9.7 PROJECT IDENTIFICATION FOR LAND TRANSPORT

9.7.1 PROJECT CATEGORIZATION

Taking account the nature of projects, they could be generally categorized into the following three:

- MINIMUM: Minimum level of transport facilities and services
- BASIC: Transport facilities and services required to meet actual demand
- STRATEGIC: Transport facilities and services required to promote envisioned regional/sector development goals

Minimum level should be assured to all human settlements equally. But the definition of minimum is arguable. On the other hand, basic level would be understandable based on accurate observation of existing conditions. At last, strategic level cannot be set up by transport sector alone. It needs well coordination with regional and other sectoral development scenarios and therefore strategic projects can be proposed regardless of current situations.

The said ideas concerning project categorization is illustrated in Figure 9.7.1.

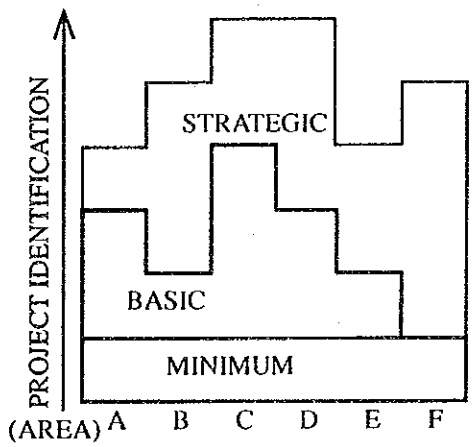


FIGURE9.7.1 CONCEPT OF PROJECT CATEGORIZATION

These conceptual categories are further defined in this study as follows:

(1) Island Minimum Projects

Island Minimum projects are designed to support existing daily activities, especially in rural area with minimum standards as follows:

- At least, each Poblacion must be connected by paved roads with 2-lane carriage way.
- To secure smooth traffic flow and inland transportation means, some east-west links must be developed with 2-lane pavement.
- Other sub-trunks and farm-to-market roads must be maintained with all-weather surface.
- Roads on remote islands such as Bantayan and Camotes must be developed, particularly between Poblacions and ports.
- Additional farm-to-market roads will be developed in order to connect with markets and barangay centers.
- Construction and maintenance of local roads which are responsible to Local Government Units should be facilitated with utilization of local people.

(2) Island Basic Projects

Island Basic projects are designed to meet the actual traffic demand which cannot be dealt with by the Island Minimum projects. For that purpose, at first, available transport assets should be improved in terms of efficiency and effectiveness. Furthermore, if necessary, capital intensive projects will be implemented.

- Improvement of public transport operations, enforcement of traffic control/management measures as well as road widening will be conducted on heavy traffic roads in urban area. Bottleneck sections should be physically solved as a matter of great urgency.
- Heavy traffic roads in rural area will widen and be well maintained to bear with the passage of many trucks and buses. At the same time, old bridges will be rehabilitated or replaced.
- To support agricultural activities, some mountainous roads will be expanded and some missing links will be opened up.
- To maximize the convenience of vehicular traffic and to overcome disadvantageous islands configuration, Roll-on/Roll-off transport system will be encouraged to ply with neighboring islands.

(3) Island Strategic Projects

Island Strategic projects are designed to materialize the development strategies which are proposed from overall regional development context or other sectors.

- Central Cebu is designated as a new RIC. The eastern side of Central Cebu where area is densely urbanized and many industries are thrived is expected to be further booming. To support propagating industry activities and to segregate industry and general urban traffic, an industrial corridor and improvement of existing roads are duly considered with industry sector.
- To mitigate serious traffic jams in Cebu CBD, development of circumferential road network should be duly considered with urban sector and land management sector.

- In line with tourism development, beautification of tourism roads and sophisticated management of tourist circulation are duly considered with tourism sector.
- To cope with massive public transport demand, the introduction of mass transit system is duly considered with urban sector.

9.7.2 ISLAND MINIMUM PROJECTS

The following projects/programs area proposed in the category of "Island Minimum". Figure 9.7.4 indicated the respective locations.

(1) Cebu Island Circumferential Road (Project Code LT01)

A circumferential road is of great importance for Cebu Island since urban centers have historically located on the coast. Therefore the road has been naturally developed as a main trunk of the island. However, the current situation of the circumferential road is quite contrastive between eastern and western sides. On the eastern side, the road stretching from Cebu City to north and south is totally developed with good pavement while long road sections are left unpaved. Barili - Aloguinsan section is not yet opened on the western side.

Resolution No. 1277-92 of the Provincial Board of Cebu requesting the DPWH addresses the concreting of Pinamungahan - Aloguinsan section, because whenever there is a downpour, the said road is almost impassable due to the thickness of mud which causes vehicles to sway and run zigzag.

Cebu North Road which connects the northern Poblacions such as Borbon, Tabogon, Bogo, Medellin and Daan Bantayan where Cebu Circumferential Road does not serve should be prioritized as a Island Minimum project.

(2) East-West Main Link (LT02)

To draw spatial structure and promote integral development of Cebu Island, east-west connection is indispensable. In actual, the mountains long ranging north and south block the way to an opposite side and cost a new road expensively.

There are three inland roads in Central Cebu which are worth discussing. They are:

1. Toledo - Naga route,
2. Toledo - Talisay route, and
3. Cebu - Balamban route (Trans Central Highway)

Out of these alternatives, Toledo-Naga route is the most favorable one for the East-West Main Link because of wide width and tight terrain. It can cope with heavy vehicles as well as intensive traffic.

Toledo-Talisay route, especially Talisay-Contabaco section is narrow and difficult to widen due to steep valley. Cebu- Balamban route which was transferred to DPWH from the Provincial Government recently and is being improved with World Bank financial assistance. But it is not suitable for heavily loaded trailers due to narrow carriage way (6.7m), bent shape and erosive terrain.

Accordingly, the Toledo-Naga and the forked section of Talisay-Contabaco which breaks up the concentrated traffic on the Contabaco-Naga section are designated as the East- West Main Link. To function as a main link, concreting on the Talisay-Contabaco and introduction of 3-lane system (two ascending lanes and one descending lane) on the Toledo-Naga are proposed.

(3) East-West Sub Links (LT12)

To serve minimum inland connections except Central Cebu, the following routes which are very important for local economy are designated as the East-West Sub Links:

1. Lugo-Tabuelan route (18.4km)
2. Carcar-Barili route (24.5km)
3. Argao-Ronda route (40.6km)
4. Dalaguete-Badian route (34.0km)

They need pavement works except Carcar-Barili and the missing link (1.6km) on the Dalaguete-Badian should be opened.

(4) Bantayan Island and Camotes Islands Road Development (LT13)

Bantayan and Camotes, remote islands, need good road transport to support daily activities. Particularly, paved roads should be provided between Poblacions and ports as Island Minimum requirements. They are:

1. Sta. Fe - Bantayan - Madridejos (26km)
2. San Francisco - Poro - Tudela (37km)
3. Pilar circumferential (26km)

The road improvement includes the rehabilitation of some old bridges in Pilar. There are 18 dilapidated and almost impassable wooden bridges from the Sangguniang Bayan of Pilar.

(5) Barangay and Municipal Roads Improvement (LT14)

Farm-to-market roads are essential for rural economies. Many roads are impassable during downpour, hence, many barangay centers are isolated except for foot traces. The farm-to-market roads have small traffic but they should be in stable operation with all-weather surfaces.

Seriousness of farm-to-market road development depends on municipality. For instance, the road network of Bogo has comparatively been developed, but Argao suffers from the insufficiency of the network, although some long farm-to-market roads are existing in many barangays, as shown in Fig. 9.7.2.

It is identified that the necessity of additional farm- to-market roads accounts for a total of 945.2 km in Cebu Province. The total length is divided by District (Congressional) as follows:

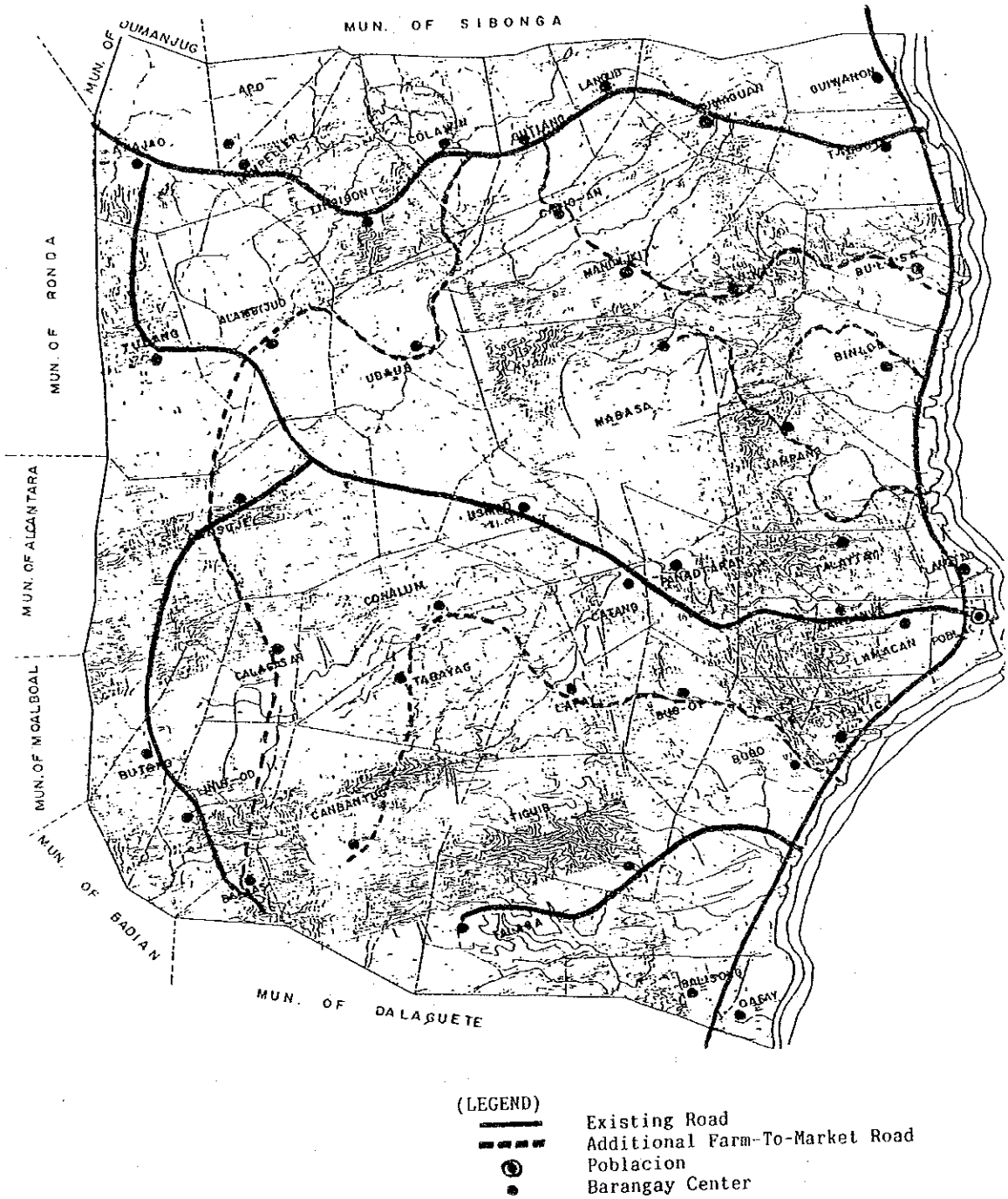


FIGURE 9.7.2 ROAD NETWORK IN ARGAO

District 1 - 125.6km
District 2 - 314.2km
District 3 - 230.7km
District 4 - 129.8km
District 5 - 123.6km
District 6 - 21.3km

Since farm-to-market roads are the lifeline for rural populace, the development of additional links should be facilitated in a prioritized manner, as one of Island Minimum projects.

(6) Local Road Development Supporting Program (LT15)

There are barangay roads of 2,363km and municipal roads of 457km in the province except cities. They need periodical maintenance service and emergency works.

The maintenance of the municipal and barangay roads was undertaken by the district offices of DPWH up to 1987. However, since 1988, the responsibility has been shifted to each local government unit.

In addition to the existing roads, the Study Team identified the necessity of new barangay roads with a total length of 945km. These roads should be constructed and maintained by LGUs.

In general, the cost of road construction and maintenance works can be divided into three items: materials, labor and equipment. Cost shares vary depending on the nature of works involved. For example, when earth work is a major component, the equipment cost share become high, while the materials cost share increases when structural work is a major component.

According to the experience of the Provincial Engineering Office (PEO) of Cebu, cost shares of materials, equipment and labor to total barangay road construction are roughly estimated as shown below.

Equipment	-	40%
Materials	-	25-30%
Labor	-	20-25%

In practice, most municipalities can't afford to prepare necessary equipment and to station maintenance administrators/engineers, resulting in low implementability.

To facilitate the construction and maintenance of the local roads such as barangay road and municipal road, Local Road Development Supporting Program is proposed with the following functions:

1. to possess necessary heavy equipment for construction and maintenance works of local roads and to rent them to municipalities
2. to train local people for related civil engineering works
3. to supervise the related works
4. to assist formulation of barangay development plans as well as municipality development plans

5. to enhance sustainable growth of local economy

Organizational structure for the proposed program is shown in Figure 9.7.3.

This program will be executed by the Cebu Local Roads Development Supporting Program Office. The Program Office has five District Offices corresponding to the Congressional District System except Metro Cebu.

The District Offices shall be responsive to local needs. The District Offices are also expected to well coordinate with the Task Forces which were established by the Provincial Government for the purpose of provincial roads maintenance.

