1993-1998, which was approved and adopted by the Government, is a blueprint aimed at economic recovery in the short run, as well as sustainable growth in the long run.

The DPWH Medium-Term Public Investment Program (1993-1998) amounting to ₱121.054 billion is shown on Table H.1.2. Flood Control and drainage projects have an allocation of ₱17.663 billion or 14.6 percent of the total program. Highway projects get the lion's share amounting to ₱96.207 billion or 79 percent of the total. Laoag River Basin Flood Control Project has a total programmed amount of ₱406 million, distributed as follows; ₱126 million for 1997, ₱280 million for 1998. For later years, ₱394 million is programmed.

(b) Annual National Budget in Recent Years

The annual budget for the construction and maintenance of flood control projects nationwide, in Region I and in the Laoag River Basin from CY 1990 to CY 1996

is summarized below.

Annual Budget for Construction and Maintenance of Flood Control Projects

(in Thousand Pesos)

CY	Total Nationwide	Region I	Laoag River Basin
Construction			
1990	1,327,571	150,772	1,035
1991	1,551,984	90,465	-
1992	2,077,911	58,900	-
1993	1,715,702	51,400	-
1994	1,907,000	122,700	6,500
1995	2,606,014	149,524	1,785
1996	2,852,858	98,000	10,000
Maintenance			
1990	199,687	17,311	-
1991	142,716	12,979	-
1992	143,391	12,979	-
1993	168,155	13,589	-
1994	171,960	11,326	-
1995	619,805	45,787	-
1996	651,775	48,076	-

CHAPTER II WATERSHED MANAGEMENT (REFORESTATION)

2.1 Related Laws and Regulations

The conservation, management, development and proper use of the country's environment and natural resources including those in the watershed are governed by Executive Order No. 192 dated June 10, 1987. This order is the Reorganization Act of the Department of Environment and Natural Resources (DENR).

On the reforestation aspect of watershed management, Presidential Decree No. 705 was issued earlier in January 14, 1981. This decree is known as the "Revised Forestry Code of the Philippines." Under Section 2, Policies, of this Code, the government adopts as one of its policies, the protection, development and rehabilitation of forest lands, so as to ensure their continuity in productive condition. Section 33 of the Code, identifies forest lands to be reforested.

To implement the provisions of the Code, Executive Order No. 277, was issued on July 25, 1987. This order amends Section 68 of Presidential Decree No. 705, for the purpose of penalizing possession of timber or other forest products without the legal documents required by existing forest laws, authorizing the confiscation of illegally cut, gathered, removed and possessed forest products, and granting rewards to informers of violation of forestry laws, rules and regulations.

2.2 Responsible Agencies

(1) Organization

The DENR is the primary government agency responsible for watershed management. The reforestation aspect is managed by the Forest Management Bureau, one of the sectoral bureaus of the DENR. This Bureau recommends policies, regulations and/or programs to the Secretary, and advises the regional offices on the effective implementation of the development and conservation programs. The field offices of the DENR are the regional offices in the thirteen (13) administrative regions. In addition to these, there is the Environment and Natural Resources Provincial Office in every province, and the Community Office in every municipality, whenever feasible. A typical setup of a Provincial Environment and Natural Resources Office (PENRO) in the Province of Ilocos Norte is shown on Fig. H.2.1. All reforestation projects are funded under the regular budget of DENR, from foreign loans and private sectors.

(2) Activities

(a) General Activities

In 1934, the country has about 17 million hectares or 57 percent of its land area in forests, with virgin forest covering about 11 million hectares. As of 1994 forest land comprised 15.88 million hectares or 53 percent of the total land area of the Philippines. About 15 million hectares or 94 percent of these forest lands have been classified into various forest categories the largest of which are the established timberlands at 67 percent. The unclassified portion of forest lands comprised 0.881 million hectares or 6 percent. Certified alienable or disposable lands were about 14.1 million hectares or 47 percent of the total land area. Classification of land in the country during the period 1976 to 1994 is shown on Table H.2.1.

The status of land use in the country indicates that forest areas covered only about

5.7 million hectares or roughly 19 percent of the total land area. The dipterocarp forest, mainly being the most dominant forest type in the Philippines covered 3.77 million hectares, or 66 percent. The remaining old growth (virgin) dipterocarp forest comprised 0.805 million hectares. Status of land use is shown on Table H.2.2.

The important contributions of the forestry sector have been eroded by deforestation, which has been ongoing at the rates acknowledged to be among the highest in the world. According to the Forest Management Bureau, the average annual deforestation rate had been as high as 300,000 hectares per year in the late 1960's and was still going on at rates higher than 150,000 hectares per year in the early 1980's although the rates have been estimated to be less than 100,000 hectares in 1990.

Studies made by the DENR, show that there is a strong link between population growth and deforestation. The country had about 17 million hectares of forest in 1934 when the population was less than 15 million. The population had more that double in 1969 when the first nationwide forest inventory was completed. There were only 10.4 million hectares of forests left then. Satellite imageries show that the forest cover had further decreased to around 8.5 million hectares in 1976 and 7.4 million hectares in 1980, as population rose to 43 to 48 million, respectively. Projections based on the consolidation of the second nationwide forest inventory and SPOT satellite imagery data show that the forest cover will drop to only 6.7 million by the end of 1990. The inverse relationship between population and forest cover can be clearly seen in Fig. H.2.2. The deforestation rate during the period 1935 to 1990 is show in Fig. H.2.3.

In recent years, the government has taken a number of steps to address the fundamental causes of forest destruction and to start a most systematic program of reconstruction in the forestry sector. These are:

(i) The more rigorous enforcement of forest laws and regulations and the cancellation of errant Timber License Agreements (TLAs), including the confiscation of illegally cut logs and lumber.

(ii) The implementation of the ban on export of logs and raw lumber.

(iii) The intensification of the Integrated Social Forestry Program. Rather than look at people in the forest lands as enemies of the government, the DENR is trying to make them partners in protecting, managing and developing these forests. The DENR is issuing a Certificate of Stewardship Contract (CSC) which give families and communities living in the forests the privilege to stay in the area and use the land for 25 years, renewable for another 25 years. They are required to plant trees in at least 20 percent of their area.

(iv) The launching of the National Forestation Program and introduction of the Forest Land Management Agreement (FLMA) to encourage communities to take care of the 3-year-old plantations covered by the program, by giving them the privilege to harvest the planted trees once they reach maturity. The FLMA is also good for a period of 25 years renewable for another 25 years.

(v) Starting January 1, 1992 logging is no longer allowed in the old growth (virgin) forest, since the areas have been placed under the National Integrated Protected Areas System (NIPAS) for biodiversity conservation and environmental protection pursuant to RA 7586, the National Protected

Areas Systems Act of 1992.

Records from 1994 Philippine Forestry Statistics show that as of 1975, a total of 189,876 hectares have been reforested by the government. From 1976 to 1994, a total of 1,235,294 hectares was reforested; 782,707 hectares by the government, and 452,587 by non-government sectors. The area reforested by the government and the private sectors from 1976 to 1994 is shown in Fig. H.2.4.

(b) Activities in the Laoag River Basin in the Past

There are two Community Environment and Natural Resources Office (CENRO) under the PENRO of Ilocos Norte. CENRO I with office in the Municipality of Bangui, has jurisdiction on projects in the municipalities of Bangui, Pagudpod, Burgos, Adams, Dumalneg, Pasuquin and Vintar, all outside the watershed of Laoag. CENRO II with office in Laoag City, has jurisdiction on projects in the city and the municipalities of San Nicolas, Solsona, Dingras, Piddig, Sarrat, Espiritu, Marcos and Nueva Era, all inside the Laoag River watershed, and the municipalities of Bacarra, Batac, Carasi, Paoay, Currimao, Pinili and Badoc outside the watershed.

According to the DENR, Region I, the National Forestation Program which involves the rehabilitation of critically denuded watersheds and other protected areas as well as open and denuded forest lands, through the establishment of forest plantations, urban forest, forest protection, maintenance of plantations established under the Community Forestry Program are continuing programs of the government. The program also includes dipterocarp seedling production/research and planting.

On the watershed rehabilitation and management, a number of projects are continuously implemented to address the problems of soil erosion and environmental degradation in the watershed areas. These include the ADB funded-Philippine Forestry Development Project in Ilocos Norte, and the World Bank funded Environment and Natural Resources Sectoral Adjustment Loan (ENR-SECAL) projects in identified watershed areas in each province in Region I.

The DENR Region I, PENRO in Ilocos Norte, and the CENROS, however, do not have specific details/information on the activities/programs in the Laoag River Basin.

2.3 Recommendations

The eastern watersheds of the Laoag River Basin yield excessive sediment runoff to the downstream rivers, causing a large aggradation of the beds of the Cura, Labugaon, Solsona, Madongan and Papa rivers. The average annual aggradation rate in the rivers is estimated to be 3.0 cm/year in Cura/Labugaon River, 5.1 cm/year in Solsona/Madongan River, and 4.8 cm/year in Papa River. These aggradation rates will be decreased to a considerable extent by the proposed sabo dams. However, some amount of aggradation; namely, 0.7 cm/year in Cura/Labugaon River, 2.5 cm/year in Solsona/Madongan River and 2.3 cm/year in Papa River, will still be left for other sediment control measures. For details, se Appendix F.

On the other hand, DENR is undertaking eight (8) reforestation projects with a total area of 47,111 ha in the eastern watersheds. Locations of the projects are shown in Fig. H.2.5. These projects are expected to supplement the sediment control of the proposed sabo dams. However, the ongoing reforestation project covers only a part of the watersheds of the Madongan and Papa rivers which are the most critical in the Laoag River Basin. Extension of the ongoing reforestation project in the Madongan and Papa river basins is necessary.

CHAPTER III FLOOD FORECASTING AND WARNING

3.1 Related Laws and Regulations

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) was established by virtue of Presidential Decree No. 78, dated December 8, 1972. This Act is known as the "Atmospheric, Geophysical and Astronomical Science Act of 1972." PAGASA then, was under the Department of National Defense. On June 2, 1977, the provisions of Section 4 of this Act was amended by Presidential Decree No. 1149, and among this is the inclusion of the National Flood Forecasting Office as one of the major organizational units of the PAGASA. On January 30, 1987, Executive Order No. 128, known as the Reorganization Act of the National Science and Technology Authority was promulgated. The PAGASA, in accordance with this order was one of the offices placed under the Authority.

3.2 Responsible Agencies

(1) Organization

Under Section 4(f) of Presidential Decree No. 1149, the PAGASA through its National Flood Forecasting Office shall undertake operational activities in flood forecasting and warning covering important river basins in the country; develop the systems and facilities necessary to carry out these functions; improve the techniques and methods used; and coordinate with other agencies concerned in flood mitigation and control. Other national government agencies that directly participate and coordinate with PAGASA are the DPWH, the NIA, the NPC and the OCD.

The PAGASA has flood monitoring centers in the Agno, Cagayan, Pampanga and Bicol river basins located in Regions I, II, III and V, respectively.

(2) Activities

The first pilot flood forecasting and warning system project in the country was established in 1973 in the Pampanga River System; and was financed by grant aid funds from the Government of Japan. This was followed by the construction of similar projects in the Agno, Bicol and Cagayan river basins. In addition to these, flood forecasting and warning projects for dam operations were established in the Angat, Pantabangan, Ambuklao, Binga and Magat dams, purposely to give warning immediately below the dams before releasing excess flood waters from the reservoirs. The latest project was installed in the Pasig, Marikina, Laguna Lake complex in 1993.

All rainfall and water level gauging equipment in the flood forecasting and warning projects are fully automatic. Depth of rainfall and water level of the river at each station within a particular river basin are transmitted by telemetery at specified time intervals to the respective Flood Forecast Center. The hydrological data collected by each Flood Forecast Center are automatically relayed to the National Flood Forecasting Office Operation Center in Quezon City. Average basin rainfall is calculated which serves as input to flood forecasting models for each basin to obtain flood forecast of flood levels at selected stations in the lower reaches of principal rivers. Forecast values of water stages are interpolated for other locations and translated in terms of areas to be inundated.

A Flood Outlook is issued when a considerable rise in water level at a particular forecast point but no imminent danger of inundation is expected. It gives the rates of

rise of water levels, rainfall characteristics and other pertinent information.

A Flood Advisory is issued when the rates of rise of water level threaten to reach or surpass critical levels in about 12 or more hours. The advisory includes specific lead time forecast of water stage, rates of water level rise, rainfall characteristics and areas most likely to be affected, etc.

All forecasts, outlooks and advisories are promptly relayed to the following:

(a) National Disaster Management Center, Office of Civil Defense
(b) Department of Public Works and Highways
(c) Flood Forecast Center in Agno, Bicol, Cagayan and Pampanga river basins.
(d) Broadcast media, newspapers and private entities upon request.

In the case of the Flood Forecasting and Warning system for Dam Operations, the supervisory control offices at the damsites which are managed by the NIA and NPC directly transmit flood warning notices to the municipal halls concerned which serve as the center for dessimination of warnings to the people in the area.

The overall layout of the telecommunication networks of these projects are shown on Fig. H.3.1.

No flood forecasting and warning system has been established so far in the Laoag River Basin.

3.3 Recommendations

(1) General

A flood forecasting and warning system is necessary to achieve a successful flood fighting and evacuation. However, its applicability depends on the length of flood traveling time in the river basin.

Floods of the Laoag River Basin are mainly generated from the mountain watersheds of the Cura, Labugaon, Solsona, Madongan, Papa, Bongo and Guisit rivers. The flood traveling time in these mountain watersheds from the mountain top to the mountain valley exit is estimated to be approximately 1.0 hour. On the other hand, the traveling time in the river channel from the mountain valley exit to Laoag City (Gilbert Bridge) is calculated as follows by assuming the average flood velocity as 3.5 m/s.

River Reach	River Length	Traveling Time
Cura Intake---Gilbert Bridge	36 km	2.9 hr
Labugaon Dam---Gilbert Bridge	38 km	3.0 hr
Solsona Dam---Gilbert Bridge	36 km	2.8 hr
Madongan Dam---Gilbert Bridge	35 km	2.8 hr
Papa Dam---Gilbert Bridge	42 km	3.3 hr
Nueva Era Dam---Gilbert Bridge	46 km	3.6 hr
Poblacion Piddig---Gilbert Bridge	20 km	1.6 hr
Average	36 km	2.8 hr

As shown above, the flood traveling time in the Laoag River Basin is considered too short to make a quantitative forecasting of flood discharge or water level in advance. The flood fighting and evacuation in the basin need to be performed based on real time hydrological information and qualitative flood forecasting. Hence, a simple but speedy flood forecasting and warning system is proposed.

The proposed flood forecasting and warning system is composed of (1) hydrological

observation network, (2) data transmission, (3) flood forecasting, and (4) flood warning.

(2) Hydrological Observation Network

The flood forecasting and warning in the basin is performed based on the data of river water level but not rainfall data in principle from the following reasons:

(a) Elevation of the mountain watersheds widely varies from 100 m to 2,300 m, causing a large change of rainfall distribution. Hence, a number of rainfall stations are required to estimate a basin average rainfall with high accuracy.

(b) Appropriate operation and maintenance of the rainfall stations in the mountain watersheds cannot be expected due to the difficult access.

(c) Flood traveling time in the mountain watersheds is as short as 1.0 hour. Advantage of the flood runoff estimation by rainfall data is small.

Nine (9) water gauging stations are considered necessary for flood forecasting and warning in the basin. Three (3) automatic stream gauging stations were earlier installed during the Study at Gilbert Bridge, Cauplasan Bridge and Solsona Irrigation Dam along with staff gauges. Six (6) other water gauging stations (staff gauges) will be installed at the following sites:

(a) Irrigation dams or intakes at Cura, Labugaon, Madongan, Papa and Upper Bongo rivers, and
(b) Guisit River at Poblacion Piddig

Locations of the above gauging stations are shown in Fig. H.3.2.

(3) Data Transmission

Flood water level observed at the gauging station is transmitted to the Provincial Disaster Operation Center (PDOC) through DPWH District Engineering Office by portable telephone during flood time. The water level will be observed and transmitted in every one hour during flood time. For this purpose, a small building with a portable telephone will be constructed near each gauging station.

(4) Flood Forecasting

Flood forecasting on a qualitative basis will be performed by using the collected data of river water level along with the typhoon information forecast by PAGASA (magnitude, course, etc.). The flood forecasting will become possible by analyzing the records of river water level and typhoon in the past, and it will be improved by accumulating such records in the future.

(5) Flood Warning

Based on the above flood forecasting, flood warning will be issued from PDCC to all the MDCC in the basin by telephone or portable telephone. MDCC will promptly disseminate the flood warning to the related BDCC after receiving the flood warning from PDCC. BDCC will then take the necessary actions for flood fighting and evacuation.

CHAPTER IV FLOOD FIGHTING

4.1 Related Laws and Regulations

Flood fighting is one of the activities embodied in Presidential Decree No. 1566, dated June 11,1978. This decree calls for "Strengthening the Philippine Disaster Control Capability and Establishing the National Program on Community Disaster Preparedness." The objective is to save lives, prevent needless suffering, protect property, and minimize damages during disaster and calamities such as the occurrence of earthquakes, floods, volcanic eruptions, tidal waves, conflagrations, and others. A follow-up to this law is the "Calamities and Disaster Preparedness Plan," issued by the National Disaster Coordinating Council (NDCC), dated August 24, 1988.

4.2 Responsible Agencies

(1) Organization

At the national level, the National Disaster Coordinating Council acts as the top coordinator of all disaster management efforts, as the highest policy making body, and as the highest allocator of resources in the country to support the efforts of the lower level councils in the system.

By Decree, the NDCC is headed by a Chairman in the person of the Secretary of National Defense. Its composition includes other department secretaries, the Director General of the Philippine National Red Cross, the Chief of Staff of the Armed Forces of the Philippines, and some other key officials of the Philippine government. The Civil Defense Administrator is a member and is the Executive Officer of the Council. The Office of Civil Defense (OCD) provides the Secretariat services for the NDCC.

At the regional level, the Regional Disaster Coordinating Council coordinates the activities of all national government agencies assigned to a particular administrative region. The RDCC is composed of the national government officers assigned to work at that level. The Chairman of the RDCC is assigned to the post by Presidential designation. In autonomous regions, the Chief Executive automatically becomes the Chairman of the Disaster Coordinating Council. In Metro Manila, the MM Governor automatically becomes the Chairman of the MMDCC.

At the local government level, the Chief Executive is by law, the Chairman of the respective Council. Thus, the Governor is the Chairman of the PDCC. The PDCC is composed of organic key officers paid out of provincial funds, and of national government employees assigned to work in the Province. The same is true in the case of the City Mayor who becomes the Chairman of the CDCC. At the municipal level, the Town Mayor is the Chairman of the MDCC. At the barangay level, the barangay captain is the Chairman of the BDCC.

The functional relationship between the Disaster Coordinating Councils and the Tasked Agencies of the government shall be such that the different departments and agencies extend support/assistance to the National Disaster Coordinating Council through the Office of Civil Defense. The regional offices of the departments shall provide similar support/assistance to the Regional Disaster Coordination Council.

(2) Activities

(a) General Activities

Flood Fighting is a joint effort of the national and local governments. Under the Calamities and Disaster Preparedness Plan, the NDCC shall exercise direction and control, through the OCD, over all emergency operations from the regional down to the lowest political subdivision/council. The NDCC shall coordinate the department's support/assistance activities in disaster management through this organizational arrangements.

The NDCC operates through the facilities and resources of the OCD, which has a newly constructed operations building, with modern equipment needed in disaster management-related activities such as Geobased Information System, Disaster Information System and Weather Satellite. This operating facility is named as the National Disaster Management Center (NDMC). The Disaster Operations Flow Chart at the NDMC is shown in Fig. H.4.1.

Information due to an impending flood and warning in a major river basin with or without flood forecasting and warning facilities, are directly disseminated by the PAGASA to the NDMC, which in turn relays the same to the concerned Regional, and ultimately to the Provincial and City/Municipal Disaster Coordinating Center with use of land lines, FAX and back-up system of the Government Telephone System. The respective centers shall thereafter be placed on alert or immediately mobilized, depending on the situation. Three phases of operations are involved.

(i) Phase I is the Pre-Emergency Phase. During this period, individual agencies shall undertake various activities in order to prepare their personnel, equipment and facilities, as well as the civilian populace for any emergency.

(ii) Phase II is the Emergency Phase. Upon notice of probable flooding, an emergency signal shall be sounded and the Disaster Operation Center shall immediately be activated. All task units shall immediately assume their respective roles and undertake assigned tasks.

(iii) Phase III is the Post Emergency Phase. The extent of damage caused by the flood should be assessed, to have a basis in requesting assistance/fund from appropriate government agencies.

(b) Activities in Laoag River Basin in the Past

Flood fighting in the Laoag River Basin is one of the activities covered under the Calamities and Disaster Preparedness Plan of the province of Ilocos Norte. The Provincial Disaster Coordinating Council (PDCC) has established an operating facility known as the Provincial Disaster Operation Center (PDOC) situated at the provincial capitol building in Laoag City.

The PDCC is headed by the Governor, who is the Chairman, and is assisted by the Philippine National Police Provincial Director as Vice-Chairman and Action Officer, and all organic provincial officials as well as national officials assigned to the province as members. The Organization Chart of the PDCC is shown on Fig. H.4.2. Each of the municipalities in the province of Ilocos Norte and the City of Laoag has its own disaster coordinating council, headed by municipal mayors and the city mayor, respectively. When an emergency affects at least one or more municipalities and/or city, the mayors and their personnel and facilities are placed under the operational control of the Provincial Governor for the duration of the emergency. Each city/municipality in the province shall utilize all available

resources in the area of responsibility before asking assistance from higher authorities.

Transmission of warning regarding the possible occurrence of flood is normally made by the PAGASA through the Office of Civil Defense's National Disaster Management Center. The warning comes in the form of information on possible paths the typhoon will take, and rainfall and wind conditions. The PAGASA provincial representative to the PDCC of Ilocos Norte Province helps facilitate the receipt of information direct from the PAGASA Central Office.

Upon receipt of such information, the PDCC shall raise alarm through the use of a siren installed at the PDOC. A signal with one (1) long siren is an indication that the PDCC should be on alert. With two (2), the center should be activated; and three (3) long sirens is an indication that all task units of the PDCC shall immediately assume their respective roles and assigned tasks.

Communication and transmission of warning to the other municipalities and barangays are done with the use of available telephones, two-way radios and the services of radio stations.

However, no large systematic flood fighting has been performed in the past and evacuation from flood appears to be the major activity. The JICA Study Team conducted an interview survey on the performance of flood preparedness and flood fighting with all the barangay captains (115 persons) in the potential flood area. The results are summarized below. For details, Volume IV, Data Book I, DB. 1, Flood Damage and Flood Fighting System.

Activities	No. of Barangays	
	Alluvial Fan Area	Other Areas
A. Flood Preparedness before Flood		
(1) Barangay officials instruct people to evacuate or advise people to prepare for possible evacuation	5	32
(2) People construct temporary riverbank protection/other works under control of barangay captain	36	8
(3) DPWH constructs spur dikes, revetment and other works	4	3
(4) People transfer furniture/commodities/livestock to higher grounds	2	-
(5) No Activity	9	14
B. Flood Fighting during Flood		
(1) People evacuate to higher grounds under control of barangay captain	20	37
(2) People transfer furniture to higher grounds under control of barangay captain	-	2
(3) People construct emergency riverbank protection under control of barangay captain	7	-
(4) No activity	28	21

A considerable number of barangays construct riverbank protection or other works before flood season to cope with coming floods and construct emergency riverbank protection during floods. Such structural flood preparedness and fighting activities are mostly performed in the alluvial fan areas while evacuation

is the major flood activity in other areas. However, these structural works are all small due to lack of technology, equipment and financial sources.

Location of the barangays which performed structural flood preparedness and fighting activities in the alluvial fan area is shown in Fig. H.4.3.

Barangay people usually cope with flood disasters under the leadership of the barangay captain. However, their activities are not always systematic.

Flood fighting in the Basin will be further promoted by a more technical and systematic flood fighting in the barangay level and by establishing a financial support system.

Strengthening works on bridges and existing flood control facilities like revetments and dikes are undertaken whenever feasible during floods by the DPWH through its District Offices, and the Provincial and City Engineers Offices. Construction and rehabilitation/restoration works on critical stretches along the river system are also undertaken prior to the onset of the rainy season, if funds are available.

Construction equipment and other available land vehicles from the government and private sectors are mobilized in times of emergency. In extreme cases, the use of the military maybe resorted to.

4.3 Recommendations

(1) General

The Laoag River Basin is very vulnerable to flooding and once a big flood occurs, a wide area may be flooded.

However, no flood fighting has been performed except small scale flood fighting in some few barangays and evacuation appears to be the major activity during flood. This is considered attributable to the fact that no large scale flood control structures were provided in the basin.

The necessity of flood fighting has much increased in the alluvial fan areas since the temporary dikes were constructed by NIA in 1993. The dikes are subject to breaching by floods because of their temporary and unstable structure.

The flood fighting and evacuation system for the basin has been institutionally established based on the Calamities and Disaster Preparedness Plan of Ilocos Norte Province. However, no detailed operation manual has been prepared. The guidelines for preparation of the operation manual are described in the following sections.

(2) Flood Fighting Team

Floods of the Laoag River cause a rapid rising of river water. The flood rising time between half of the flood peak and the flood peak at a large flood time such as the design flood is roughly estimated to be 5-6 hours, as shown below.

River	Location	Half of Design Discharge (m^3/s) (2-3 year freq.)	Design Discharge (m^3/s) (25 year freq.)	Time (hr)
Cura	Irrigation Intake	430	850	5
Labugaon	Irrigation Dam	630	1,260	5
Solsona	Irrigation Dam	520	1,030	5
Madongan	Irrigation Dam	990	1,970	5
Papa	Irrigation Dam	350	690	7
Bongo	Irrigation Dam	380	750	6
Guisit	Poblacion Piddig	700	1,390	5
Bongo	Cauplasan Bridge.	3,250	6,500	6
Laoag	Gilbert Bridge	5,450	10,900	6

On the other hand, access to the riverbanks is difficult, especially in the alluvial fan areas. As mentioned in Appendix A, Chapter 8, the existing road conditions in the alluvial fan are bad. There are very few roads leading to the rivers and even these are cut easily by local floods during flood season.

Once a river dike is breached, many barangays will be flooded and theoretically, the flood fighting activities should be borne by all the beneficiary barangays. However, the barangays located near the rivers will be responsible for the flood fighting, in principle, because the other barangays far from the rivers cannot timely participate in the flood fighting due to difficulty of access to the rivers.

The responsible barangays will organize the respective flood fighting teams and prepare the necessary materials and equipment. The flood fighting team will work under the control of BDCC.

The city or municipality will bear the flood fighting costs since the flood fighting will produce beneficial effects on a wide area covering many barangays. Provincial governments will extend necessary financial support to the city or municipality.

(3) Objective Facilities of Flood Fighting

The existing major river facilities to be protected by flood fighting in the basin are river dikes and bank protection works. Their total length is estimated at 51 km. The length of the objective facilities will increase to 109 km after completion of the proposed master plan. The location and length of the objective flood fighting facilities are summarized below.

River	Related Municipality	Existing Length	Future Length
Laoag	Laoag City	3.2 km	19.2 km
	San Nicolas	0.1 km	3.1 km
	Sarrat	0.7 km	3.3 km
	Dingras	0.1 km	8.5 km
Sarrat	Sarrat	0.6 km	0.6 km
Apagang	Piddig	0.3 km	0.3 km
Guisit	Piddig	0.3 km	0.3 km
Cura/Labugaon	Solsona/Dingras	1.0 km	22.9 km
Solsona	Solsona/Dingras	19.6 km	25.2 km
Madongan	Dingras/Marcos	13.0 km	13.0 km
Papa	Banna/Nueva Era	12.2 km	12.2 km
Total		51.1 km	108.6 km

(4) Priority Watching Site

The above-mentioned dikes and bank protection works will be continuously watched during flood to achieve a successful flood fighting. The priority watching sites at present are given below.

(a) Fan apexes of Solsona, Madongan and Papa rivers:

The river sections of 2-3 km distance downward from the respective irrigation dams are subject to severe sediment deposition, resulting in river course shifting and dike breaching. Watching these river sections is considered the most important since the dike breaching in these sections will cause an extensive flooding on the alluvial fan.