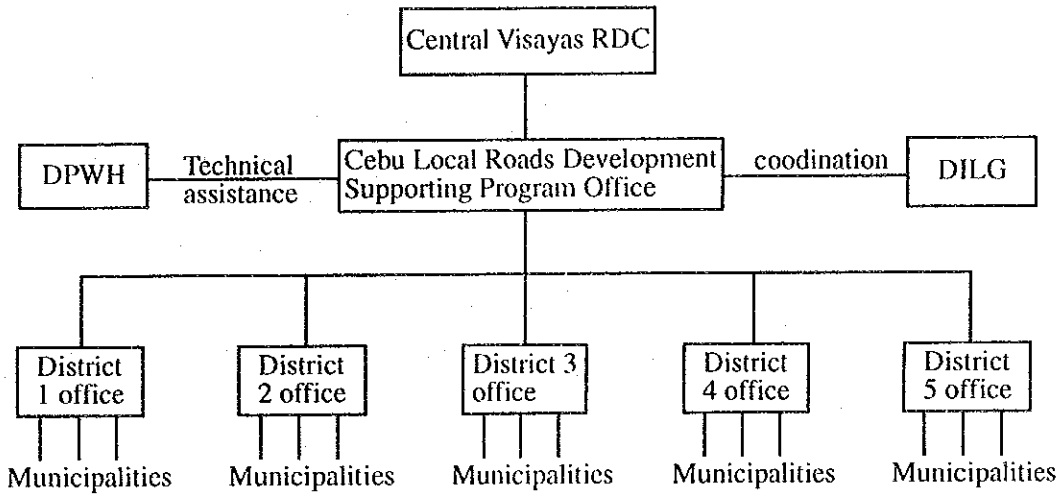


FIGURE 9.7.3 ORGANIZATIONAL STRUCTURE

Taking account the estimated work volume, each District Office will prepare the following equipment:

Dump Truck (medium size)	: 5 units
Bulldozer (medium size)	: 2 units
Grader	: 1 unit
Steel Roller	: 1 unit
Pneumatic Roller	: 1 unit
Loader (bucket $3m^3$)	: 1 unit
Back hoe Excavator	: 1 unit
Concrete Mixer	: 2 units
Water Tank Truck	: 1 unit
Prime-mover	: 1 unit

LGUs are presently adopting two systems for road construction and maintenance, namely, direct implementation by the administration; and contract-basis implementation.

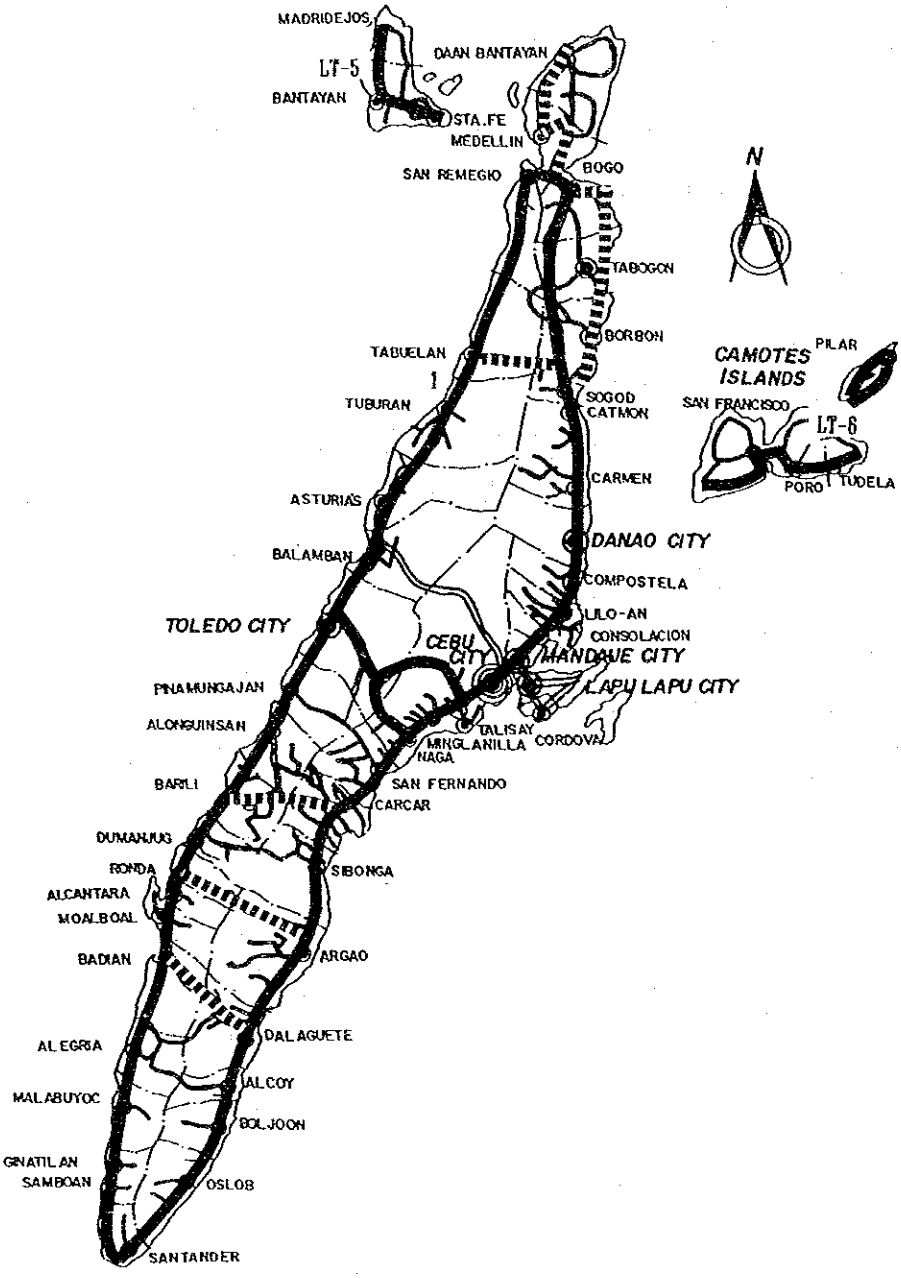


FIGURE 9.7.4 DISTRIBUTION OF ISLAND MUNIMUM PROJECTS

Under the present laws and regulations, the former is limited in construction and maintenance works. The latter is further classified into equipment-based method and labor-based method. Although the equipment based method is dominant, the labor-based method is being pursued to create as many job opportunities as possible. The proposed program intends to enhance this method provincial wide.

9.7.3 ISLAND BASIC PROJECTS

The following four projects are proposed as "Island Basic" projects. The locations are indicated in Fig. 9.7.7.

(1) Metro Cebu Public Transit Corridor

Provision of adequate and functional public transit will be essential in Metro Cebu. The Study Team proposes that the successive road sections between Liloan - Naga or Cebu North Road - M.J. Cuenco Ave. - Imus M.J. Cuenco New Link - P. del Rosario St. - Cebu North Road is designated as "Public Transit Corridor". It is 36.5km long.

On this corridor, buses and minibuses should be encouraged instead of jeepneys and tricycles to improve the road space efficiency. To facilitate such modal preference, bus terminals will be allocated properly on the corridor. Jeepneys and tricycles shall serve on feeder routes from/to the bus terminals to hinterlands.

North Bus Terminal (12,000m^2) and South Bus Terminal (9,000m^2) were constructed under MCDP scheme up to now. In addition, the following bus terminals (4,000-5,000m^2) are proposed along the corridor as shown in Figure 9.7.5.

1. Liloan Bus Terminal
2. Consolacion Bus Terminal
3. Butuanon Bus Terminal
4. Pardo Bus Terminal
5. Tabunoc Bus Terminal
6. Minglanilla Bus Terminal
7. Naga Bus Terminal

The proposed Metro Cebu Public Transit Corridor needs at least 4-lane carriage way and 24m R.O.W. Some sections should widen to meet this standard physically.

For traffic management, one exclusive bus lane and bus bays should be introduced on both directions in the sections with the sufficient ROW. Irrespective of the said parallel road, bus stops and bus bays will be allocated at 500m intervals between the bus terminals. On a long-term perspective, the proposed bus terminal sites will be more precious and become strategic bases. For example, these sites can be converted to the station sites of an elevated guide way system in the future.

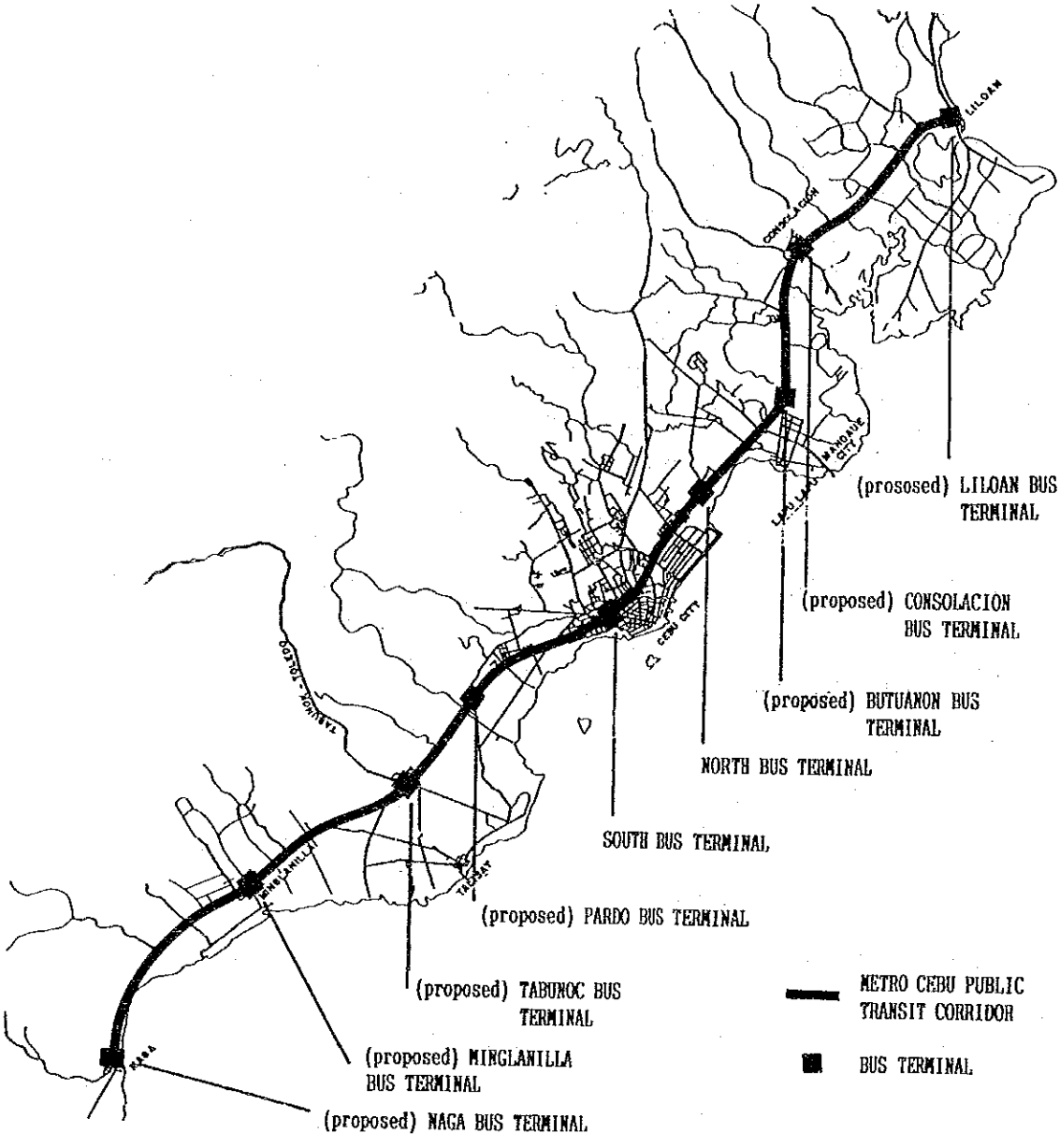


FIGURE 9.7.5 ALIGNMENT OF METRO CEBU PUBLIC TRANSIT CORRIDOR

(2) Second Mandaue-Mactan Bridge and Its Approaches (LT04)

The capacity of the existing Mandaue-Mactan Bridge with 2-lane carriage way is estimated at around 21,400 PCU (Passenger Car Units) per day based on DPWH Highway Planning Manual. The traffic surveys conducted in recent years reveals that the actual traffics sometimes exceed the designed capacity to some extent. In addition, its structural weakness has been pointed out.

Furthermore, urban development in Mactan Island is still vital in tourism and industrial fields.The traffic demand on Mactan - Mainland section is estimated at 36,000 PCU in 2000 and 58,000 PCU in 2010. Accordingly, both bridges will be at the peak of congestion again in the middle of 2000's.

The Second Mandaue-Mactan Bridge is therefore a matter of great necessity, although there is a large room for discussion to utilize ferryboat service in coexistence with the bridges. According to the latest project schedule, its detailed engineering study will commence in 1994 and completion of construction is scheduled in 1998 with financial assistance of OECF.

The approaches linked with the Bridge should be duly considered from a traffic management viewpoint. On the Mactan side, a direct junction to Mactan Ring Road is easy and only one route. On the Mandaue side, the approach is requested to reach to Cebu North Road as a part of Metro Cebu Public Transit Corridor and Plaridel St as a part of Cebu East Industrial Corridor in parallel with A. Cortes St., as shown in Figure 9.7.6.

(3) Cebu Trans Central Highway: Cebu-Balamban Corridor (LT10)

The Cebu Trans Central Highway starts at the junction of Barangay Busay, one kilometer northwest of the Cebu Plaza Hotel, towards a northwesterly direction through Barangay Pungol, passing Barangay Gavas and Pitogo, ending at the junction of Toledo-Asturias Road in Balamban. The total length is 40.5 km. The existing road traverses a dominantly mountainous terrain, while the horizontal and vertical alignments are generally fair.

The project includes to concrete current gravel surface and replace old bridges. Detailed engineering study completes in 1994 and civil works are scheduled to complete in 1997.

The project aims at decongestion of Metro Cebu and urban expansion to western side. But only few settlements dangles from the road and its ADT (Average Daily Traffic) is around 500 vehicles in 1991. It is noted that the road even after the project completion will not be suitable for heavy traffic, especially, heavy vehicles due to its narrow and bent shape and erosive terrain.

In general, mountainous roads are naturally and primitively develop by winding valleys or traversing peaks. Compared to terrain conditions, valley roads are stiff, while peak roads are likely to suffer from landslides. Cebu Trans Central Highway is a typical peak road and the Study Team observed a lot of landslides.

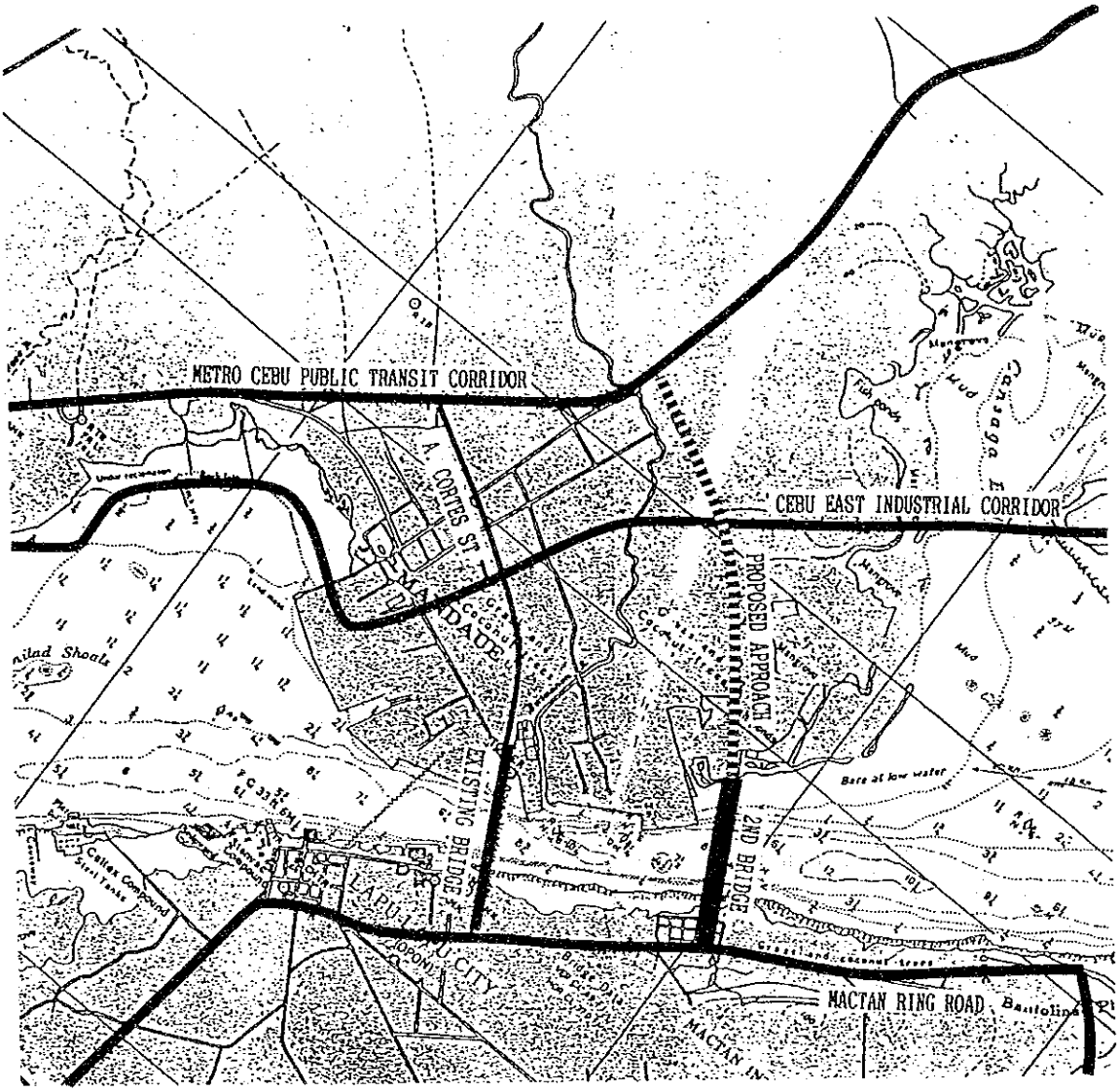


FIGURE 9.7.6 SECOND MANDAUE-MACTAN BRIDGE AND ITS APPROACHES

Slope protection works are effective necessary for prevention of landslides, introducing the appropriated environmental techniques, even though the costs are much.

(1) Metro Cebu Public Transit Corridor
(2) 2nd Mandaue-Mactan Bridge and Its Approaches
(3) Trans Central Highway (Cebu - Balamban)
(4) Cebu South Vegetable Basket Roads

Despite of the aforementioned disadvantages, Cebu Trans Central Highway has the attractive and strategic route alignment passing through vast road scarcity area. In conclusion, the project should push through with due environmental considerations. After the completion, it will require necessary budgetary allocation for maintenance work and proper traffic management such as putting restriction on heavy vehicles.

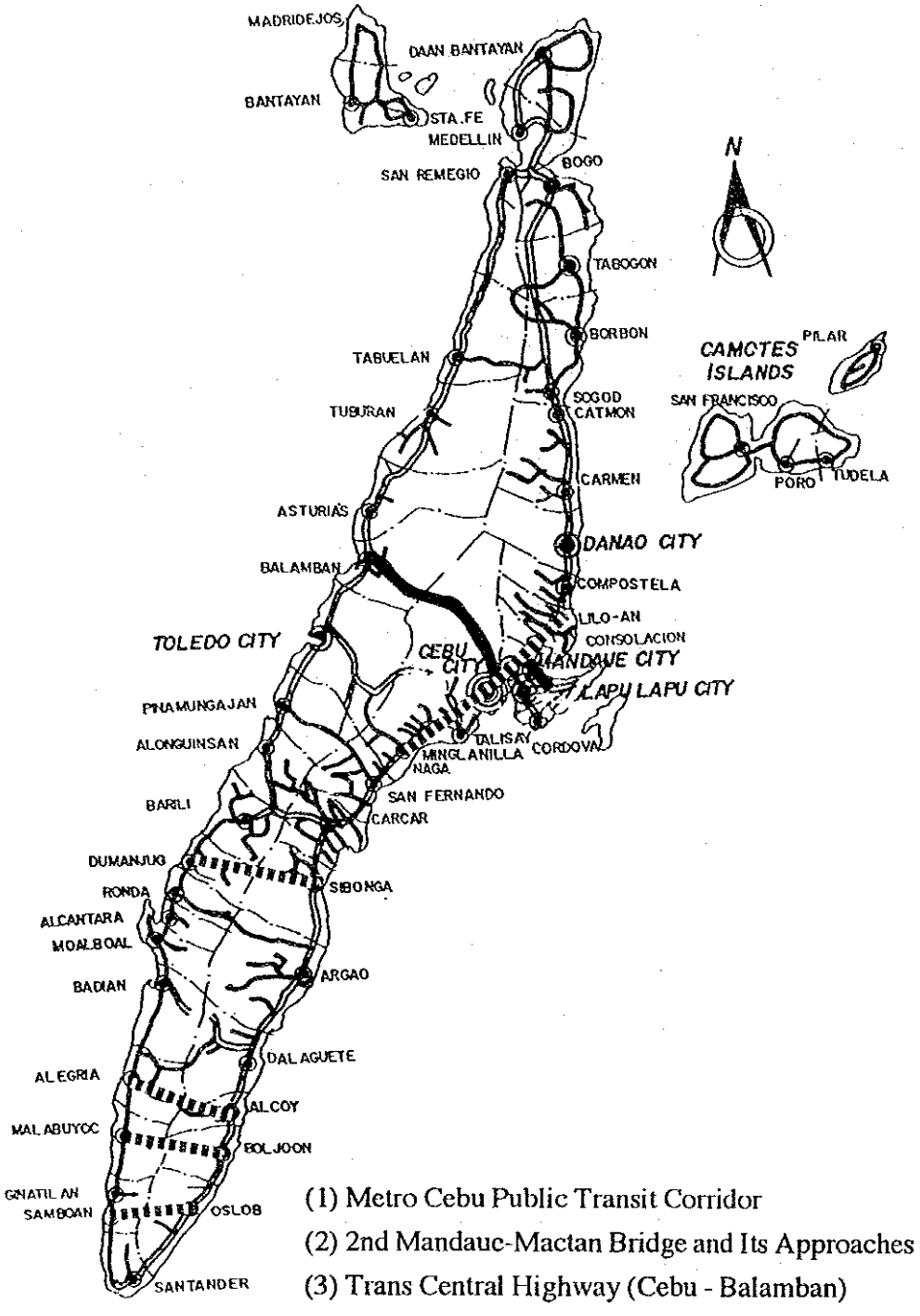
(4) Cebu South Vegetable Basket Roads

At the southern part of Cebu, agricultural activities have exploited upland areas where profitable products such as vegetables can be grown within small land. But roads are narrow and curved and some portions are blocked with steep mountains. It needs some concerted efforts to conquer such hard geographic features.

In order to facilitate the agricultural productivity and marketability in the southern Cebu, the following roads should be improved and opened as Cebu South Vegetable Basket Roads:

1. Sibonga - Dumanjug (27.8km)
2. Arcoy - Alegria (21.1km)
3. Boljoon - Malabuyoc (24.5km)
4. Oslob - Samboan (14.1km)

The proposed roads are supposed to accommodate small traffic. Therefore some sections within Poblacions and barangay centers will be paved while others will be improved as all- weather roads. The opening works of missing links are another important task of this project.



(1) Metro Cebu Public Transit Corridor
(2) 2nd Mandaue-Mactan Bridge and Its Approaches
(3) Trans Central Highway (Cebu - Balamban)
(4) Cebu South Vegetable Basket Roads

FIGURE 9.7.7 DISTRIBUTION OF ISLAND BASIC PROJECTS

9.7.4 ISLAND STRATEGIC PROJECTS

Five projects are proposed for the "Island Strategic" projects, the locations of which area shown in Fig. 9.7.8.

(1) Metro Cebu Coastal Industrial Corridor (LT07)

Segregation of freight traffic from passenger traffic is necessary to bear both benefits on residents and industries. The Study Team proposes the development of Metro Cebu Coastal Industrial Corridor stretching from Carcar to Carmen, consisting of the following sections:

1. Carcar - Naga (18.6km):	widening existing Cebu South Road
2. Naga - Talisay (8.9km):	new road construction in proposed reclamation area
3. Talisay - Cebu CBD (11.5km):	construction of elevated road, causeway and plain road under MCDP III
4. Cebu CBD - Old Reclamation (3.1km):	utilization of existing MacArthur Blvd. and Second Avenue
5. Mandaue City area (7.3km):	construction of causeway under MCDP II and widening and extension of existing Plaridel St.
6. Consolacion - Liloan (6.3km):	widening existing Tayud Road
7. Liloan - Carcar (22.5km):	widening existing Cebu North Road

The total corridor is 78.2km long, comprising of existing road improvement and widening of 55.8 km and new road/causeway construction of 22.4km. The corridor is designed to be at least 4-lane carriage way. Taking into account the traffic demand of heavy vehicles, the corridor prefers to concrete surface rather than asphalt one.

(2) Metro Cebu Circumferential Roads (LT11/LT18)

The planned circumferential roads are very attractive for Metro Cebu, because it provides an alternative bypass route for traffics passing through Cebu CBD, leading to facilitation of the hinterland development. Currently Metro Cebu has two kinds of plans:

1. Urban Circumferential Road, and
2. Outer Circumferential Road

The Urban Circumferential Road starts at the intersection of Cebu South Road at the vicinity of USJ-R High School and going inward and outward mountainous area, and

finally connects the Talamban-Cadre Road. It is the total length of 12.7km with one tunnel (450m) and one bridge (250m).

Urbanization has almost spread within the Urban Circumferential Road, but the road density of surrounding area is comparatively poor. Thus, the necessity of the Urban Circumferential Road can be easily justified, however, it will cost around 10.8 billion pesos. It might be difficult to justify the project economically.

The Outer Circumferential Road starts from the vicinity of the boundary of Lawaan Talisay and traverses through many barangays such as Buhisan, Sapang-daku, Kalunasan, Busay, Sirao and Binaliw in Cebu City and Cabangahan, Polog and Donlog in Consolacion and finally reaches to the Poblacion of Liloan Town. It is about 40km and 85% of the length is located in mountainous and undeveloped area.

There are vast areas for development between the two circumferential roads, but the areas are essential for watershed. It is a crucial urban issue how to manage the land use in the future.

(3) Mactan Road Widening and Beautification (LT09)

Mactan Island accumulates many urban functions such as residential, industrial and tourism. It has still vast vacant and underdeveloped areas for further development. But the road network is insufficient in density and in quality.