(b) Fan apexes of Cura/Labugaon River:

The main stream of the Labugaon River joins the Cura River at its fan apex. However, it tends to branch away, cutting off a new channel through the downstream villages and farmlands. This branching will be carefully watched during flood time.

(c) River section where river stream converges:

The stream convergence sites in Solsona and Laoag rivers are comparatively well fixed. Such sites will be carefully watched during flood time. However, the convergence sites in the Madongan and Papa rivers change every year. Hence, the convergence sites will be confirmed before flood season. For the existing river stream convergence sites, see Appendix E, Chapter I.

(d) River section where irrigation intake is provided, bridge crosses or tributary joins:

According to the experiences in the past, these river sections are subject to bank erosion and dike breaching. Especially, 12 sites of the existing small irrigation intake in the Solsona, Madongan and Papa rivers will be carefully watched to prevent breaching of the temporary dikes.

(5) Alert Water Level

An alert water level will be designated beforehand to timely commence flood fighting activities. The alert water level will be given at the principal location of each river as shown below.

(a) Cura, Labugaon, Solsona, Madongan and Papa river: Irrigation intake or dam sites

(b) Upper Bongo River: Irrigation dam site

(c) Lower Bongo River: Cauplasan bridge site

(d) Guisit River: Poblacion Piddig site

(e) Laoag River: Gilbert bridge site

The alert water level will be determined, taking into consideration the required time length for flood fighting preparation, critical water level which may cause serious damages and river water rising speed.

In this study, the alert water level of the basin is tentatively proposed to be 2-3 year probable flood water level (in terms of flood discharge, it is equivalent to about 50% of the design flood discharge).

(6) Flood Evacuation

Flood evacuation will be performed under the control of BDCC in principle since very

quick communication and action are necessary. It is considered that there is no sufficient time to follow the recommendation or instruction of MDCC, judging from the flood water rising speed of the rivers.

The evacuation will be commenced based on the flood warning issued from PDCC through MDCC and flood information transmitted from the flood fighting team in the field.

At least, one (1) shelter will be located on a high and easily accessible place in every related barangay. The location will be determined, based on the experiences in the past floods, and referring to the flood hazard map and flood topographic map drawn by this study.

CHAPTER V RIVER LAND MANAGEMENT

5.1 Related Laws and Regulations

Several laws and regulations have been promulgated and are still in effect in connection with river land management. These are:

(1) LOI No. 19, dated October 2, 1972, directing among others the Secretary of Public Works and Communications, now the Secretary of Public Works and Highways, in the interest of public health, safety and peace and order, to remove all illegal construction, including buildings on and along esteros and riverbanks, and to relocate, assist in the relocation and determine sites for squatters and other persons to be displaced.

(2) PD 296, dated September 18, 1973, directing all persons, natural and juridical, to renounce possession and move out of portions of rivers, creeks, esteros, drainage channels and other similar waterways encroached upon and prescribing penalty for violation thereof.

(3) PD 772, dated August 20, 1975, is a follow-up of LOI No. 19, at the same time prescribing penalty for squatting and other similar acts.

(4) Presidential Decree No. 1067, known as the Water Code of the Philippines of 1976. Article 5 of this Code states among others, that rivers and their natural beds belong to the State. Article 51 of the Code also states, "The banks of rivers and streams and the shores of the sea and lakes throughout their entire length and within a zone of three (3) meters in urban areas, twenty (20) meters in agricultural areas and forty (40) meters in forest areas, along their margins, are subject to easement of public use in the interest of recreation, navigation, floatage, fishing, and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, floatage, fishing or salvage or to build structures of any kind." Article 38 requires that authority for the construction of dams, bridges and other structures across or that will interfere with the flow of navigable or floatable waterways shall first be secured from the Department of Public Works and Highways.

5.2 Responsible Agencies

While the construction of structures within the river easement is prohibited under the Water Code, illegally constructed buildings or structures in violation of any law or ordinance may now be ordered removed by the Municipal Mayor being the Chief Executive of the municipal government, as stated in Subsection (3) VI of Section 444 of the Local Government Code, and the City Mayor being the Chief Executive of the City Government, as stated in Subsection (3) VI of Section 455 of the same code. The contents of both subsections are the same, which require owners of illegally constructed houses, buildings or other structures to obtain the necessary permit, subject to such fines and penalties as may be imposed by law or ordinance or to make necessary changes in the construction of the same when said construction violates any law or ordinance, or to order the demolition or removal of said house, building or structure within the period prescribed by law or ordinance.

Removal of improvements, particularly those owned by squatters takes time, as the government has to comply with the provision of Republic Act No. 7279, otherwise known as the Urban Development and Housing Act of 1992, approved on March 28, 1992. Under Section 2 of this Act, it is the policy of the State to undertake, in cooperation with the private sector, a comprehensive and continuing Urban and Housing Program which shall among others:

(1) Uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available to them decent housing at affordable cost, basic services and employment opportunities;

(2) Equitable utilization of residential lands in urban an urbanized areas with particular attention to the needs and requirements of the underprivileged and homeless citizens and not merely on the basis of market forces;

(3) Access to land and housing by the underprivileged and homeless citizens; and

(4) Reduction in urban dysfunction's, particularly those that adversely affected public health, safety and ecology, etc.

Section 28 of RA. No. 7279 states that eviction or demolition as a practice shall be discouraged. Eviction or demolition, however, may be allowed, when persons or entities occupy danger areas such as esteros, railroad tracks, garbage dumps, riverbanks, shorelines, waterways and other public places such as sidewalks, roads, parks and playgrounds. Section 29 also of this Act, requires that the local government unit, in coordination with the National Housing Authority, shall provide relocation or resettlement sites with basic services and facilities and access in employment and livelihood opportunities sufficient to meet the basic needs of the affected families. This provision of the Act has considerably delayed the relocation and resettlement of affected persons, in view of the difficulties encountered by the government in acquiring and developing the needed sites due to budgetary constraints.

CHAPTER VI RIVER NATURAL RESOURCES MANAGEMENT (WATER AND GRAVEL)

6.1 Related Laws and Regulations

The appropriation, utilization, exploitation, development, conservation and protection of water resources is governed again by the Water Code. One of the underlying principles pursuant to Article 3 of this Code, is that, all waters belong to the State. Waters, as used in this Code, refers to water under the ground, water above the ground, water in the atmosphere and waters of the sea within the territorial jurisdiction of the Philippines. Waters may be appropriated and used in accordance with Article 9 of this Code. Appropriation of waters is the acquisition of rights over the use of water or taking or diverting of waters from natural source in the manner and purpose allowed by law.

The conservation, extraction and utilization of mineral resources (sand and gravel) is under the jurisdiction of the Department of Environment and National Resources (DENR), by virtue of Executive Order No. 192 dated June 10, 1987. The Mines and Geo-Sciences Bureau created under Section 15 of the said order as one of the staff bureaus of the DENR is tasked, among others, to advise the Secretary on matters pertaining to geology and mineral resources, exploration, development and conservation.

In the extraction/utilization of sand and gravel resources, the provisions of Chapter XII, Quarry Operations, of the Implementing Rules and Regulations (IRR) of RA. No. 7942, known as the Mining Law of 1995 is followed.

6.2 Responsible Agencies

(1) Organization

The National Water Resources Board, is the government agency tasked with the administration and enforcement of the provisions of the Water Code. The Board pursuant to Section 1 of the Implementing Rules and Regulations of the Water Code, has delegated the granting of permit/authority required under the provisions of PD 1067 to other agencies in accordance with the nature or activities listed below.

(a) Excavation for the emission of a hot spring - Department of Energy

(b) Cloud seeding to induce rainfall - PAGASA

(c) Recharging of ground water supplies - Environmental Management Bureau, DENR.

Whenever necessary the Board may exercise any of the above delegated authorities.

Applications for quarry or sand and gravel permit shall be filed with the Provincial/City Mining Regulation Board concerned or to the DENR Regional Office concerned in accordance with the IRR of RA No. 7942.

After the application for a quarry or commercial/industrial sand and gravel permit has been processed and evaluated and the requirements therefore fully complied with, the Regional Director or Provincial Governor/City Mayor concerned shall issue the quarry or commercial/industrial sand and gravel permit.

The city referred to in this IRR of RA No. 7942, refers to an independent component city as classified under the Local Government Code.

(2) Activities

The National Water Resources Board is continuously processing applications for water permits for agricultural, municipal, fisheries, recreational, industrial, power, and other purposes. Application in the prescribed form for a permit to appropriate water, shall be filed with the Office of the Public Works District Engineer, the NIA Provincial Irrigation Engineer, the NPC Regional Manager or the LWUA Water District General Manager, in the area where the point of diversion is situated. Upon receipt of an application for a water permit, the office concerned shall process the same for compliance with the requirements prescribed in the Code, after which the same is forwarded to the National Water Resources Board for appropriate action.

On the tax on sand, gravel and other quarry resources, the province may in accordance with Section 138, R.A. No. 7160, levy or collect not more than ten percent (10%) of the fair market in the locality per cubic meter of the material. The proceeds of the tax on sand, gravel and other quarry resources shall be distributed as follows:

(a) Province - Thirty percent (30%)

(b) Component City or Municipality where the sand, gravel and other quarry resources are extracted - Thirty percent (30%)

(c) Barangay where the sand and gravel and other quarry resources are extracted - Forty percent (40%)

CHAPTER VII FLOOD PLAIN MANAGEMENT(LAND USE CONTROL IN FLOOD PLAIN)

7.1 Related Laws and Regulations

To promote the best interest and the coordinated protection of the flood plain, the Secretary of Public Works and Highways may declare flood control areas and promulgate guidelines for governing flood plain management plans in these areas. In declared flood control areas, rules and regulations maybe promulgated to prohibit or control activities that may damage or cause deterioration of lakes and dikes, obstruct the flow of water, change the natural flow of river, increase flood losses or aggravate flood problems. These are provisions contained in Article 53 and 54 of the Water Code of the Philippines.

Under Section 20 of the Local Government Code of 1991, a city or municipality may, through an ordinance passed by the Sanggunian (Council) after conducting public hearing for the purpose, authorize the reclassification of agricultural lands and provide for the manner of their utilization and disposition.

The Housing and Land Regulatory Board created under Executive Order No. 90, dated December 17, 1986, is the sole regulatory body for housing and land development. This regulatory body was formerly the Human Settlements Regulatory Commission reorganized under Executive Order No. 648 dated February 7, 1981, with powers and attributes of a quasi-judicial body and was then attached to the defunct Ministry of Human Settlements.

7.2 Responsible Agencies

(1) Organization

Under Section 36 of the Implementing Rules and Regulations of the Water Code of the Philippines, the Secretary of Public Works and Highways shall form an Inter-agency Flood Plain Management Committee for each flood plain declared as flood control area, the members of which shall include, but not limited to, representatives from the following:

(a) Department of Public Works and Highways;
(b) National Power Corporation;
(c) Department of Interior and Local Governments;
(d) National Irrigation Administration; and
(e) National Water Resources Board.

The other responsible agencies are the Local Government Units, and the Housing and Land Use Regulatory Board.

(2) Activities

The functions of the Inter-agency Flood Plain Management Committee as stated in the implementing rules and regulation of the Code shall be:

(a) To establish close liaison among national and local government entities and promote the best interest and coordinated protection and management of flood plain lands for the mitigation of flood damages viewed in a larger context to include other aspects such as environmental quality and public health, safety and welfare;

(b) To provide guidelines for local governments in the formulation of regulatory ordinances regarding flood plain use and occupancy;

(c) To draft and recommend guidelines for flood plain management in a particular flood plain area in order to achieve the goals and objectives thereof; and

(d) To perform such other function as the Secretary may direct.

The local government units in conformity with existing laws, shall continue to prepare their respective land use plans enacted through zoning ordinances, which shall be the primary and dominant bases for future use of land resources. In the reclassification of agricultural lands, and the manner of utilization and disposition, the following cases are to be considered:

(a) When the land ceases to be economically feasible and sound for agricultural purposes as determined by the Department of Agriculture.

(b) Where the land shall have substantially greater economic value for residential, commercial, or industrial as determined by the sanggunian concerned.

Reclassification shall however be limited to the following percentage of total agricultural land area at the time of the passage of the ordinance:

(a) For highly urbanized and independent component cities, fifteen percent (15%);

(b) For component cities and first to third class municipalities, ten percent (10%); and

(c) For fourth to sixth class municipalities, five percent (5%).

Agricultural lands distributed to the agrarian beneficiaries pursuant to RA No. 6657, otherwise known as "The Comprehensive Agrarian Reform Law of 1988" shall not be affected by said classification and the conversion of such lands into other purposes shall be governed by Section 65 of said Act.

As mandated by Executive Order No. 648, the Housing and Land Use Regulatory Board shall, among others, promulgate zoning and other land use control and standards and guidelines which shall govern the land use plans and zoning ordinances of local government; the zoning components of civil works and infrastructure projects of the national, regional and local governments; subdivision or estate development projects of both public and private sectors; and urban renewal plans, programs and projects. It shall also review, evaluate and approve or disapprove comprehensive land use development plans and zoning ordinances of local governments; and zoning components of civil works and infrastructure projects of national, regional and local governments; subdivision; condominiums or estate development projects including industrial estates, of both the public and private sectors and urban renewal plans and projects. In both of the above, the land use development plans and zoning ordinances of local government units herein, subject to review, evaluation and approval shall respect the classification of public lands for forest purposes as certified by the DENR.

7.3 Recommendations

Land use in the following flood plains will be controlled to minimize flood damage.

(1) Flood Area Unprotected by Structural Measures

The total flood area by the design flood with a 25-year return period in the Laoag River Basin is estimated at 17,300 ha of which 15,260 ha or 88% will be protected by the proposed structural measures. However, the remaining 2,040 ha or 12% will remain unprotected. Such unprotected areas and the residing population are estimated as shown below.

River	Location	Unprotected Area	Residing Population
Laoag	San Felipe, Sarrat	100 ha	182
Laoag	Sto. Tomas, Sarrat	150 ha	107
Laoag	San Marcos, Sarrat	30 ha	102
Laoag	San Cristobal, Sarrat	80 ha	73
Laoag/Guisit	Guisit River / Mandaloque, Dingras	730 ha	1,058
Bongo	Lower Bongo	400 ha	480
Bongo	Upper Bongo	550 ha	1,528
Total		2,040 ha	3,530

Locations of the above unprotected flood areas are shown in Fig. H.7.1 Construction of new buildings will be restricted.