The trunk road network comprising of a ring road and a cross-island road is now being improved under the MCDP scheme. But it is not enough for industrial development in terms of road width and not attractive to tourism development. In order to meet these demands, the Study Team proposes some modifications of the original designs in the MCDP scheme as follows:

Mactan Island is divided into two zones geographically and functionally, that is, Urban Zone and Resort Zone. The Urban Zone suffers from daily traffic jam and many heavy trucks plying between somewhere in Mainland and MEPZ or MIA. Accordingly, the road should widen from 2 to 4 lanes with concrete pavement to meet these apparent demands.

On the other hand, the Resort Zone has many tourist accommodations and comparatively small traffic. Accordingly, 2-lane carriage way can meet traffic demand, but needs more comfortable and scenic walking and driving space rather than additional carriage way.

(4) Tourism Sea Link

On a long-term perspective, Panglao Island in Bohol is expected to be a popular tourist destination linked with Mactan. The circulation of tourists from the Mactan International Airport to these tourist areas will become an important issue.

For this purpose, development of a tourist port in Mactan and introduction of modern and high-speed tourist boat service (such as jet-catamaran and hydro-foil) connecting Panglao, Bohol via Argao is proposed. With this service, Mactan and Panglao can be linked less than one hour. It will be also one of attractions for tourists. This aspect is further discussed in the Tourism Sector in the Study.

(5) F/S on Metro Cebu Mass Transit System (LT06)

The Cebu Province has been conducting the Feasibility Study on the Metro Cebu Mass Transport System since 1992. Although it is not yet completed, this study prevails the following preliminary outputs:

1. Route alignment is proposed between Mandaue-Talisay on the Metro Cebu Public Transit Corridor, proposed in the preceding section 9.7.3.

2. The transit ridership on maximum section is expected to be around 9,000 and 12,000 in 2002 and 2012, respectively, assuming the introduction of "LRT System".

The preliminary results, the mass transit system seems to be possibly viable in Metro Cebu. Therefore a full- scale feasibility study is proposed in this study.

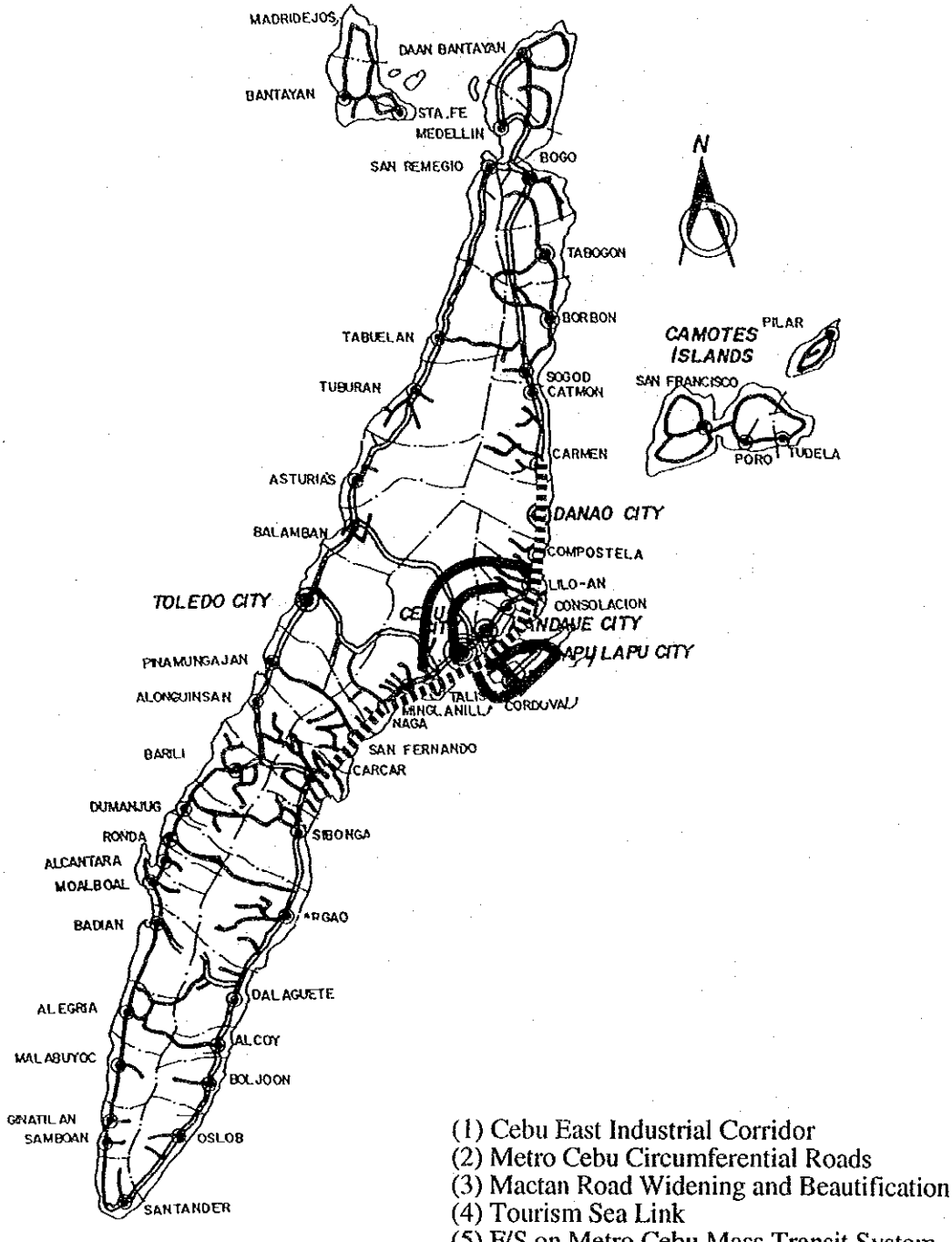
The proposed F/S highlights the following points:

1. Formulation of a comprehensive public transport system in Metro Cebu: a mass transit system will affect all public transport services. Therefore the comprehensive picture of public transport system in Metro Cebu should be formulated.

2. Comparison between several alternative systems : the Philippines have a precious experience of the LRT system in Metro Manila. It now transports 35 thousand passengers in a morning peak hour or daily 400 thousand passengers on the average. But it is questionable whether or not the same system is really applicable and adequate for Metro Cebu. The new transit systems vary for the demands. Hence, a comparative analysis of the system is important.

3. Utilization of foreign assistance : There are a couple of alternatives for the operation scheme, i.e., (1) build, operation and transfer (BOT) scheme, (2) establishment of Metro Cebu Mass Transit Authority, and (3) joint private/government owned Metro Cebu Mass Transit Corporation. Given any operation scheme, the funding is a matter of the utmost importance. Utilization of foreign assistance may be a key issue in the Philippines. Therefore, the proposed F/S must be internationally qualified for the external assistance.

4. Integral development with other infrastructure: in general, a mass transit system is huge and expensive infrastructure in densely urbanized area. Therefore, well coordination with other infrastructure developments is required. The vertical use of road space will be duly considered and coordinated through the proposed F/S.



(1) Cebu East Industrial Corridor
(2) Metro Cebu Circumferential Roads
(3) Mactan Road Widening and Beautification
(4) Tourism Sea Link
(5) F/S on Metro Cebu Mass Transit System

FIGURE 9.7.8 DISTRIBUTION OF ISLAND STRATEGIC PROJECTS

9.8 PROJECT IDENTIFICATION FOR SEA TRANSPORT

Based on the discussion Section 9.4, the following projects are proposed to meet future sea transport demand and to play a expected role of sea port.

(1) Rehabilitation and Improvement of Cebu Port and Cebu International Port: Port Rehabilitation and Improvement Project

• Location:	Cebu Port
•Implementing Agency:	Cebu Port authority
• Relevant Agencies to be Coordinated:	DOTC
• Objectives:	- To increase cargo handling productivity - To realize an effective use of port area
• Project Description:	- Expansion of berthing facilities and backup area - Expansion of berth capacity by conducting the reclamation of obsolete piers - Construction of the passenger terminal and boarding bridge for Ro/Ro ferry
• Target Beneficiaries:	- Port Authority - Shipping agencies - Ro/Ro ferry passengers
• Expected Benefits/Output:	- Reduction of cargo handling cost - Reduction of ship operations - Saving the shipping cost

(2) Rehabilitation and Improvement of Cebu Port and Cebu International Port: Ferry Port Facility Construction at CIP

• Location:	Cebu International Port
• Implementing Agency:	Cebu Port Authority
• Relevant Agencies to be Coordinated:	DOTC
• Objectives:	- To facilitate Ro/Ro ferry equipment - To realize a smooth port cargo flow at CIP
• Project Description:	Construction of pier for long distance Ro/Ro ferry at CIP

• Target Beneficiaries:	- Port Authority - Shipping agencies - Ro/Ro ferry passengers
• Expected Benefits/Output:	- Saving the time of passengers - Reduction of ship operation cost - Promotion of regional development

(3) Rehabilitation and Improvement of Cebu Port and Cebu International Port: Cargo Handling Modernization Project

• Location:	Cebu International Port
• Implementing Agency:	Cebu Port Authority
• Relevant Agencies to be Coordinated:	DOTC
• Objectives:	To increase of the cargo handling productivity
• Project Description:	Installation of container handling equipment to increase productivity
• Target Beneficiaries:	- Port Authority - Shipping Agencies
• Expected Benefits/Output:	- Increase in cargo handling productivity - Reduction of cargo handling cost - Reduction of maintenance cost

(4) Industrial Ports Improvement Project

• Location:	Toledo, Carmen, and Mandaue
• Implementing Agency:	PPA
• Relevant Agencies to be Coordinated:	DOTC
• Objectives:	To construct port facilities for transportation of industrial materials and products.
• Project Description:	Construction of berthing facilities
• Target Beneficiaries:	- Port Authority - Industries - Shipping Agencies - Local Governments

• Expected Benefits/Output:	- Reduction of transportation cost for the industries - Promotion of regional development - Increase in job opportunities

(5) Regional Ferry Port Facilities Rehabilitation and Improvement Project - Phase I

• Location:	Argao, Samboan Toledo, Sta. Fe, and Hagnaya
• Implementing Agency:	PPA
• Relevant Agencies to be Coordinated:	DOTC and DPWH
• Objectives:	- To facilitate ferry ship facilities for local communication - To facilitate berthing facilities for tourism ships
• Project Description:	Construction of: - ferry berth - water basin, and - passenger terminal
• Target Beneficiaries:	- Port Authority - Shipping Agents - Local Residents - Tourists
• Expected Benefits/Output:	- Reduction of ship operation cost - Increase in tourism passengers - Promotion of regional development

(6) Feasibility Study of the Expansion of Cebu Port

• Location:	Cebu Port
• Implementing Agency:	Cebu Port Authority
• Relevant Agencies to be Coordinated:	DOTC
• Objectives:	To conduct a feasibility study on the expansion project of Cebu Port

• Project Description:	The study constitutes: - Natural condition survey - Demand forecast - Port planning - Design and construction method - Environment - Port management operation - Economic and financial analysis
• Target Beneficiaries:	Port Authority
• Expected Benefits/Output:	- Reduction of shipping cost - Increase in cargo handling productivity, therefore, cargo handling cost - Promotion of industrial location

(7) Second Cebu International Port Construction Project

• Location:	Cebu Port
• Implementing Agency:	PPA
• Relevant Agencies to be Coordinated:	DOTC
• Objectives:	- To handle the increased cargo - To accept larger container ships - To increase the cargo distribution function - To create the industrial zone
• Project Description:	Expansion construction of: - Wharf - Back-up area - Approach channel and water basin - Access road - Reserved area
• Target Beneficiaries:	- Port Authority - Shipping Agents • Local Governments
• Expected Benefits/Output:	- Reduction of shipping cost - Reduction of cargo handling cost - Promotion of industrial location

(8) Regional Ferry Port Facilities Rehabilitation and Improvement Project: Phase II

• Location:	Dumanjug, Tuburan, Toledo, Sta. Fe, Hagnaya, and Cordova
• Implementing Agency:	PPA
• Relevant Agencies to be Coordinated:	DOTC and DOWH
• Objectives:	- To facilitate ferry ship facilities for the local communication - To facilitate berthing facilities for the tourism ships
• Project Description:	Construction of: - ferry berth - water basin, and - passenger terminal
• Target Beneficiaries:	- Port Authority - Shipping Agents - Local Residents
• Expected Benefits/Output:	- Reduction of ship operation cost - Increase in tourism passengers - Promotion of regional development

9.9 PROJECT IDENTIFICATION FOR AIR TRANSPORT

9.9.1 AIR TRANSPORT DEVELOPMENT NEEDS

(1) Passenger

A tourism purpose is one of leading motivations to ride on planes. In particular, tourists are dominant in international flights. Therefore development of tourism industry is synonymous with development of air transport industry to a degree. In fact, oppositely, air transport seems to hamper the tourism development for the following reasons:

1. Insufficient direct and chartered flights
2. Comparatively high air transport cost which can be explainable by the existing high pricing tour package rather than competitive ASEAN tourism destinations
3. Poor airport management at MIA
4. Poor tourist circulation

Business is another major purpose of air passengers. The number of business trips is closely related to the status quo of Cebu economy. The increase in domestic passengers has been attributed to the recent Cebu Boom to a great extent. The Cebu Boom is intended to spread over the province and air transport must ensure such movement.

The trips of working away from home and homecoming have seasonal variations but not negligible in the air market.

In conclusion, the following directions should be pursued to meet future traffic demand and to develop air transport industry:

1. Extension of MIA runway and improvement of MIA passenger terminal
2. Expansion of air links both in domestic and international flights
3. Holding up open-air policy to compete in the international tourism market
4. Development of island commuter services and facilities

(2) Cargo

While air transport is perceived as the most expensive mode of transporting goods, a total cost approach to distribution with considering storage, inventory, time, effects on product quality and prices, and freight cost, can make it not prohibitive in some fields.

One sector highly reliant on air transport is the cutflowers industry. Cutflowers should reach their destinations in the shortest possible time. Also, highly valuable goods, jewelry and the like, prefer to air transport because marine insurance cannot cover their value.

A series of hearings from the enterprises branching out in MEPZ reveals that they fully enjoy the proximity to MIA. They very often use the air freight service and it is of great help to their business.

On the other hand, the reliance of air transport is not actually high. Because there are several instances when perishable items had to be bumped off from a flight to give priority to passengers and to abide by related safety regulations. The assurance of cargo space is important to secure the current consignors. Furthermore, exclusive cargo terminal facilities and freighters are necessary to increase handling cargo volume drastically.

9.9.2 MIA DEVELOPMENT PLAN

The airport facility equipments must be designed with taking into consideration the standards and recommended practices of International Civil Aviation Organization (ICAO) and International Air Transportation Association (IATA) and the type of critical aircraft, the longest flight stage length, estimated peak hour traffic, simulated flight schedule, local behavior in the operation of MIA, etc.

The on-going Mactan International Airport Development Project (MIADP) has two phases, i.g., Phase I with target year 2000 and Phase II with target year 2010. The Phase II has two options corresponding to traffic demand (medium and high ranges). The major facilities will be developed as described in Table 9.9.1

TABLE 9.9.1 MIA DEVELOPMENT PALN BY MIADP

Major Facilities	Phase I (2000)	Phase II (2010)	
		Medium Range	High Range
Air Field Facilities	3,300 x 45 m	3,300 x 45 m	3,300 x 45 m
1. Runway			
2. Taxiway System	Full parallel & rapid exits	Full parallel & rapid exits	Full parallel & rapid exits
3. Apron (Aircraft Stand)	10	12	14
- Domestic operations	2	4	4
- Int'l operations			
Terminal Facilities			
1. Passenger Terminal Builiding			
- Domestic operation	22,500 m^2	35,500 m^2	47,500 m^2
- Int'l operation	21,500 m^2	28,500 m^2	28,400 m^2
2. CArgo Terminal Building			
- Domestic operation	11,800 m^2	22,900 m^2	28,400 m^2
- Int'l operation	12,400 m^2	28,700 m^2	32,800 m^2
3. Rescue and Fire Fighting (ICAO category)	VIII	IX	IX
4. Aircraft Maintenance Area	27,800 m^2	27,800 m^2	27,800 m^2
5. General Aviation Area	19,100 m^2	19,900 m^2	21,300 m^2
6. Access Road Capacity	1,230/hr	2,460/hr	3,070/hr
7. Carparking Slots	810	1,610	2,090
8. Fuel Farm Storage (7 days)	3,800 kl	7,800 kl	11,000 kl
Utilities			
1. Power	5,290 kVA	9,680 kVA	11,690 kVA
2. Water supply	1,200 m3	2,300 m3	2,900 m3
3. Sewage System	1,100 m3	2,200 m3	2,800 m3

If the MIA would coexist with the Philippine Air Force and/or have morcover demand in future, the construction of a parallel runway becomes an attractive idea because it makes the flight transaction capacity double.

9.9.3 FEEDER AIRPORTS DEVELOPMENT PLAN

There are several small airports in the province beside from MIA. Some are privately-owned and the others are publicly-owned. But no airport can operate actively due to limited demand.

For instance, Sta. Fe Airport was rehabilitated with 30 million pesos to provide commuter services during the former governor's tenure of office. But the regular service between Cebu and Sta. Fe by the Philippine Airline had not been popular and

eventually suspended. Local people preferred the combination of bus and boat and air service was prohibitive for them.

However, this episode need not deny the necessity of local airports. The assets of local airports are precious for local people as well as outside people. Air transport is not only the fastest means but also reliable means rather than sea transport in case of rough sea. Therefore, some efforts should be made to maintain local airports in good conditions.

It is obvious that there is not enough demand to provide daily service at present. But local airports should continue to operate irregular flights to the specific people such as business men and tourists and try to increase traffic demand in line with local development. The individual development strategy is proposed as follows:

(1) Toledo

Toledo City which is the core of the proposed Western Sea- Board development in this study has two private airports (i.e., Sangi and Lutopan). The passengers on business purpose is expected to increase from Cebu and other places such as Negros, Panay and Manila in line with industrial development. Under such situations, either of the airports will become public and have regular links.

(2) Argao and Bogo

Tourism development and agro-industry development are key factors to manage small airports in Argao and Bogo. Beside Cebu linkage, Leyte/Samar link is prospective at Bogo Airport while Bohol link is hopeful at Argao Airport.

(3) Sta. Fe and San Francisco

Both airports are located in remote islands where tourism development potentials lie. Financially, their feasibility totally depends on the progress and scale of tourism development. From a social development viewpoint, however, the remote islands must need dual transportation means (i.e., sea and air), for making preparation against emergency. Therefore, there is some rooms for discussions to subsidize both the airports.

CHAPTER 10

WATER RESOURCES DEVELOPMENT

CHAPTER 10

WATER RESOURCES DEVELOPMENT

10.1 INTRODUCTION

In this chapter, the following water-related topics are described:

1. Water supply system (including ground water)
2. Flood control
3. Watershed management
4. Sewerage system

The policies and strategies taken up for the water resources sector will be as follow:

1. To adopt an integrated planning and development strategy for an area-wide development scheme for purposes of combining irrigation, hydropower, flood control, and domestic and industrial water supply, if available, to realize optimum benefits

2. To implement cost-efficient water resources development projects for increasing productivity and employment opportunities

3. To develop more small and medium scale projects which yield quicker results and can be developed and maintained through the active participation of the rural populace

4. To improve the efficiency in the collection of irrigation and water supply projects

10.2 WATER RESOURCES RELATED INSTITUTIONS AND PROJECTS

10.2.1 NATIONWIDE INSTITUTIONS

(1) DPWH

The Department of Public Works and Highways (DPWH) is responsible for the development of Level 1 by international cooperation fund and flood control, water supply systems, in line with national plans and policies. It performs engineering and construction works such as drilling of wells, development of spring, installation of rain collector and flood mitigation structures.

(2) LWUA

The Local Water Utilities Administration (LWUA) is responsible for water supply development in all the areas. It provides water services for Level 2 and Level 3, which are explained in Section 10.3. In addition, it undertakes institution building activities, planning and engineering for the implementation of sewerage projects in several urban areas.

Specially, LWUA provides loan to water districts for the development of water systems at concessionary terms based on their development potentials and continued viability. It extends engineering services to water district as well. Its functions include the promotion of organization for works of rural water works and sanitation associations (RWSA's), and the provision of institutional, technical and financial assistance to RWSA's in the construction, operation and maintenance of rural water supply systems.

(3) NWRB

The National Water Resources Board (NWRB), attached to DPWH, is a high level body responsible for coordinating and integrating all the activities related to water resources development and management. It formulates policies, evaluates and coordinates water resources programs, regulates and controls the utilization, exploitation, development and conservation of the country's water resources and the regulation of the water utilities operation.

10.2.2 REGIONAL OR PROVINCIAL INSTITUTIONS

(1) RDC VII

In Region VII the Regional Development Council (RDC VII) has the following functions:

- Approval of the Regional Development Plan, the multi-year Regional Development Investment Program and the Regional Annual Investment Program.
- Reviewing and endorsing to the national government the regional budget proposals of government agencies.

- Ensuring the consistency of local development plans with the regional plan and priorities.

(2) PPDO and PWDTF

The Provincial Planning and Development Office (PPDO) serves as the planning arm of the province that will translate its development thrust and priorities established by the Chief Executive and the Provincial Officials into specific programs/projects.

The PPDO does the following:

1. Formulate integrated economic, social, physical, and other development plans and policies for consideration of the provincial development council;

2. Conduct continuing studies, researches, and training programs necessary to evolve plans and programs for implementation;

3. Integrate and coordinate all sectoral plans and studies undertaken by the different functional groups or agencies;

4. Monitor and evaluate the implementation of the different development programs, projects, and activities in the local government unit concerned in accordance with the approved development plan; and

5. Prepare comprehensive plans and other development planning documents for the consideration of the Provincial Board.

The Provincial Waterworks Development Task Force (PWDTF) takes charge of all the activities related to the provincial water supply programs/projects.

In close coordination with the provincial board, local and national government offices or agencies, and other government and non-government organizations, the PWDTF shall:

1. Formulate plans for the overall water supply program of the province of Cebu;

2. Establish a Database Center and a Library for all waterworks development programs;

3. Prepare feasibility studies and detailed engineering and cost estimates for Levels I, II and III waterworks projects;

4. Provide technical assistance in the construction of waterworks development projects of municipal governments;

5. Assist in the conduct of waterworks management training for RWSAs;

6. Monitor and supervise the implementation of all waterworks projects, and evaluate project's operations; and

7. Perform other assignments as assigned and delegated by competent authority.

10.2.3 OTHERS

(1) MCWD

Metro Cebu Water District (MCWD) provides potable water in Metro Cebu including Talisay, Compostela, Liloan, Consolacion, Mandaue City, Lapu-Lapu City, and Cebu City. It is responsible for the planning, design, construction, operation, and maintenance of the water works within its jurisdiction. Funding for the various short and long-scale improvement programs for MCWD is secured by LWUA from both local and international lending institutions for relending to water utilities.

(2) WRC

The Water Resources Center (WRC) of the University of San Carlos searches the water resources of the Province, especially groundwater. WRC has its own rainfall observation stations and water level gauges. It does the consultancy work on ground water to MCWD and local governments. It has become a major information center on water resources in the province now.

(3) WD's and RWSA's

Water Districts (WD's) and Rural Waterworks and Sanitation Associations (RWSA's) are institutions established for the purpose of ensuring proper operation and maintenance of completed water supply, sewerage and sanitation facilities. As mandated by law, these institutions are organized and registered with LWUA.

A water district is a non-profit, quasi-public and local entity created primarily for the purpose of acquiring, installing, improving, maintaining and operating water supply and distribution system within the boundaries of the district. WD's are formed at the option of the local government concerned. RWSA's are non-stock, non-profit organizations envisioned to operate and manage Level 1 and 2 water supply facilities. It usually encompasses one or more cities, municipalities or provinces provided that the area covered comprises a contiguous territory.

(4) LGUs and Cooperatives

Some cities and municipalities in the Province have water systems constructed, owned, and operated by themselves. These are called City or Municipal Waterworks. and are entirely different from the WDs and RWSAs.

Argao, Carmen, Sibonga, Aloguinsan, and Borbon cooperatives have been formed and registered with CDA. These are water-supply based cooperatives organized under the CVWSP for the purpose of extracting and selling water and other purpose. By 1996, a total of 13 municipalities in Cebu will be covered by CVWSP with approximately 200 barangays and just as many water cooperatives operating independently.

10.3 PRESENT CONDITIONS

10.3.1 RIVERS

The rivers in the province run mostly toward the east to west or west. Hence, river lengths are short and is steep of slope. The location of river and catchment areas of the Province are shown in Figure 10.3.1 to 10.3.4.

- Districts 1 and 2: There are no wide plains in districts 1 and 2 except in the municipalities of Talisay, Carcar, Argao, and Moalboal. The mountain sides in the center of this area have karst formations characterized by sinkholes and small lakes. Some of the rivers in these karst areas do not reach the seacoast.

  MCWD plans to tap the water supply of the Mananga river, which is the largest river in Districts 1 and 2. The Mananga river often floods forcing the river to change its course thus causing soil erosion.

- District 3 including Toledo City: There are large rivers in Toledo City and in Asturias namely: Sapang Daku river, Balamban river, and Guinabasan river. The average mountain height is 900 m and the area top surrounding is a national park.

- District 4: Medellin, Daan-Bantayan, and northern part of San Remingo and Bogo are plain area and no large-scale rivers. The Bantayan island has no mountains and rivers.

- District 5 including Danao City: Kotkot river located to the boundary of Compostela and Liloan occurs the flooding and erosion by changing the river course. National road near Kotkot river was covered by the water in flooding time.

- District 6 and Cebu City: Mandaue river is the most large river in District 6 and Cebu City. Mandaue river, Sunban Daku river, Lahug river, Guadalupe river, Kanabunsan river, and Bulacao river in Cebu City and Mandaue City come to be urbanized. River banks of these are constructed and squatters occupy river bank in some places.

  Mactan island is plane area and there is no river and no good existing drainage system. And the people in some area, especially coastal area, cannot get a fresh water from wells.

10.3.2 METEOROLOGICAL AND HYDROLOGICAL CONDITION

Annual rainfall of the province is estimated to be 800 mm around Oslob to 2,000 mm in mountain side of Mananga river basin. Isohyets map of annual average rainfall in Cebu Province and Bohol Province is given in Figure 10.3.5.