(2) Alluvial Fan Area with High Flood Risk

The fan apex areas of the Cura/Labugaon, Solsona, Madongan and Papa rivers will be protected by the proposed structural measures. However, these areas, especially 2-3 km down from the irrigation dams/intakes will still be highly exposed to flood even after the completion of the structural measures. Once a large flood exceeding the design flood occurs, the river dikes may be breached and, as a result, the fan apex areas will suffer from severe damage due to the cascading high floodwaters carrying much sediment. The inundation area and depth by a 100-year flood is estimated as shown in Fig. H.7.2. (This inundation area was drawn by modifying the numerically simulated area in Appendix C, referring to the flood topographic map show in Fig. H.7.3)

Construction of new buildings will be restricted in the following flood risk areas.

(a) Fan apex flood area in the left bank of Cura/Labugaon River
(b) Fan apex flood area in both banks of Solsona River
(c) Fan apex flood area in the left bank of Madongan River
(d) Fan apex flood area in both banks of Papa River

(3) Closed Branch River Area in Alluvial Fan

The Solsona, Madongan and Papa rivers have many old branch rivers of which entrances were temporarily closed by the urgent disaster prevention works in 1991-1993. These entrance closures will be completed by the proposed master plan. The Labugaon River joining the Cura River branched away to the left side at its fan apex during the large floods in the recent years. This branch will also be closed by the master plan.

However, these branch river areas will still be exposed to a higher flood risk compared to the other flood plains even after completion of the master plan. Once the main rivers are flooded, the flood-waters may easily flow down the former branch rivers.

Construction of new buildings within the major former branch rivers will be restricted. The left-side branches of the Cura/Labugaon River are the typical restricted areas. For locations of the existing and former branch rivers in the alluvial fans, see Fig. H7.3, flood topographic map.

REFERENCES

I CONSTRUCTION AND OPERATION/MAINTENANCE OF SABO AND FLOOD CONTROL WORKS

(1) Executive Order No. 124 dated January 30, 1987

(2) Local Government Code of 1991 or R.A. No. 7160 dated October 10, 1991

(3) DPWH Medium Term Public Investment Program (1993-1998)

(4) Annual Infrastructure Budget (Capital Outlay) Nationwide on all categories, for Flood Control Overall, for Region I and Laoag River Basin, Calendar Years 1990 to 1996. Maintenance funds are also included.

II WATERSHED MANAGEMENT (REFORESTATION)

(1) Executive Order No. 192 dated June 10, 1987.

(2) Presidential Decree No. 705 dated January 14, 1981, known as the Forestry Code of the Philippines.

(3) Executive Order No. 277 dated July 25, 1987.

(4) Organization Chart of the DENR.

(5) Extracts from the Master Plan for Forest Development, DENR, dated June 30, 1990.

(6) Extracts from the 1994 Philippine Forestry Statistics, Forest Management Bureau, DENR.

III FLOOD FORECASTING AND WARNING

(1) Presidential Decree No. 78, dated December 8, 1972

(2) Presidential Decree No. 1149, dated June 2, 1977

(3) Presidential Decree No. 128, dated January 30, 1987

(4) Flood Forecasting and Warning Systems in the Philippines.

IV FLOOD FIGHTING

(1) Presidential Decree No. 1566, dated June 11, 1978

(2) Calamities and Disaster Preparedness Plan issued by the National Disaster Coordinating Council, August 24, 1988

V RIVER LAND MANAGEMENT

(1) Presidential Decree No. 1067, dated December 31, 1976, known as the Water Code of the Philippines, and its Implementing Rules and Regulations, dated June 11, 1979.

(2) LOI No. 19, dated October 2, 1972.

(3) Presidential Decree No. 296, dated September 18, 1973.

(4) Presidential Decree No. 772, dated August 20, 1975.

(5) R.A. No. 7279, dated March 28, 1992, known as the Urban Development and Housing Act of 1992.

VI RIVER NATURAL RESOURCES MANAGEMENT (WATER AND GRAVEL)

(1) Extracted copy of Chapter XII, Quarry Operations of the Implementing Rules and Regulations of R.A. No. 7942, known as the Mining Law of 1995.

VII FLOOD PLAIN MANAGEMENT (LAND USE CONTROL IN FLOOD PLAIN)

(1) Executive Order No. 90, dated December 17, 1986, renaming the Housing and Land Use Regulatory Board from the Human Settlements Regulatory Commission.

(2) Executive Order No. 648, dated February 7, 1981, reorganizing the Human Settlements Regulatory Commission.

VIII OTHER RELATED DATA

(1) Presidential Decree No. 1594, dated June 11, 1978, prescribing policies, guidelines, rules and regulations for government infrastructure contracts, together with the Implementing Rules and Regulations as amended dated June 17, 1982.

(2) Implementing Rules and Regulations of P.D. No. 1594 as amended effective May 1, 1992.

(3) DENR Annual Reports for 1991, 1992 and 1993.

(4) A Primer on Community-Based Forest Management Project.

(5) A Primer on Illegal Logging and the Ormoc Tragedy.

(6) Extracted copies of the 1986 Forestry Laws, Rules and Regulation.

(7) Policies, memoranda and other issuances on the National Forestation Program, Volumes II, IV & VII.

(8) Organizational and Functional Charts of PAGASA.

(9) Warning Dissemination of Disaster Coordinating Centers and F.F.W.S. Dam Office with the Roles of OCD, Organization, etc.

(10) "Operation Laging Handa" of the Provincial Disaster Coordinating Council of Ilocos Norte, dated June 10, 1991.

(11) Updating the Organization of the Ilocos Norte DCC, dated June 10,1991.

(12) Extracted copy of Land Use, Volume 4 of the Town Planning Guidelines and Standards, prepared by the Standards and Rules Development Office, Housing and Land Use Regulatory Board, 1989.

(13) Newsclipping titled "Land use code gathering dust in Congress" published in the May 16, 1996 issue of the Philippine Daily Inquirer.

TABLES

Table H.1.1 Flood Control Structures in the Laoag River Basin

(Unit : Linear meter)

	Location	Conc. Bank Revetment	Gabion Type	Boulder Spur dike
1.	Laoag R.C. at Brgy. Tangid, Laoag City	240	-	1 line-25 m.
2.	Laoag R.C. at Brgy. Cavit Laoag City	523	-	-
3.	Laoag R.C. at Brgy. San Mateo, Laoag	68	-	5 lines-177 m.
4.	Laoag R.C. North Bank and West of the Gilbert Bridge (Marcos Bridge) Laoag	749	-	-
5.	Laoag R.C. North Bank and east of the Gilbert Bridge (Marcos Bridge) Laoag	735	-	2 lines-199 m.
6.	Laoag R.C. at Bryg. St. Joseph, Laoag	-	40	5 lines-124 m.
7.	Laoag R.C. at Brgy. Nalbo, Laoag City	-	-	4 lines-157 m.
8.	Laoag R.C. at Bryg. Gabu, Laoag City	892	-	7lines-195 m.
9.	Laoag R.C. at Brgy. La Paz, Laoag	-	-	-
10.	Sarrat River Control, Sarrat, I. Norte	643	-	8 lines-352 m.
11.	Apagang R.C. Piddig, I. Norte	300	-	4 lines- 60 m.
12.	Guisit R.C. at Brgy. Tonoton, Piddig	295	-	2 lines - 75 m.
13.	Tina R.C. at Brgy. Lipay, Solsona	-	-	1 line-180 m.
14.	Tina R.C. at Brgy. Sta. Ana, Solsona	-	-	1 line- 25 m.
15.	Tina R.C. at Brgy. Aguitap, Solsona	-	-	1 line-240 m.
16.	Tina R.C. at Brgy.. Bagbag, Solsona	930 m. cut-off channel and 670 m. closing dike		
17.	Tina R.C. at Brgy. San Jaun, Solsona	-	-	1 line- 99 m.
18.	Tina R.C. at Brgy. Santiago, Solsona	1,500 m. cut-off channel and 100 m. closing dike		
19.	Laoag R.C. at Sarrat Poblacion, Sarrat	610	-	-
20.	Laoag R.C. at Brgy. San Joaquin, Sarrat	45	-	-
21.	Laoag R.C. at Brgy. San Manuel, Sarrat	-	-	2 lines- 99 m.
22.	Laoag R.C. at Brgy. 6, Sarrat	-	-	2 lines- 55 m.
23.	Laoag R.C. at Brgy. Lumbad, Dingras	-	-	2 lines- 50 m.
24.	Laoag R.C. at Brgy. Foz, Dingras	-	-	1 line- 86 m.
25.	Laoag R.C. at Brgy. Guerrero, Dingras	-	-	2 Lines- 44 m.
26.	Laoag R.C. at Brgy. Medina, Dingras	-	-	9 lines-288 m.
27.	Laoag R.C. at Brgy. Parado, Dingras	-	-	4 lines-136 m.
28.	Laoag R.C. at Brgy. Valdez, Marcos	-	-	1 line- 35 m.
29.	Laoag R.C. at Brgy. Daquioag, Marcos	-	-	3 lines-120 m.
30.	Laoag R.C. at Brgy. Dancel, Dingras	115	-	14 lines-560 m.
31.	Laoag R.C. at Brgy. 10, Sarrat	-	-	1 line- 40 m.
32.	Laoag R.C. at Brgy. Nagrebcan, San Nicolas	-	-	2 lines- 65 m.
33.	Laoag R.C. at NIA Pump site, San Nicolas	80	-	-
34.	Cura R.C. at Solsona	-	-	1 line-200 m.
35.	Tina R.C. at Brgy.. Bagbag, Solsona	890 cut-off diversion channel		

Table H.1.2 1993-1998 Medium Term Public Investment Program
(In Thousand Pesos, Current Prices)
S ummary

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AGENCY/CORPORATION : D P W H

PROJECTS	1993	1994	1995	1996	1997	1998	Later Years	Total 1993-1998
1. HIGHWAYS	P 10,295,821	10,616,902	11,780,032	15,321,877	22,479,000	25,713,801	117,568,069	96,207,433
ARTERIAL ROADS	P 6,237,428	5,548,500	6,160,300	6,641,109	11,360,575	15,712,313	64,630,643	51,660,225
SECONDARY ROADS	P 2,546,058	3,225,169	3,459,520	4,697,251	5,936,425	6,141,687	41,974,577	26,006,110
URBAN ROADS/EXPRESSWAYS	P 1,512,335	1,843,233	2,160,212	3,983,517	5,182,000	3,859,801	10,962,849	18,541,098
2. FLOOD CONTROL AND DRAINAGE	P 1,493,739	1,907,000	2,606,014	2,852,858	3,542,202	5,261,000	36,937,656	17,662,813
3. WATER SUPPLY	P 702,308	659,912	576,255	114,303	458,771	561,242	1,136,061	3,072,791
4. URBAN INFRASTRUCTURE	P 602,860	519,000	424,647	327,700	450,000	520,000	296,867	2,844,207
5. VARIOUS PROJECTS*	P 191,744	148,785	187,239	264,000	323,027	151,957	0	1,266,752
GRAND-TOTAL	P 13,286,472	13,851,599	15,574,187	18,880,738	27,253,000	32,208,000	155,938,653	121,053,996

*Includes program for ports, detailed eng'g, national buildings and other local, projects.

Table H.2.1 Land Classification : 1976 - 1994
(In hectares)

Year	Total Area	Certified A & D	Forest Land								
			Total	Unclassified	Classified						
					Total	Established for res.	Established timberland	National parks GRBS/WA	Military & naval reserv'n	Civil reserv'n	Fishpond
1994	30,000,000	14,117,244	15,882,756	881,157	15,001,599	3,272,912	10,015,866	1,340,997	130,330	165,946	75,548
1993	30,000,000	14,117,244	15,882,756	881,157	15,001,599	3,272,912	10,015,866	1,340,997	130,330	165,946	75,548
1992	30,000,000	14,117,244	15,882,756	881,157	15,001,599	3,272,912	10,015,866	1,340,997	130,330	165,946	75,548
1991	30,000,000	14,117,729	15,882,271	881,157	15,001,114	3,272,912	10,015,381	1,340,997	130,330	165,946	75,548
1990	30,000,000	14,117,729	15,882,271	881,157	15,001,114	3,272,912	10,015,381	1,340,997	130,330	165,946	75,548
1989	30,000,000	14,117,729	15,882,271	881,157	15,001,114	3,272,912	10,015,402	1,340,997	130,330	165,946	75,527
1988	30,000,000	14,117,753	15,882,847	881,157	15,001,090	3,271,504	10,015,427	1,342,416	130,330	165,935	75,478
1987	30,000,000	14,108,087	15,891,913	881,157	15,010,616	1,494,844	11,801,973	1,342,919	130,330	165,935	74,618
1986	30,000,000	13,852,398	16,147,602	1,186,575	14,961,027	3,605,045	9,586,039	1,267,996	129,911	320,521	51,096
1985	30,000,000	14,659,760	15,340,240	1,319,794	14,020,446	3,472,252	8,805,144	1,264,364	129,911	306,291	42,484
1984	30,000,000	14,515,393	15,484,607	1,827,335	13,657,272	3,496,041	8,423,881	1,265,422	129,911	306,291	35,726
1983	30,000,000	14,467,592	15,532,408	5,060,139	10,472,269	3,496,041	4,959,417	1,571,403	129,911	306,291	9,206
1982	30,000,000	13,370,546	16,629,454	5,553,178	11,076,276	3,431,480	5,553,455	1,647,911	129,911	312,503	1,016
1981	30,000,000	13,327,630	16,672,370	5,846,639	10,825,731	3,256,421	5,535,869	1,591,027	129,911	312,503	-
1980	30,000,000	13,269,340	16,730,660	7,025,490	9,705,170	2,907,972	5,835,818	518,966	129,911	312,503	-
1979	30,000,000	13,093,263	16,906,737	7,578,178	9,328,559	8,630,007a/	-	316,117b/	129,911	252,524	-
1978	30,000,000	13,070,886	16,929,114	7,627,924	9,301,190	8,602,638a/	-	316,117b/	129,911	252,524	-
1977	30,000,000	12,990,866	17,009,134	7,738,919	9,270,215	8,571,688a/	-	316,092b/	129,911	252,524	-
1976	30,000,000	12,974,969	17,025,111	7,759,023	9,266,008	8,567,481a/	-	316,092b/	129,911	252,524	-

a/ Forest reserves & timberland

b/ National parks only

Sources : National Mapping and Resource Information Authority; Forest Management Bureau

Table H.2.2 Land Use Status by Region : 1994
(In hectares)

Land use/ Forest type	Philippines	R - 1 1/	R - 2 1/	R - 3	R - 4 2/	R - 5	R -6	R - 7	R - 8	R - 9 3/	R - 10	R - 11	R - 12 3/
Total	30,000,000	2,156,845	3,640,300	1,823,082	4,756,016	1,763,249	2,022,311	1,495,142	2,143,169	1,868,514	2,832,774	3,169,275	2,329,353
Forest	5,686,055	408,300	1,502,674	206,900	1,028,517	50,200	68,800	24,600	299,000	191,785	842,763	752,305	310,211
Dipterocarp	3,767,555	135,400	993,574	146,500	579,417	42,000	41,700	6,100	289,800	134,485	605,763	610,005	182,811
Old growth	804,900	48,100	368,900	19,300	113,800	9,600	800		34,600	9,500	97,100	89,200	14,000
Residual	2,962,655	87,300	624,674	127,200	465,617	32,400	40,900	6,100	255,200	124,985	508,663	520,805	168,811
Pine	231,500	177,700	51,900	1,100	800	-	-	-	-	-	-	-	-
Closed	125,800	91,700	33,600	500	-	-	-	-	-	-	-	-	-
Open	105,700	86,000	18,300	600	800	-	-	-	-	-	-	-	-
Submarginal	496,500	16,700	165,200	18,300	278,900	1,300	100	8,800	4,000	3,200	-	-	-
Mossy	1,070,000	78,400	288,200	40,900	140,000	6,300	24,000	7,200	4,600	-	216,700	136,500	127,200
Mangrove	120,500	100	3,800	100	29,400	600	3,000	2,500	600	54,100	20,300	5,800	200
Brushland	2,324,500	423,600	237,100	68,500	569,700	50,200	68,600	5,300	126,300	94,100	205,700	342,200	133,200
Other land use	21,989,455	1,324,945	1,900,526	1,547,682	3,157,799	1,662,849	1,884,911	1,465,242	1,717,869	1,582,629	1,784,311	2,074,770	1,885,912

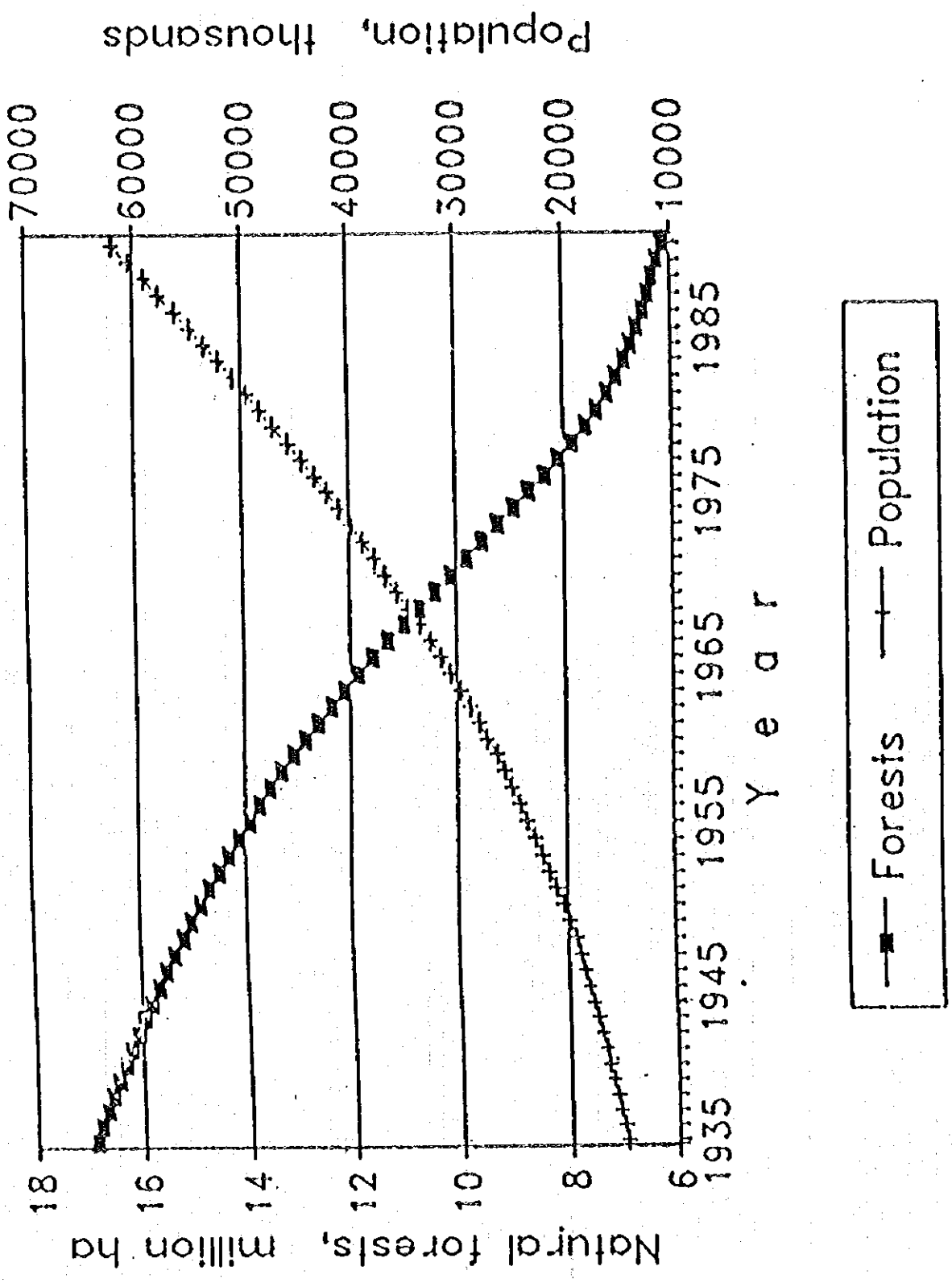
1/ Including provinces under CAR
2/ Composed of provinces under R4-A & 4-B
3/ Including provinces under ARMM

FIGURES

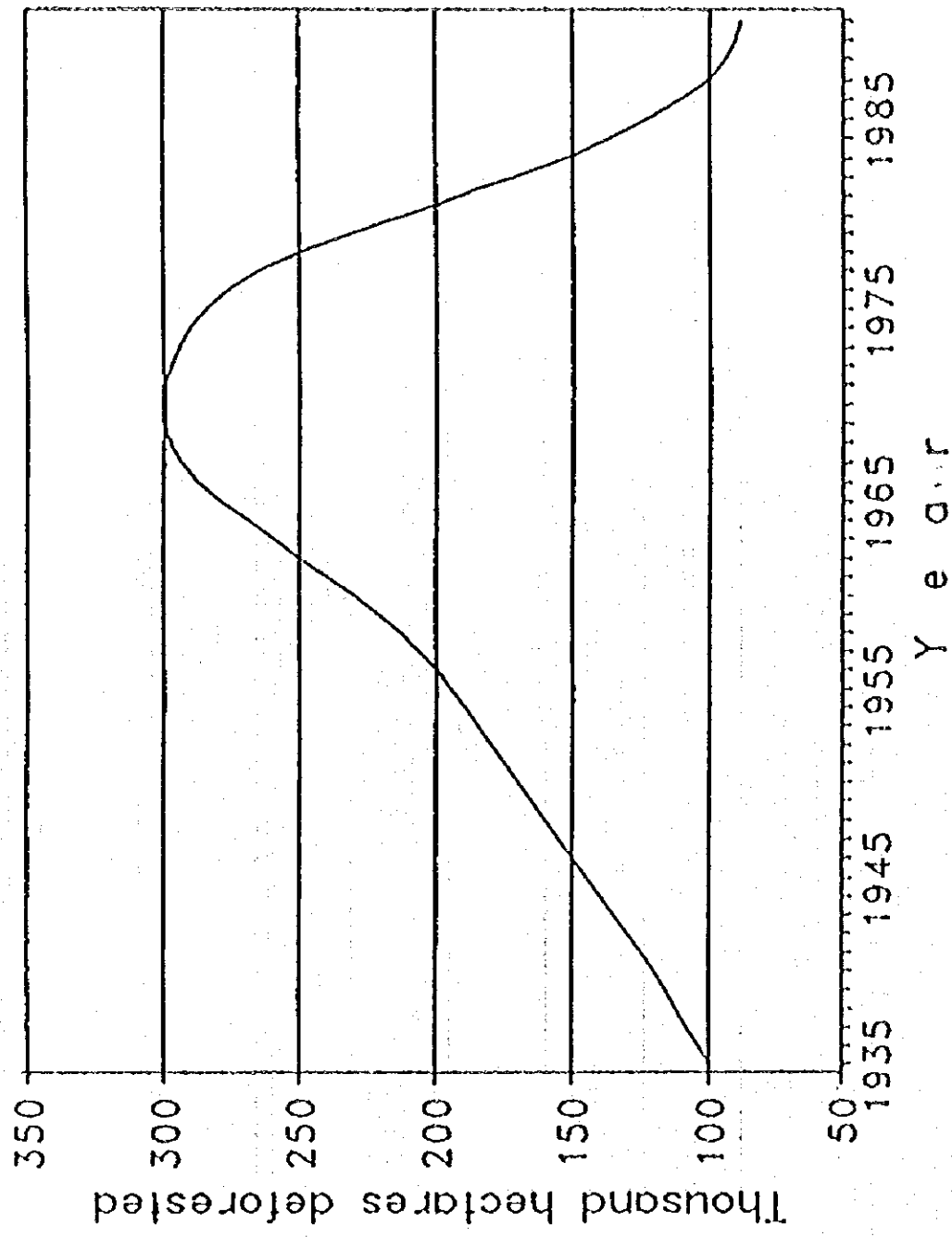
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

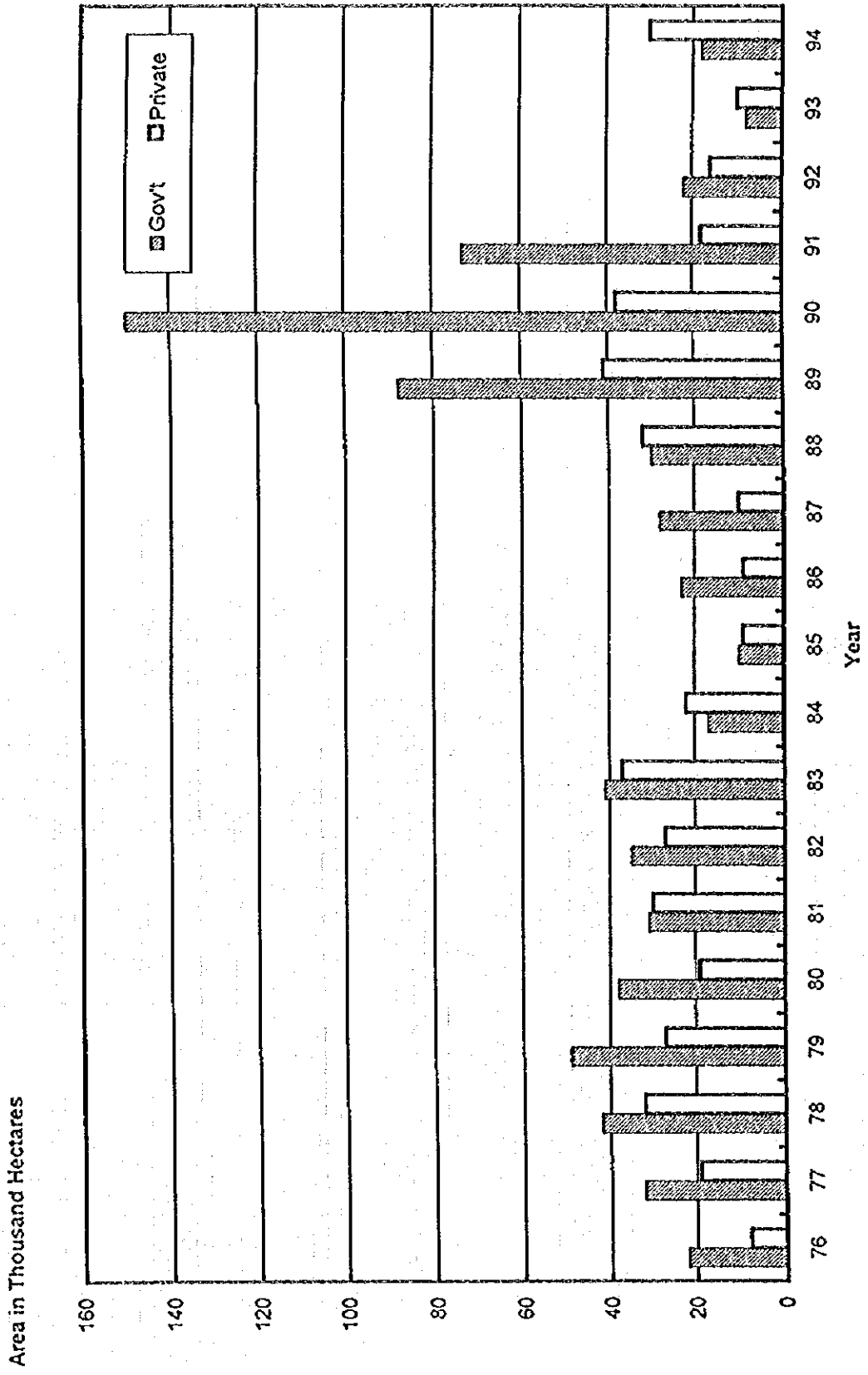
Fig. H.2.1
Organization Chart of PENRO in Ilocos Norte



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. H.2.2 Population and Deforestation, 1935-1990