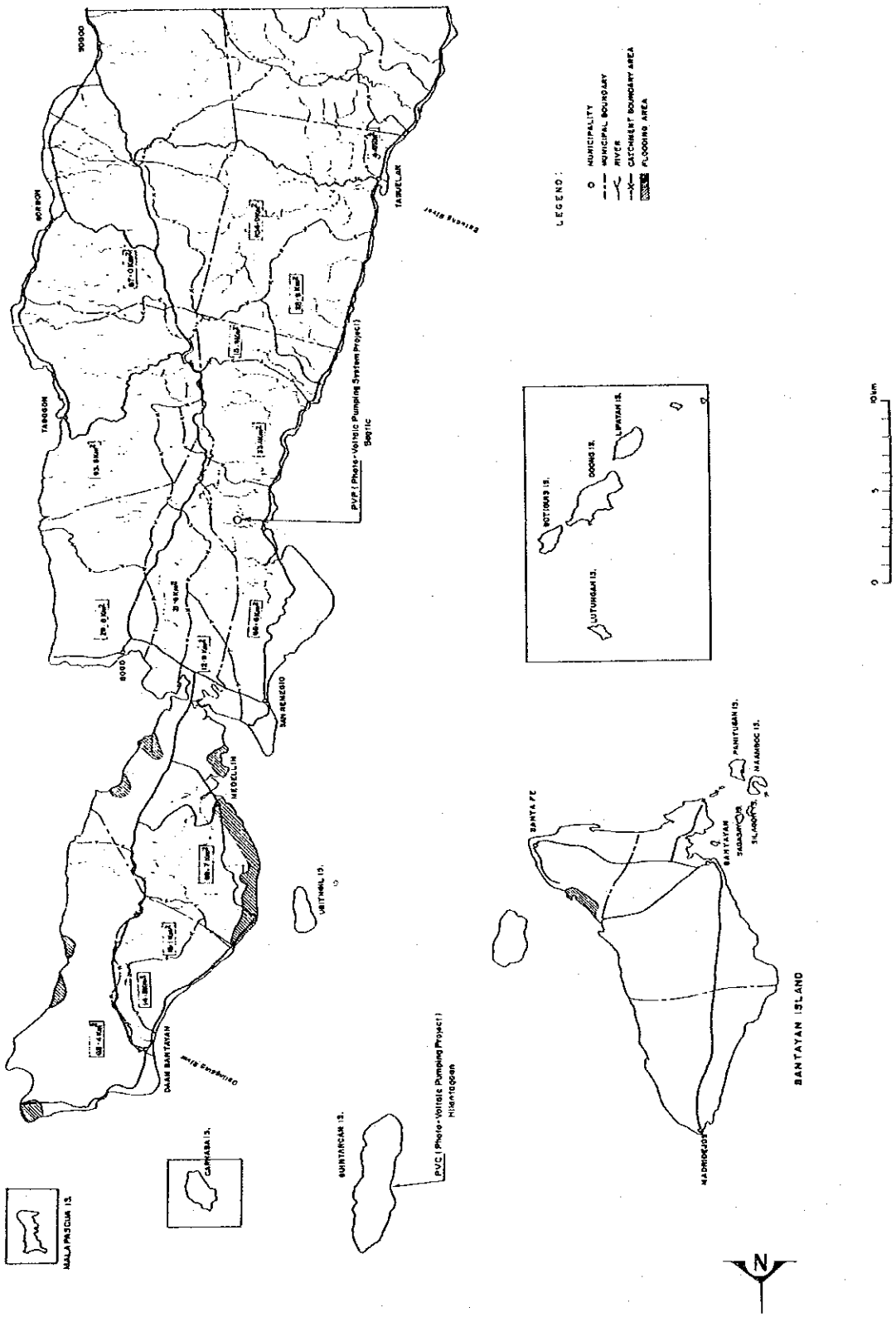


FIGURE 10.3.1 BASIN MAP (1)

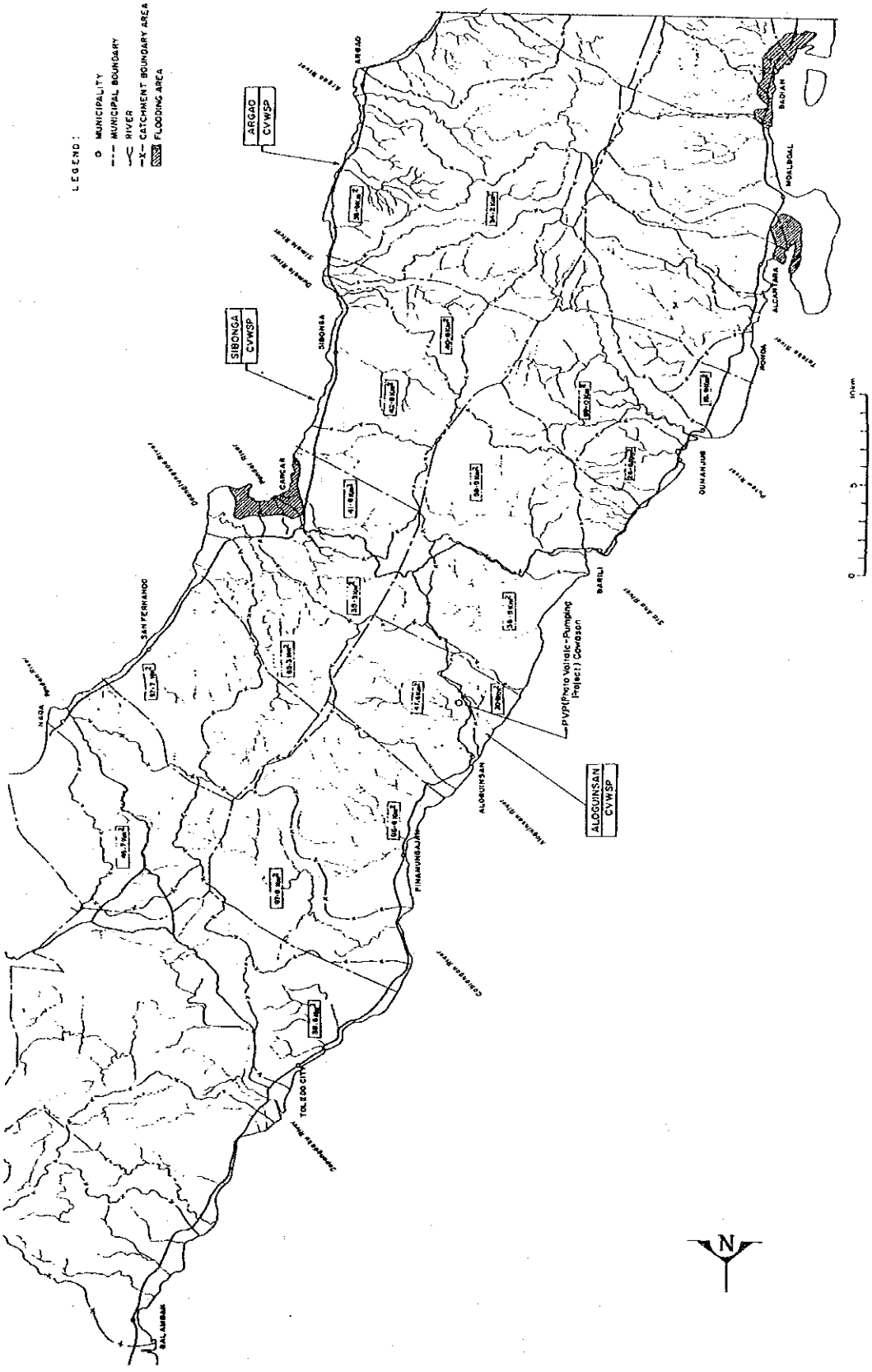


FIGURE 10.3.2.BASIN MAP (2)

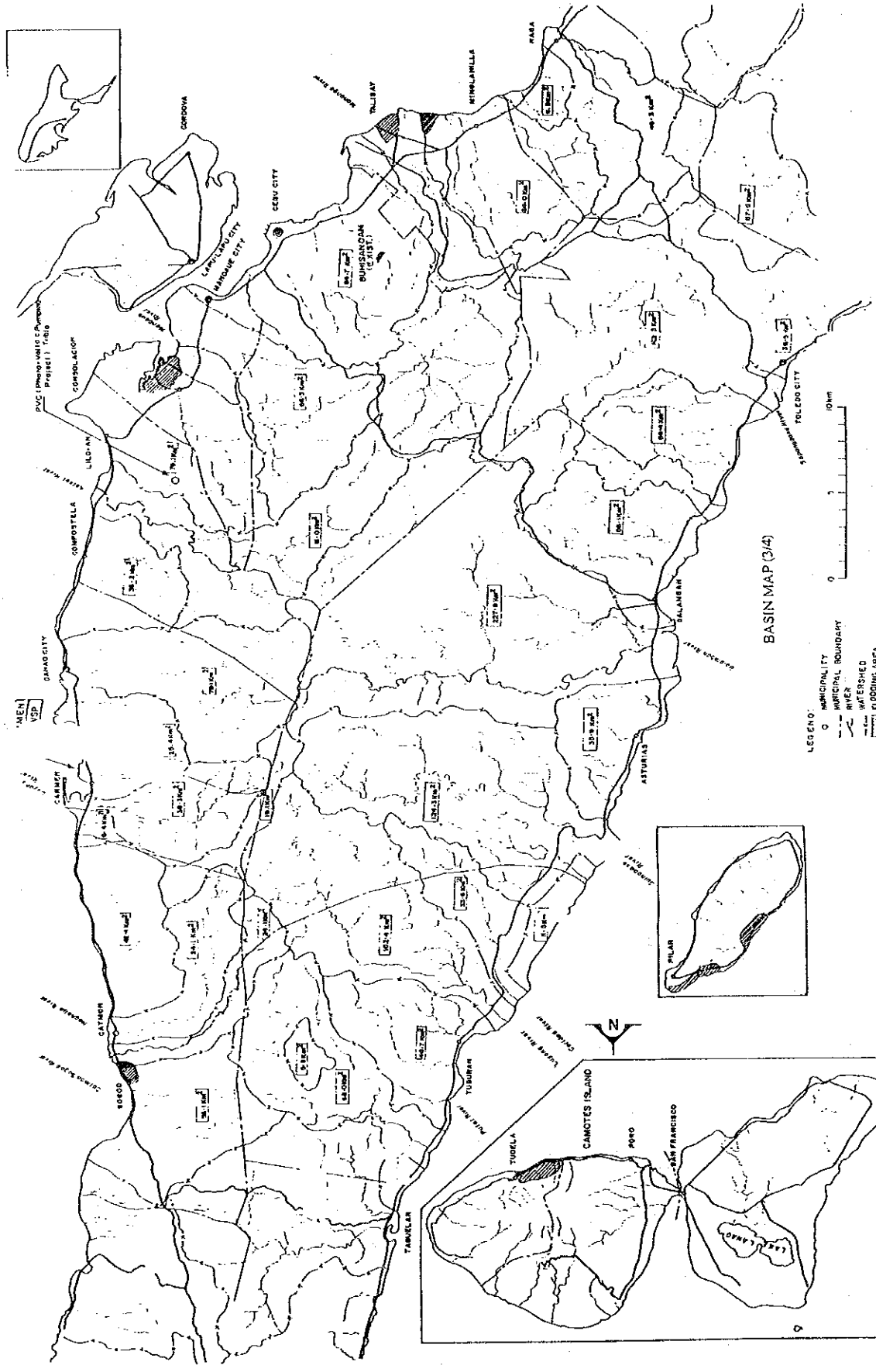


FIGURE 10.3.3 BASIN MAP (3)

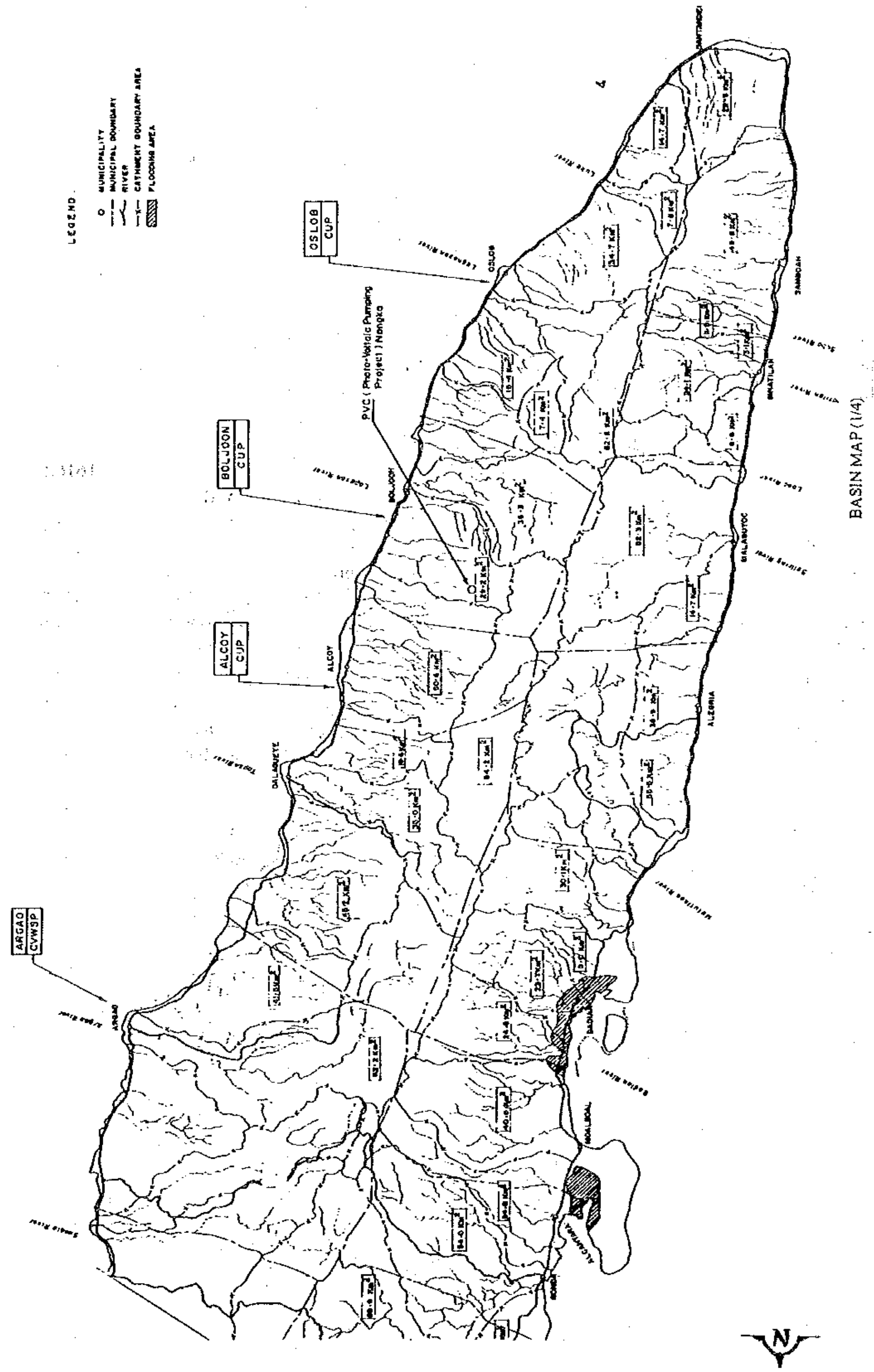


FIGURE 10.3.4 BASIN MAP (4)