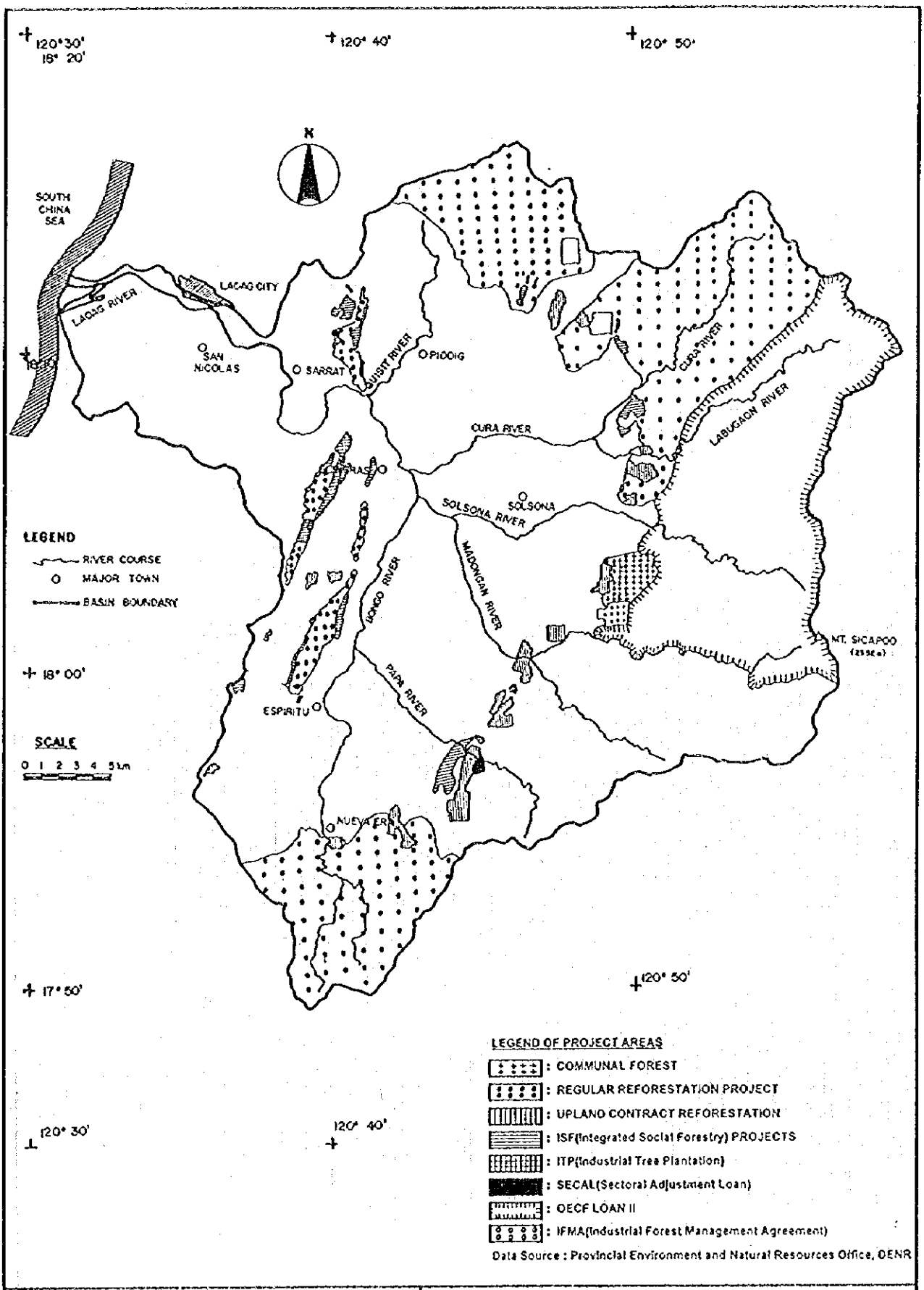
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. H.2.3 Deforestation Rate, 1935-1990



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

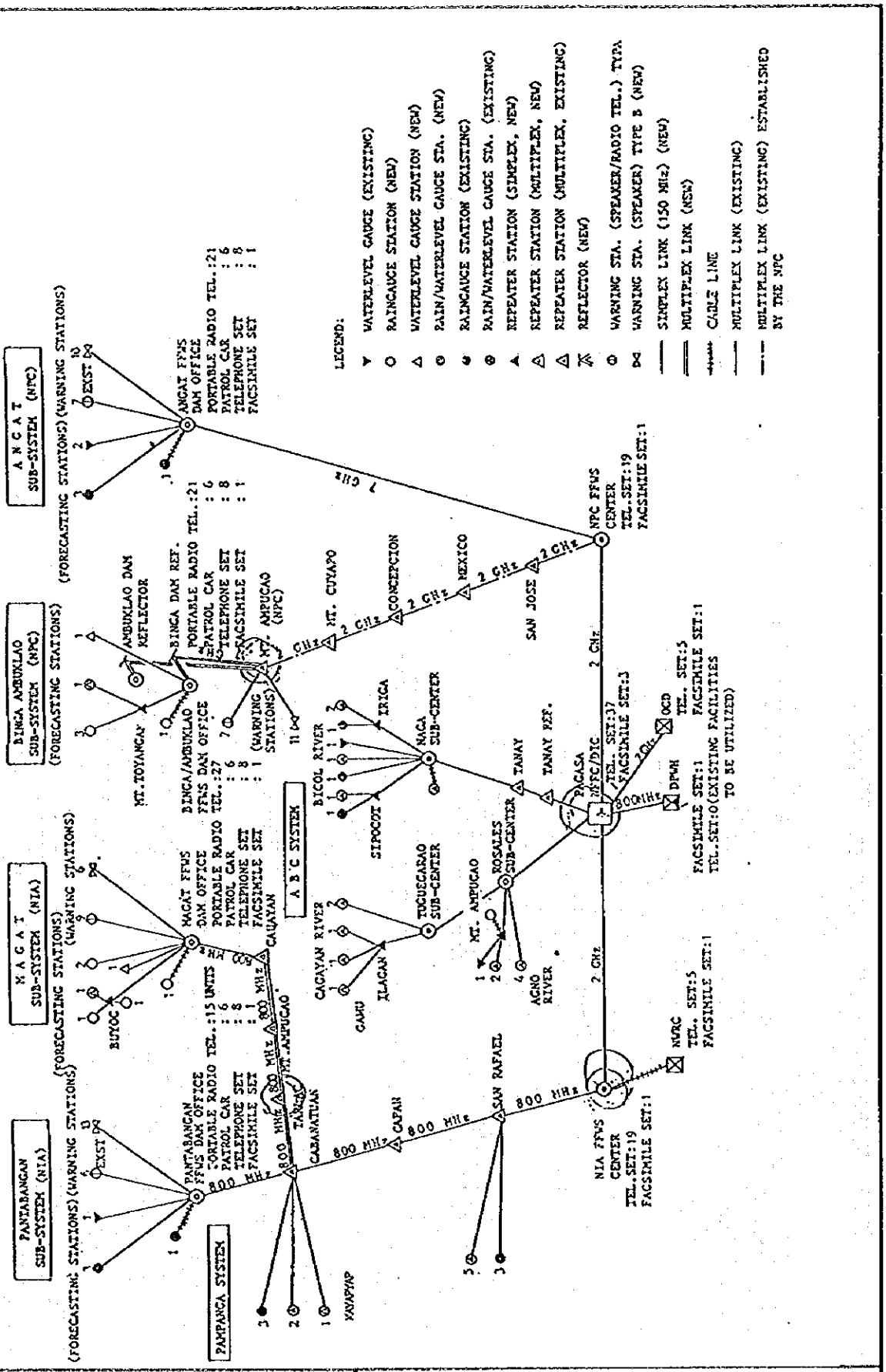
Fig. H.2.4
Area Reforested: 1976-1994



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

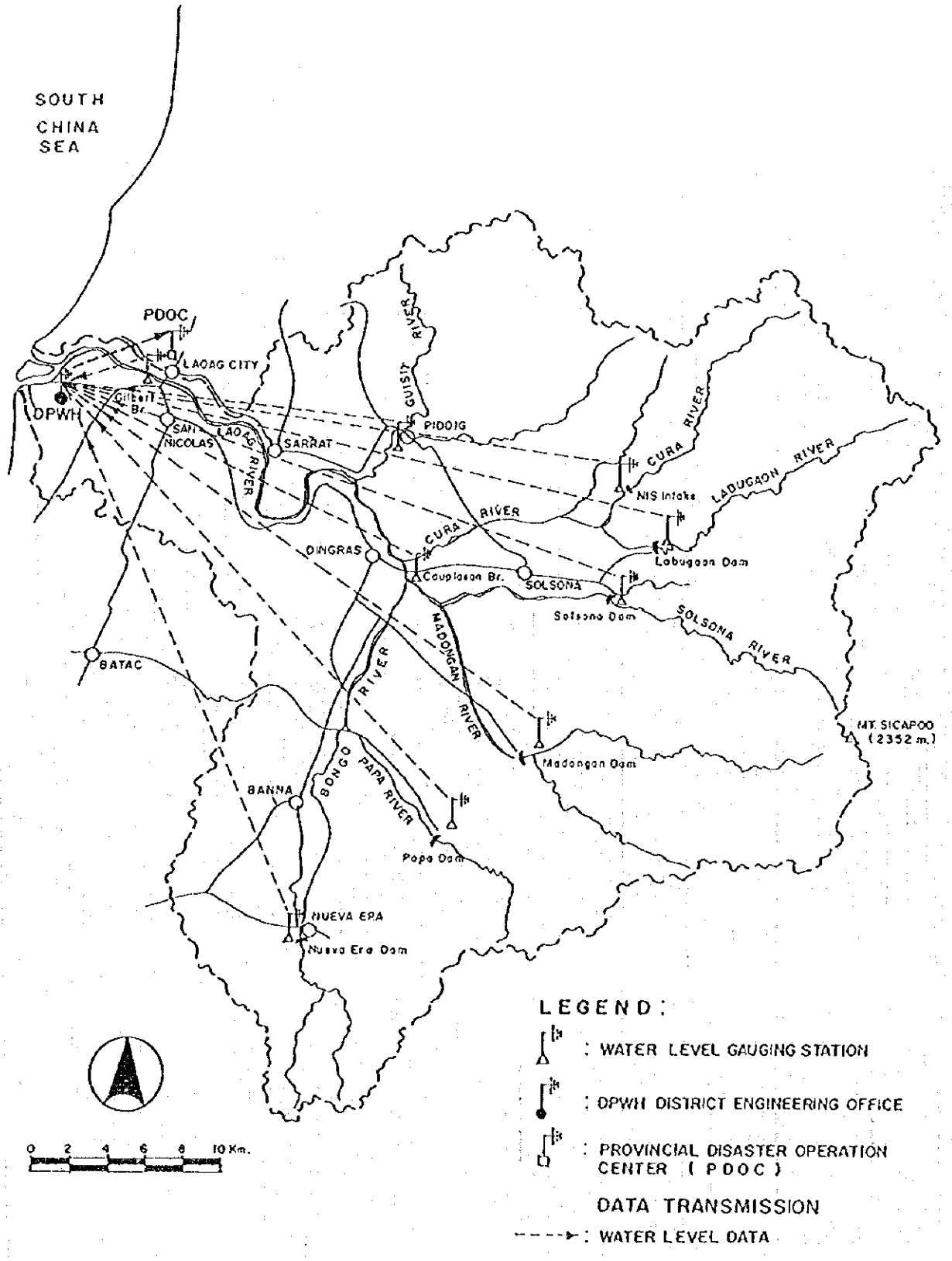
Fig. II. 2.5
Reforestation Project Area



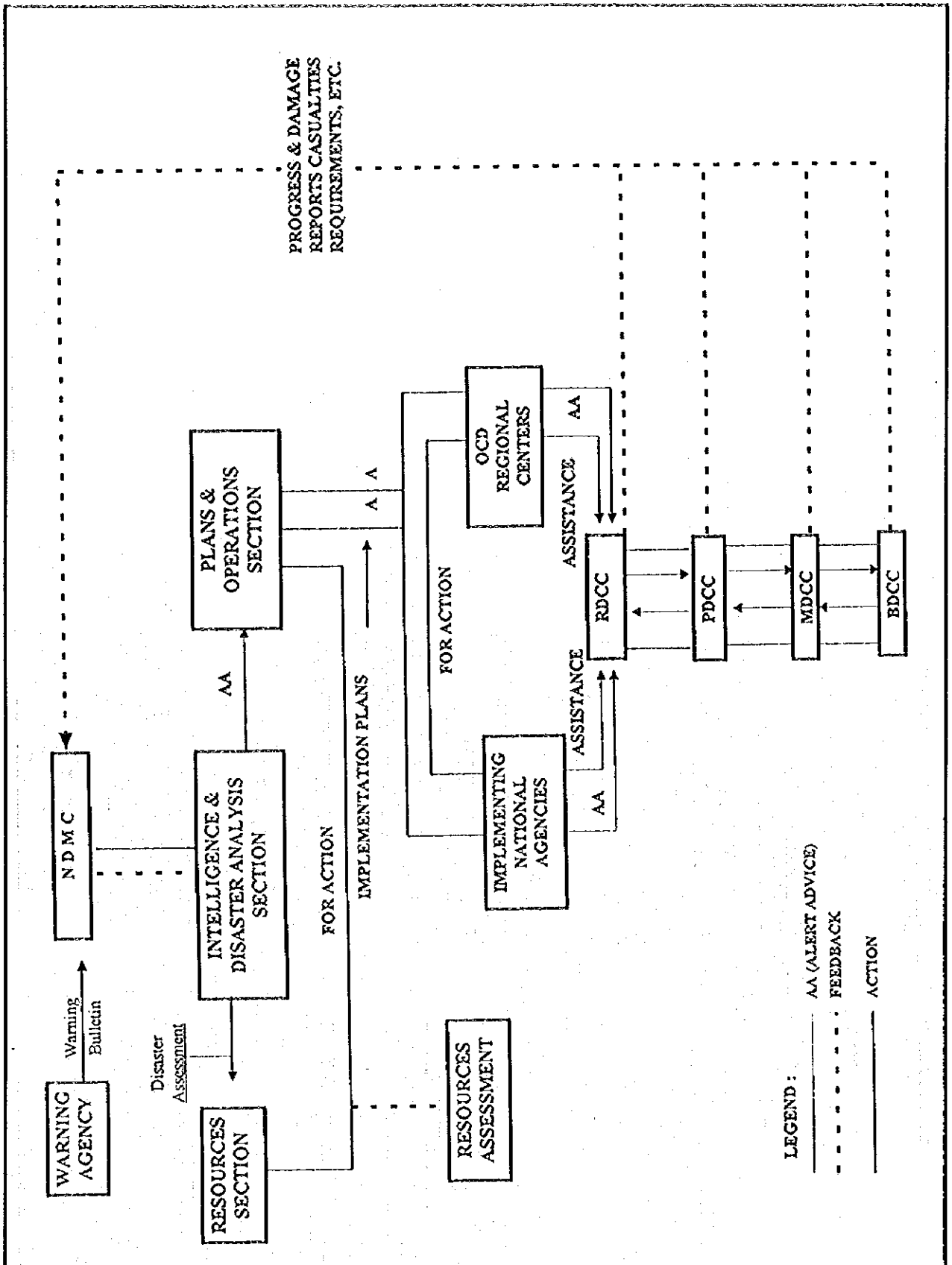
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. H.3.1
Layout of Telecommunication Network of the FFWS



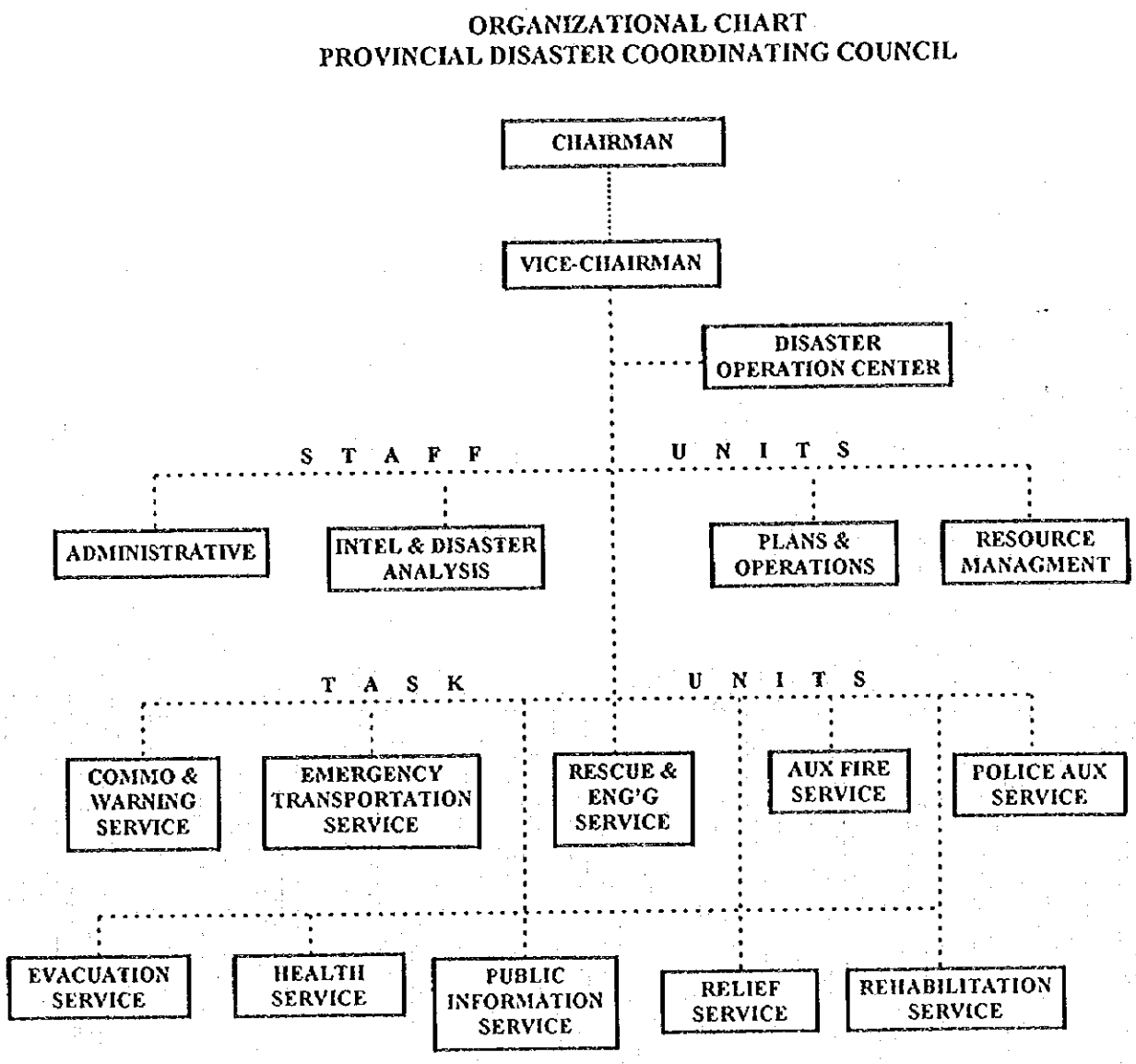
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN	Fig. II.3.2 Location of Water Guaging Stations
JAPAN INTERNATIONAL COOPERATION AGENCY	



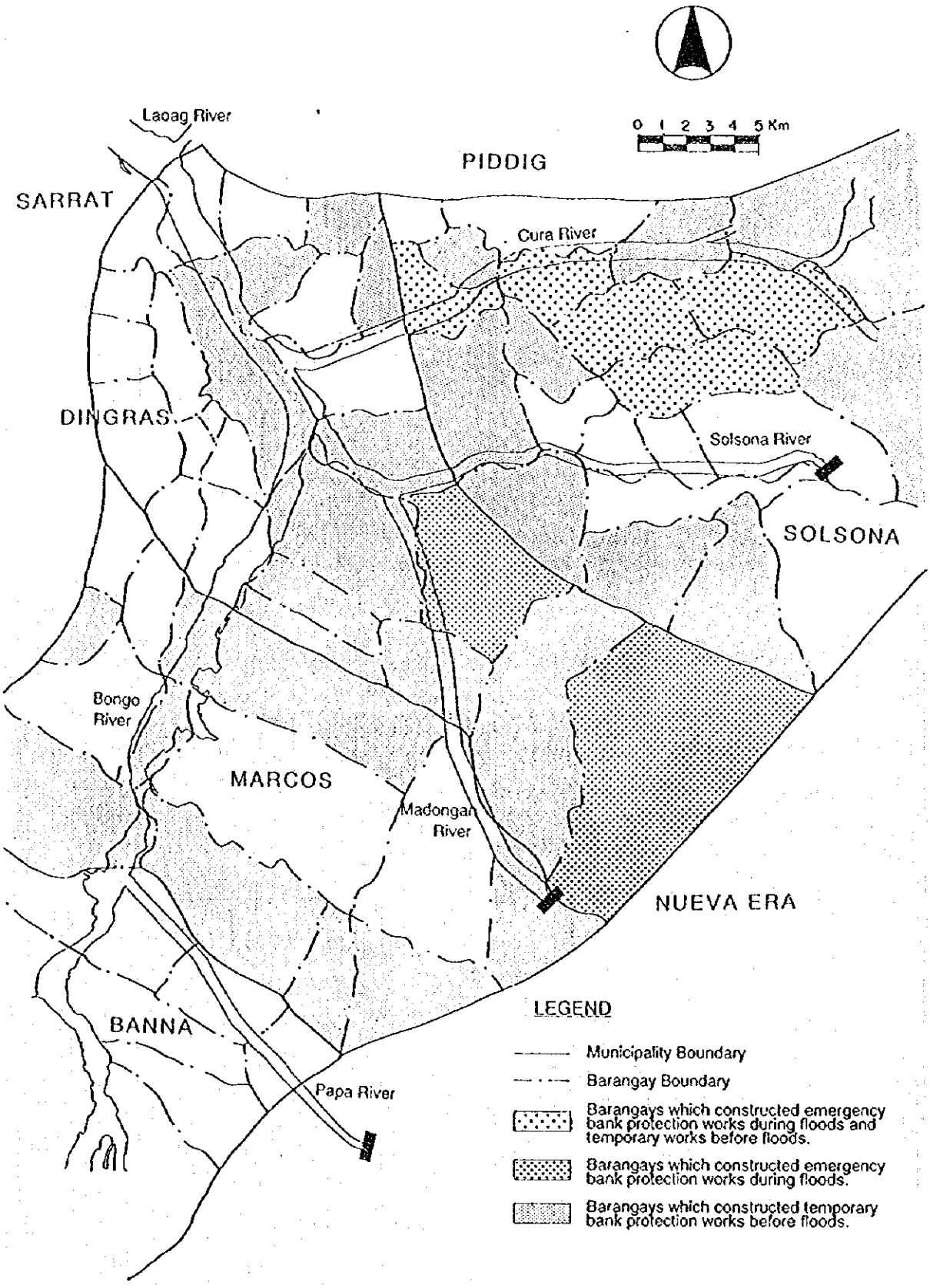
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. H.4.1
Disaster Operations Flow Chart



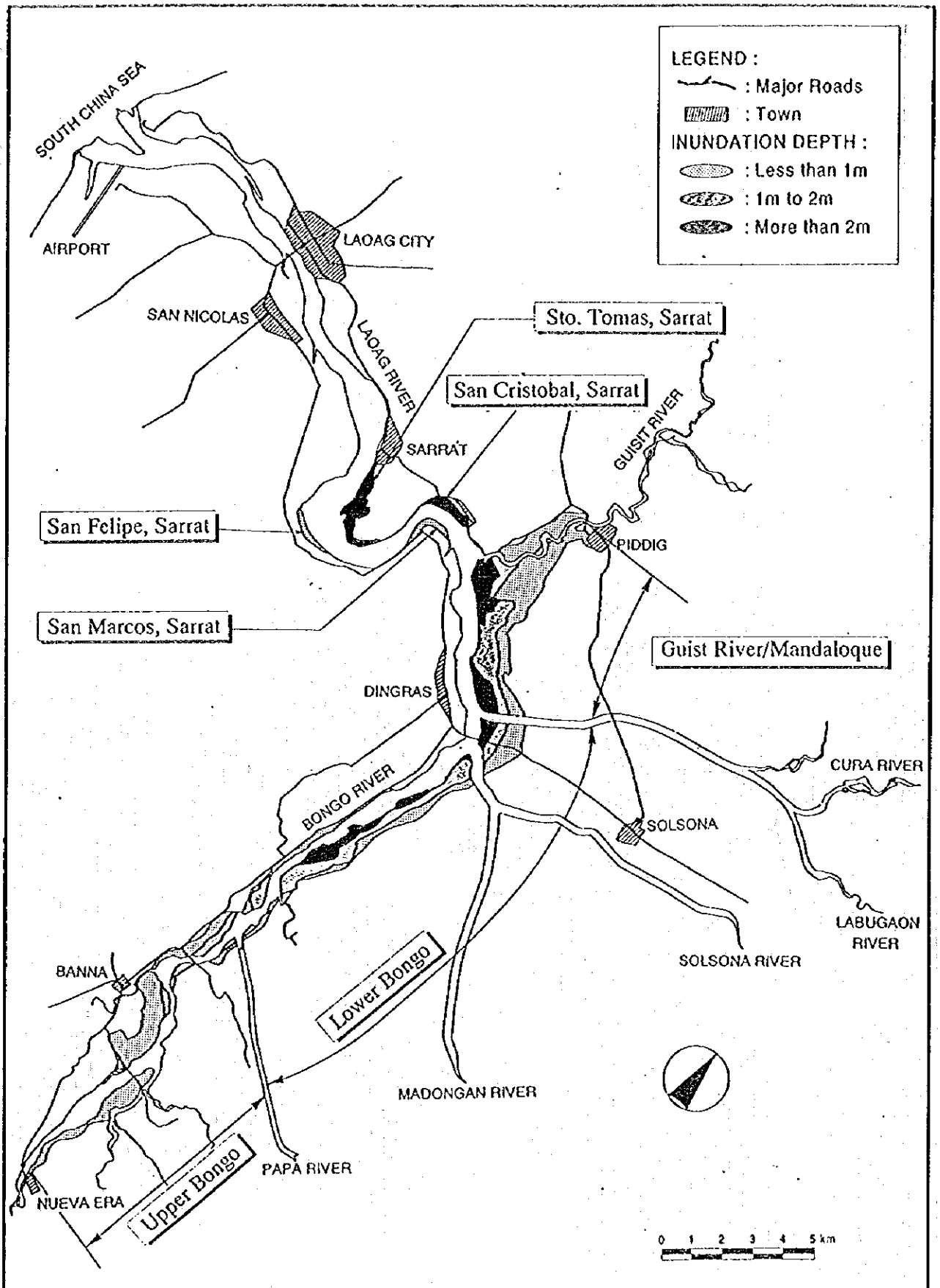
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. H.4.2 Organizational Chart of Provincial Disaster Coordinating Council