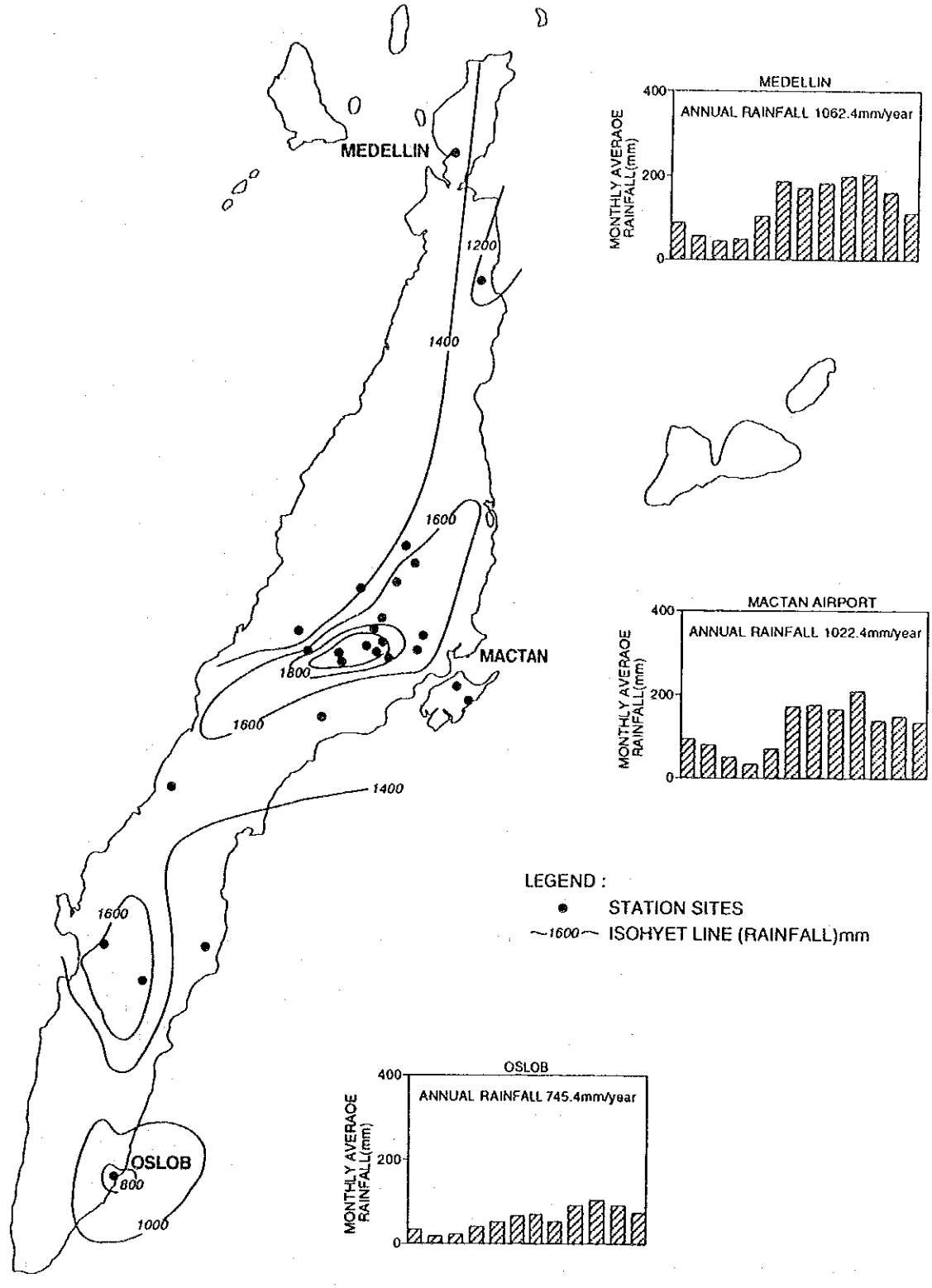
TABLE 10.3.1 LIST OF RAINFALL GAUGES

Station Name	Latitude	Longtitude	Record Period	/1 Related Organization	Ave. Annual rainfall /2 (mm/year)
Adlaon Recorder	10° 26' 33"	123° 52' 15"	1999 - present	WRC	1755.8
Adloan Manual	26' 33"	52' 15"	1977 - present	WRC	1327.6
Barili	7' 0"	31' 0"	1978 - present	WRC	1477.1
Barot (ACMDC)			1969 - 1984	ACMDC	1777.5
Biga (ACMDC)	10° 19' 28"	123° 42' 44"	1962 - present	ACMDC	1607.5
Bonbon Manual	22' 3"	49' 40"	1978 - present	WRC	1757.2
Bonbon Recorder	22' 3"	49' 40"	1978 - present	WRC	1676.7
Bucaue	20' 11"	49' 9"	1980 - present	WRC	2122.9
Buhisan #1	18' 42"	51' 3"	1976 - 1978	ERDS	1790.9
Buhisan #2	18' 56"	50' 29"	1976 - 1978	ERDS	1802.9
Buhisan #3	19' 21"	51' 43"	1976 - 1977	ERDS	-
Buhisan #4	19' 45"	51' 5"	1976 - 1978	ERDS	1999.7
Buhisan #5	19' 52"	50' 36"	1976 - present	ERDS	2077.2
Buhisan #6	20' 22"	50' 52"	1976 - 1978	ERDS	2379.4
Buhisan #7	20' 9"	51' 15"	1976 - 1978	ERDS	1899.7
Cambinocot	27' 57"	54' 12"	1977 - present	WRC	1616.6
Cambitas	23' 0"	50' 23"	1980 - present	WRC	1636.3
Camp 7-BFD	20' 0"	47' 0"	1980 - present	WRC	1353.7
Camp 7-FORI	15' 0"	47' 0"	1938 - present	ERDS	2819.1
Carmen (ACMDC)	20' 7"	43' 43"	1979 - present	ACMDC	1603.3
Cebu Customs House	17' 50"	54' 11"	1904 - 1939	PAGASA	1609.7
DAS/UG (ACMDC)	19' 12"	42' 26"	1976 - present	ACMDC	1804.6
Estancia (BPI)	20' 46"	56' 40"	1972 - present	BPI	1585.8
FRANK PIT (ACMDC)			1976 - 1977	ACMDC	1802.4
Kal-anan	57' 1"	124° 0' 50"	1980 - present	PAGASA	1158.0
Kansagahan	23' 12"	123° 46' 33"	1985 - 1985	WRC	-
Khyber Pass			1975 - 1980	ACMDC	1608.0
Lahug Airport	20' 13"	54' 18"	1949 - present	PAGASA	1636.7
Lusaran	29' 14"	53' 19"	1977 - present	WRC	1490.5
Mactan Airport	19' 13"	58' 38"	1972 - present	PAGASA	1522.4
Malubog Dam	22' 10"	43' 2"	1975 - present	ACMDC	1222.5
Mantalungon	9° 48' 48"	27' 35"	1930 - present	PAGASA	1808.1
Maribago	10° 17' 35"	59' 57"	1978 - present	WRC	1504.7
Medellin	11° 6' 57"	57' 11"	1932 - present	BOMEDCO	1562.4
NPC-TP	10° 13' 15"	45' 20"	1984 - 1985	NPC	1436.4
Odlum			1981 - 1982	ACMDC	1231.5
Oslob	9° 31' 31"	123° 25' 56"	1978 - present	WRC	745.2
RCPI	10° 22' 10"	51' 12"	1977 - present	WRC	1795.4
Sigpit	20' 51"	42' 50"	1976 - present	ACMDC	967.5
Sinsin	21' 25"	46' 56"	1980 - present	WRC	1995.8
South Lantoy			1972 - 1980	ACMDC	1749.6
Tabunan	10° 26' 12"	123° 49' 9"	1977 - present	WRC	1398.1
Talaga	9° 51' 2"	33' 47"	1977 - present	PAGASA	1225.7
Talamban (Manual)	10° 21' 10"	54' 42"	1977 - present	WRC	1575.4
Talamban (Recorder)	21' 10"	54' 42"	1977 - present	WRC	1684.5
Taytay	9° 51' 41"	23' 52"	1984 - present	PAGASA	1622.2
Tiguib	44' 30"	22' 39"	1985 - present	WRC	-

Notes:

/1 Refer to abbreviations sheet.

/2 Average annual rainfall is calculated by using the value up to 1985 December.



Source: W.R.C.

FIGURE 10.3.5 ISOHYETS MAP

The climate around Cebu City is characterized by not pronounced maximum rain period with relatively dry from November to April and wet during the rest of the year. Maximum rain period occurs any time from April to November. The average annual rainfall is 1,582 mm.

10.3.3 WATER USE

(1) Drinking Water Level

Water supply is classified into three levels by Government Policy No. 201 dated September 9, 1980 as follows:

Level 1:	Point Source	Such as well, spring or rain collector.
Level 2:	Communal Faucet System	A water supply system consisting of communal faucets, each serving about four to six households.
Level 3:	Individual House Connection System	A water supply system providing each household a service connection with one or more faucets.

Water supply condition of the province and nation's average are given in Table 10.3.2. Percentage of the safety drinking water service households in Cebu in Levels 1, 2 and 3 is below than the national average.

(2) Cost of Construction and Financing Source

(a) Water source development cost

The GOP considers Level 1 systems the fulfillment of a basic need, and 90% of the project cost is shouldered by the government. The government, however, requires that Rural Waterworks and Sanitation Associations (RWSA) be formed to operate and maintain the system, as well as contribute the remaining 10% of the cost in cash or kind. This can be in the form of labor, materials, or the land on which the facility is constructed.

Financing for the source development of Level 2 systems also includes a 90% grant from the government and a 10% mandatory contribution from the RWSA. The capital cost of the distribution systems, however, are borne entirely by the RWSAs, which obtain government loans to cover 90% of the cost and provide another 10% as equity.

For Level 3 systems, the RWSA or the water district (WD) assumes responsibility for the entire cost with 90% of the cost coming from the government and 10% from equity in the case of the RWSAs. The WDs must contribute at least 10% of the total cost.

(b) Water tariff

Water Tariffs are levied on users to enable RWSAs to pay their loans and meet operation and maintenance costs. For Level 1 facilities, water fees cover minor repair and maintenance costs. Generally, they are not collected until they are needed. Level 2 charges normally cover loan amortization, depreciation, electricity, maintenance, salaries and wages. Level 3 charges are normally based on usage as indicated by the meter and are intended to cover all debt-servicing and operating costs and to allow for a reasonable profit.

Generally speaking, there are serious problems with the collection of water tariffs at all levels. This results in poor debt-servicing and maintenance.

(3) Operation and Manintenance

The operation and maintenance of Level 1 systems is the responsibility of the RWSAs The RWSA is also supposed to undertake minor repairs, while DPWH undertakes major repairs through the District Engineers Office, which has some funds for this purpose. These funds, however, are not adequate.

For Level 2 and 3 systems, operation and maintenance are handled by the RWSAs and the WDs, using self-generated funds.

The maintenance of household sanitary facilities is the responsibility of the individual household, and the maintenance of waste water disposal systems is the responsibility of individual communities.

(4) Potable Water in Rural Areas

(a) Criteria of project selection

The factors to be considered in determining priority in project selection are as follows:

• Community commitment	This means that the beneficiary households must form themselves into WD and to discharge the responsibilities expected from such formation.
• Inadequacy of existing water supply system	This means that communities with sources of water supply that are insufficient, that are unreliable or too far from the households will have higher than priority.
• Prevalence of water related diseases	This means that preferential attention will be given to communities where diseases as gastroenteritis, dysentery, cholera, typhoid and hepatitis are prevalent.
• Development status and potential of the community	The poor and depressed areas with economic potential will be given priority.
• Capital costs per capita	Project which will cost lower per capita for a given level of service will be given preferential attention.

For example, more densely populated communities generally require lower investment per capital. Also, ground water from springs and wells which requires little or no treatment is preferred over surface water. So shallow well pumps over the more expensive deep wells is preferred.

(b) Current condition of each district

District 1 Public water system is installed by MCWD, Water District, or Water supply of Poblacion in all poblacion areas. In the coastal area of Talisay, water from wells have high chloride content. -Water system of each municipality is necessary for rehabilitation and development.