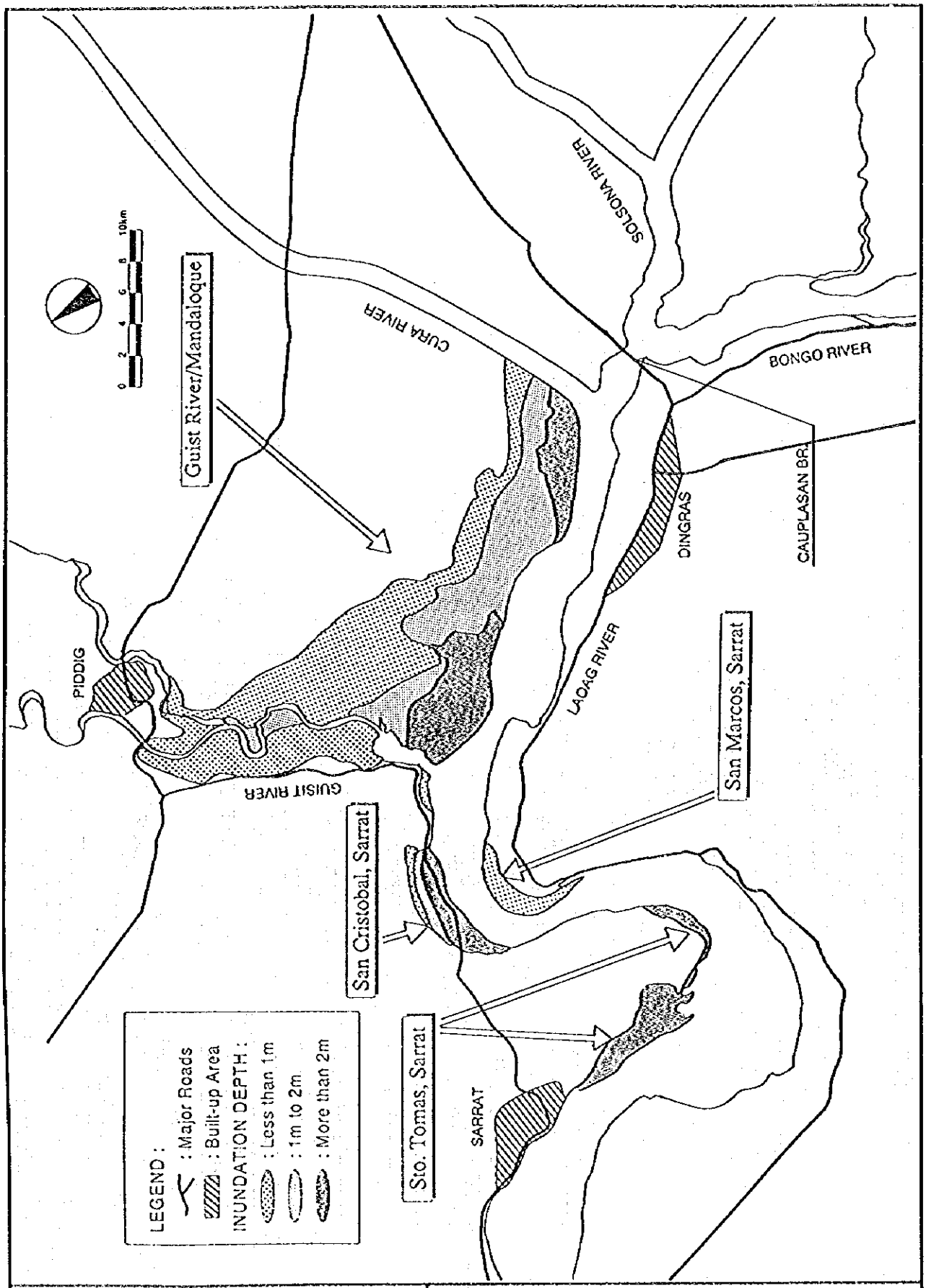
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. H.4.3
Location of Barangays which Performed Structural Flood Preparedness/Fighting in Alluvial Fan Area



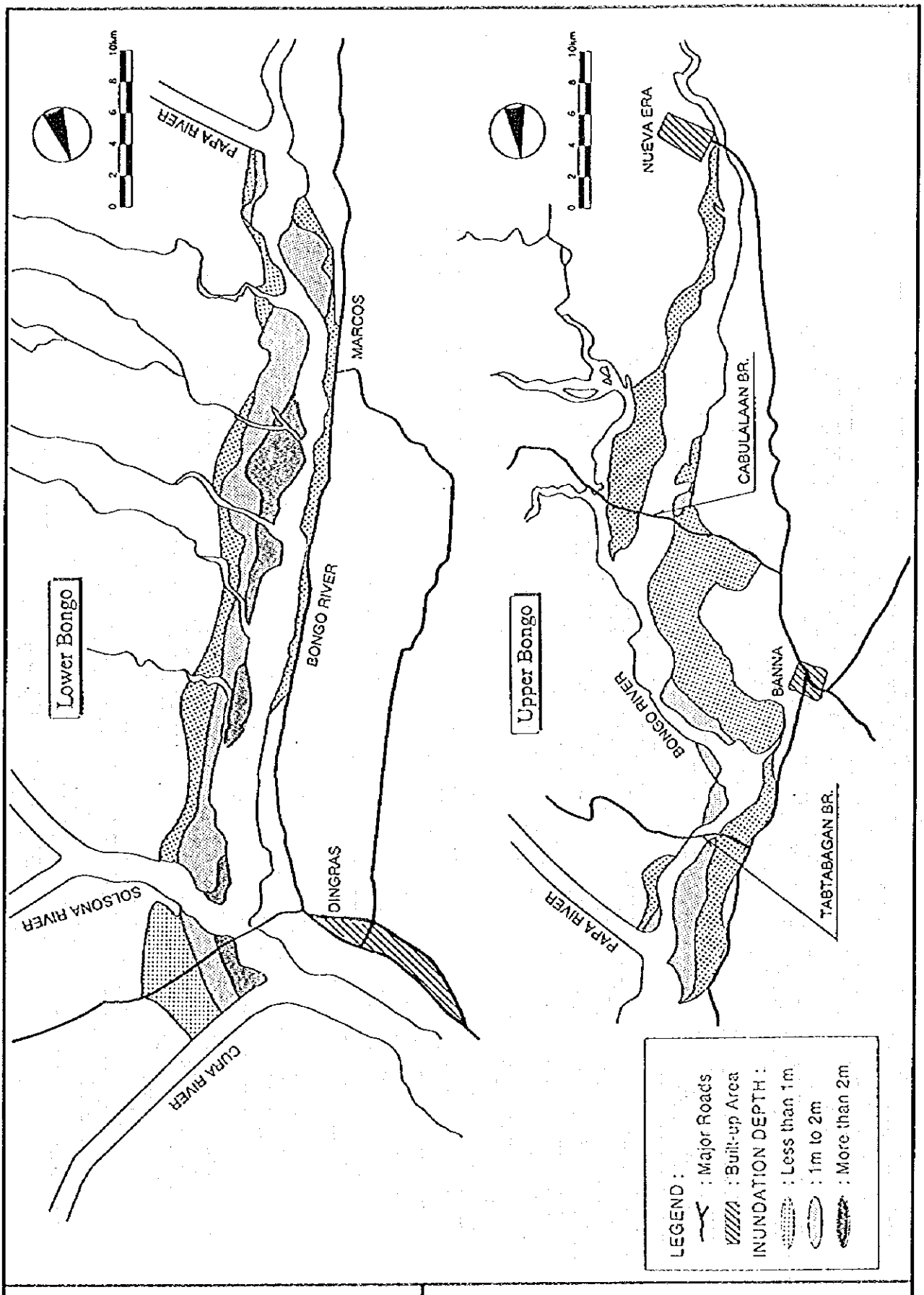
THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. H. 7.1 (1) Location of Unprotected Flood Area



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

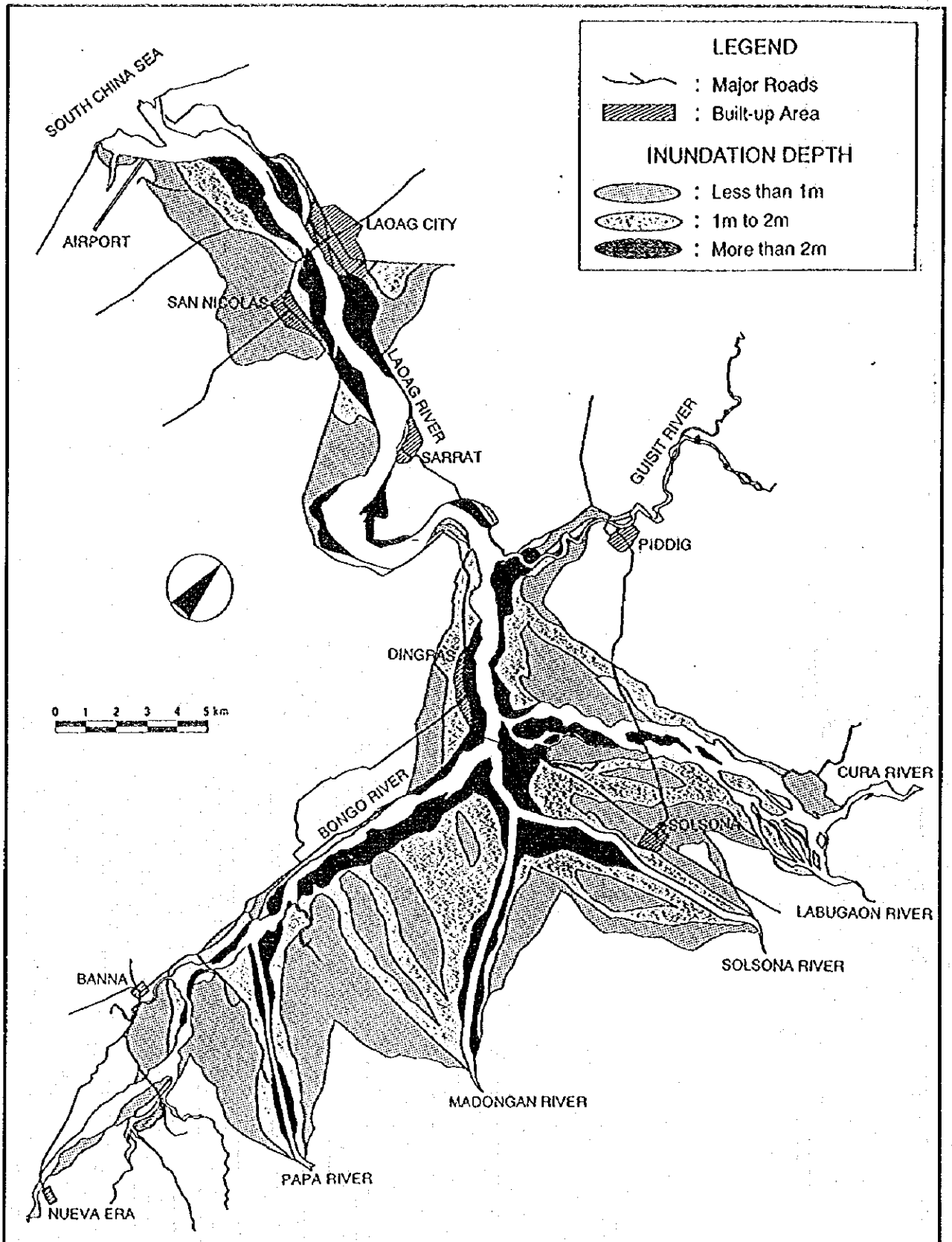
Fig. H. 7.1 (2)
Location of Unprotected Flood Area



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

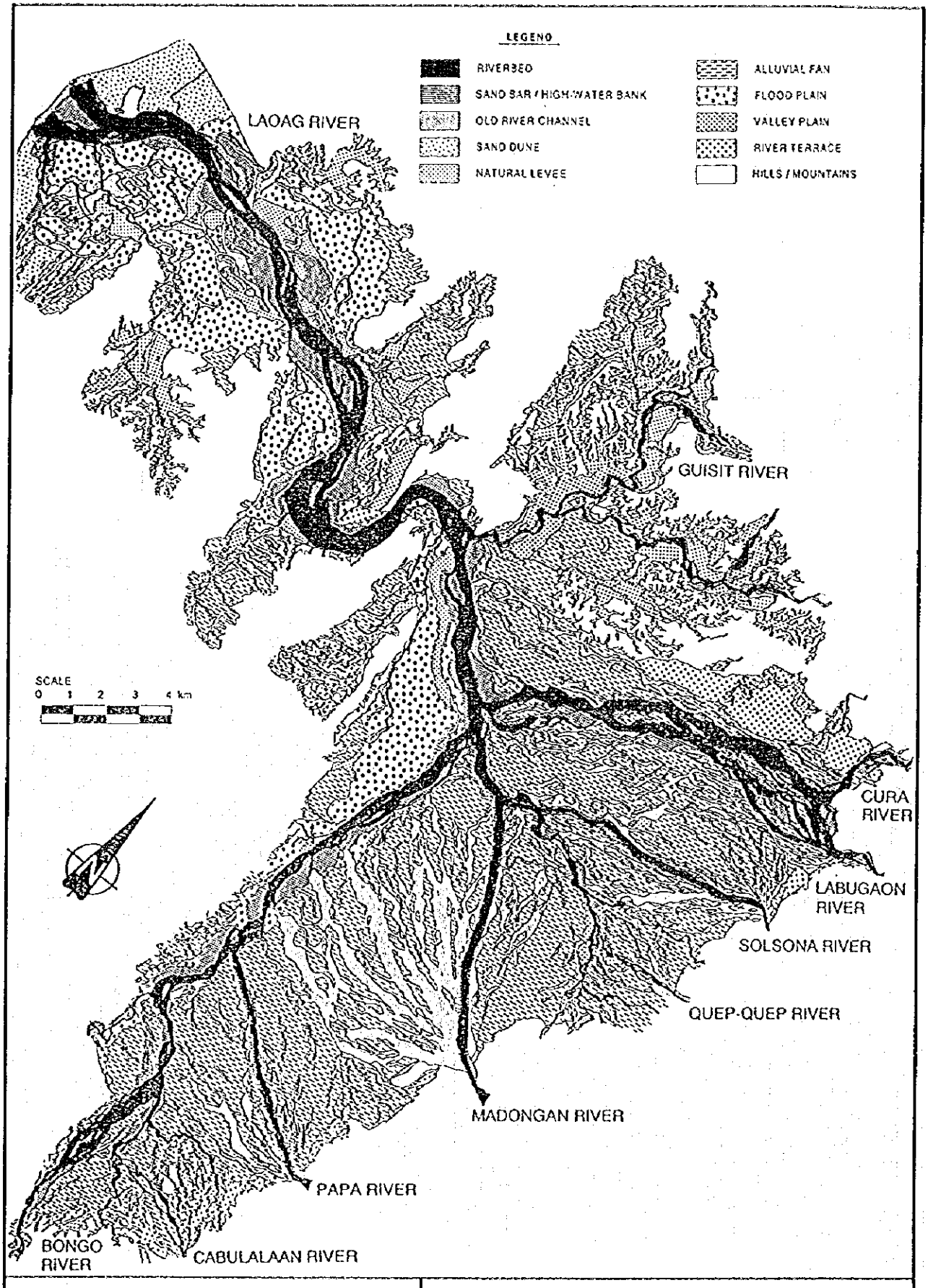
Fig. H. 7.1 (3)
Location of Unprotected Flood Area



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. H. 7.2
Inundation Area and Depth by 100 - year Flood



THE STUDY ON SABO AND FLOOD CONTROL IN THE LAOAG RIVER BASIN	Fig. H. 7.3
JAPAN INTERNATIONAL COOPERATION AGENCY	Flood Topographic Map