District 2 Public water system is installed by RWSA, Water District, or Water supply of Poblacion in all poblacion areas. Main water supply systems of mountain side barangay are Levels 1 and 2 system. -Deforestation causes water scarcity of ground water. The fisherman's barangay in some municipalities and tourist area in Moalboal on coastal area lack of potable water.

The water in Badian island is supplied from the mainland through pipeline.

District 3 This district area has sufficient water source compared to other districts and there are many springs for potable water.

The coastal area in Aloguinsan experience water problems due to high saline content.

All poblacion barangays except Astutias have a high level water supply system such as Levels 2 and 3.

District 4 All poblacion areas except Bantayan have the Level 3 water supply system. The water system of Tabogon does not have continuous supply because the discharge volume of water source fluctuates during dry season and wet season. The people buy water during dry season when there is no more available supply.

In the poblacion of Bantayan, the people always buy water from ambulant vendors due to insufficient water supply system. The aquifer in Bantayan island is not sufficient for deep well water system.

There is a possibility that the expansion of tourist facilities in Tabogon can experience water deficit in the future.

District 5 The poblacion area of Compostela and Liloan is covered by MCWD. The aquifer in the coastal area of said municipalities is contaminated by the saline water content.

District 6 The people of islands behind Mactan island such as Olango, Caohagan, Cambi-an and Pangan-an also have experience water deficit. Usually they have a water from poor wells or buy canned water transported from Mactan.

TABLE 10.3.2 WATER SUPPLY LEVEL OF THE PROVINCE

NOTE (1)=Own use,faucet,Community water system (LEVEL III), (2)= Sheared, Faucet, Community system(LEVELII)
(3)=Own use, Tubed/piped, Deep well (LEVEL I), (4)=Sheared, Tubed/piped, Deep well (LEVEL I) (5)=Tubed/Piped Shallow well (LEVEL I)
(6)=Dug well, (7)=Spring, Lake, River, Rain, Etc., (8)=Peddler (Sourced by 1990 census and 1992 year book) UNIT: Households

CODE	NAME	No. of Barangay	TOTAL HH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	URBAN		259,156	62,972 (24%)	75,565 (29%)	15,656 (6%)	51,636 (20%)	9,485 (4%)	22,371 (9%)	8,754 (3%)	12,717 (5%)
	RURAL		246,872	13,160 (5%)	47,498 (19%)	8,378 (3%)	43,922 (18%)	11,429 (5%)	58,676 (24%)	58,497 (24%)	5,312 (2%)
100	DISTRICT I	130	65,250	6,890 (11%)	15,878 (24%)	4,582 (7%)	17,635 (27%)	2,394 (4%)	6,860 (11%)	10,647 (16%)	364 (1%)
101	Talisay	22	18,202	2,903 (16%)	6,443 (35%)	1,780 (10%)	5,213 (29%)	339 (2%)	220 (1%)	940 (5%)	364 (2%)
102	Minglanilla	19	9,233	801 (9%)	2,278 (25%)	968 (10%)	3,492 (38%)	411 (4%)	246 (3%)	1,037 (11%)	0 (0%)
103	Naga	28	11,372	768 (7%)	1,853 (16%)	628 (6%)	3,616 (32%)	647 (6%)	1,825 (16%)	2,035 (18%)	0 (0%)
104	San Fernando	21	6,681	339 (5%)	1,137 (17%)	560 (8%)	1,805 (27%)	330 (5%)	316 (5%)	2,194 (33%)	0 (0%)
105	Carcar	15	13,438	1,380 (10%)	2,595 (19%)	351 (3%)	2,638 (20%)	548 (4%)	3,577 (27%)	2,349 (17%)	0 (0%)
106	Sibonga	25	6,324	699 (11%)	1,572 (25%)	295 (5%)	871 (14%)	119 (2%)	676 (11%)	2,092 (33%)	0 (0%)
200	DISTRICT II	286	61,515	6,156 (10%)	17,459 (28%)	1,770 (3%)	9,650 (16%)	1,980 (3%)	2,636 (4%)	21,190 (34%)	674 (1%)
201	Argao	45	10,138	519 (5%)	1,048 (10%)	493 (5%)	2,998 (30%)	266 (3%)	858 (8%)	3,936 (39%)	20 (0%)
202	Dalaguete	33	8,807	582 (7%)	2,512 (29%)	94 (1%)	1,418 (16%)	396 (4%)	133 (2%)	3,672 (42%)	0 (0%)
203	Alcoy	8	1,982	104 (5%)	1,126 (57%)	47 (2%)	201 (10%)	40 (2%)	129 (7%)	318 (16%)	17 (1%)
204	Boljoon	11	2,304	293 (13%)	120 (5%)	154 (7%)	489 (21%)	147 (6%)	11 (0%)	1,090 (47%)	0 (0%)
205	Oslob	21	4,056	762 (19%)	1,475 (36%)	0 (0%)	637 (16%)	9 (0%)	34 (1%)	1,114 (27%)	25 (1%)
206	Santander	10	2,487	292 (12%)	1,278 (51%)	66 (3%)	147 (6%)	8 (0%)	43 (2%)	653 (26%)	0 (0%)
207	Samboan	15	2,983	627 (21%)	917 (31%)	119 (4%)	181 (6%)	105 (4%)	54 (2%)	980 (33%)	0 (0%)
208	Ginatilan	14	2,307	442 (19%)	683 (30%)	89 (4%)	80 (3%)	142 (6%)	96 (4%)	775 (34%)	0 (0%)
209	Malabuyoc	14	2,781	359 (13%)	705 (25%)	145 (5%)	67 (2%)	26 (1%)	0 (0%)	1,479 (53%)	0 (0%)
210	Alegria	9	3,561	461 (13%)	834 (23%)	27 (1%)	161 (5%)	9 (0%)	104 (3%)	1,965 (55%)	0 (0%)
211	Badian	29	5,168	424 (8%)	2,910 (56%)	79 (2%)	557 (11%)	29 (1%)	28 (1%)	1,141 (22%)	0 (0%)
212	Moalboal	15	3,877	262 (7%)	1,220 (31%)	239 (6%)	488 (13%)	196 (5%)	109 (3%)	763 (20%)	600 (15%)
213	Alcantara	9	1,809	217 (12%)	446 (25%)	57 (3%)	412 (23%)	8 (0%)	17 (1%)	640 (35%)	12 (1%)
214	Ronda	14	3,086	417 (14%)	753 (24%)	46 (1%)	423 (14%)	204 (7%)	82 (3%)	1,161 (38%)	0 (0%)
215	Dumanjug	39	6,169	395 (6%)	1,432 (23%)	115 (2%)	1,391 (23%)	395 (6%)	938 (15%)	1,503 (24%)	0 (0%)
300	DISTRICT III	230	67,264	5,435 (8%)	14,151 (21%)	1,938 (3%)	11,599 (17%)	3,713 (6%)	16,083 (24%)	13,376 (20%)	969 (1%)
301	Barili	42	9,038	556 (6%)	2,519 (28%)	68 (1%)	793 (9%)	182 (2%)	2,356 (26%)	2,341 (26%)	223 (2%)
302	Aloguinsan	15	3,816	51 (1%)	464 (12%)	332 (9%)	237 (6%)	104 (3%)	2,092 (55%)	536 (14%)	0 (0%)
303	Pinamungahan	26	7,594	212 (3%)	1,086 (14%)	192 (3%)	1,689 (22%)	517 (7%)	1,720 (23%)	2,128 (28%)	50 (1%)
304	Toledo City	38	22,272	3,479 (16%)	6,146 (28%)	600 (3%)	2,354 (11%)	1,478 (7%)	5,582 (25%)	2,402 (11%)	231 (1%)
305	Balamban	28	9,198	264 (3%)	1,552 (17%)	368 (4%)	3,452 (38%)	372 (4%)	1,823 (20%)	1,296 (14%)	71 (1%)
306	Asturias	27	6,278	351 (6%)	960 (15%)	167 (3%)	1,944 (31%)	395 (6%)	597 (10%)	1,470 (23%)	394 (6%)
307	Tuburan	54	9,068	522 (6%)	1,424 (16%)	211 (2%)	1,130 (12%)	665 (7%)	1,913 (21%)	3,203 (35%)	0 (0%)

TABLE 10.3.2 WATER SUPPLY LEVEL OF THE PROVINCE

NOTE (1)=Own use,faucet,Community water system (LEVEL III), (2)= Sheared, Faucet, Community system(LEVELII)
(3)=Own use, Tubed/piped, Deep well (LEVEL I), (4)=Sheared, Tubed/piped, Deep well (LEVEL I) (5)=Tubed/Piped Shallow well (LEVEL I)
(6)=Dug well, (7)=Spring, Lake, River, Rain, Etc., (8)=Peddler (Sourced by 1990 census and 1992 year book) UNIT: Households

CODE	NAME	No. of Barangay	TOTAL HH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
400	DISTRICT IV	181	62,966	2,306 (4%)	6,626 (11%)	1,771 (3%)	9,909 (16%)	3,509 (6%)	30,199 (48%)	4,284 (7%)	4,362 (7%)
401	Tabuelan	12	3,125	162 (5%)	294 (9%)	10 (0%)	426 (14%)	129 (4%)	912 (29%)	1,192 (38%)	0 (0%)
402	San Remegio	27	7,348	198 (3%)	810 (11%)	81 (1%)	1,592 (22%)	279 (4%)	3,590 (49%)	772 (11%)	26 (0%)
403	Daanbantayan	20	10,991	792 (7%)	1,279 (12%)	432 (4%)	1,555 (14%)	1,449 (13%)	5,322 (48%)	162 (1%)	0 (0%)
404	Medellin	19	6,773	245 (4%)	679 (10%)	586 (9%)	1,385 (20%)	298 (4%)	3,383 (50%)	177 (3%)	20 (0%)
405	Bogo	29	10,633	534 (5%)	2,828 (27%)	453 (4%)	2,887 (27%)	535 (5%)	3,298 (31%)	52 (0%)	46 (0%)
406	Tabogon	25	5,076	245 (5%)	192 (4%)	102 (2%)	905 (18%)	442 (9%)	2,524 (50%)	666 (13%)	0 (0%)
407	Santa Fe	10	3,747	31 (1%)	0 (0%)	46 (1%)	83 (2%)	231 (6%)	2,797 (75%)	252 (7%)	307 (8%)
408	Bantayan	25	10,830	59 (1%)	11 (0%)	38 (0%)	62 (1%)	84 (1%)	6,094 (56%)	1,011 (9%)	3,471 (32%)
409	Madridejos	14	4,443	40 (1%)	533 (12%)	23 (1%)	1,014 (23%)	62 (1%)	2,279 (51%)	0 (0%)	492 (11%)
500	DISTRICT V	207	61,303	5,676 (9%)	15,539 (25%)	2,935 (5%)	11,987 (20%)	3,302 (5%)	8,496 (14%)	11,490 (19%)	1,878 (3%)
501	Borbon	19	4,644	170 (4%)	246 (5%)	8 (0%)	620 (13%)	369 (8%)	1,244 (27%)	1,987 (43%)	0 (0%)
502	Sogod	18	4,838	437 (9%)	798 (16%)	8 (0%)	1,266 (26%)	268 (6%)	1,092 (23%)	969 (20%)	0 (0%)
503	Catmon	20	3,967	217 (5%)	821 (21%)	87 (2%)	403 (10%)	182 (5%)	385 (10%)	1,663 (42%)	209 (5%)
504	Carmen	21	5,571	725 (13%)	1,222 (22%)	65 (1%)	660 (12%)	126 (2%)	416 (7%)	2,099 (38%)	258 (5%)
505	Danao City	42	14,460	1,499 (10%)	3,814 (26%)	544 (4%)	3,786 (26%)	595 (4%)	1,452 (10%)	2,703 (19%)	67 (0%)
506	Compostela	17	4,255	433 (10%)	688 (16%)	349 (8%)	1,058 (25%)	292 (7%)	941 (22%)	287 (7%)	207 (5%)
507	Liloan	14	8,260	685 (8%)	837 (10%)	1,536 (19%)	2,855 (35%)	492 (6%)	1,495 (18%)	202 (2%)	158 (2%)
508	San Francisco	15	6,785	510 (8%)	2,340 (34%)	253 (4%)	925 (14%)	769 (11%)	855 (13%)	235 (3%)	898 (13%)
509	Poro	17	3,911	233 (6%)	1,839 (47%)	41 (1%)	206 (5%)	108 (3%)	395 (10%)	1,089 (28%)	0 (0%)
510	Tudela	11	2,169	538 (25%)	831 (38%)	21 (1%)	208 (10%)	101 (5%)	214 (10%)	256 (12%)	0 (0%)
511	Pilar	13	2,443	229 (9%)	2,103 (86%)	23 (1%)	0 (0%)	0 (0%)	7 (0%)	0 (0%)	81 (3%)
600	DISTRICT VI	90	73,083	8,959 (12%)	16,468 (23%)	4,905 (7%)	19,698 (27%)	3,355 (5%)	13,847 (19%)	1,684 (2%)	4,167 (6%)
601	Consolacio	21	7,912	814 (10%)	1,690 (21%)	371 (5%)	3,851 (49%)	312 (4%)	545 (7%)	329 (4%)	0 (0%)
602	Mandaue City	27	34,403	6,329 (18%)	10,351 (30%)	2,818 (8%)	11,995 (35%)	1,487 (4%)	648 (2%)	21 (0%)	754 (2%)
603	Lapu-Lapu City	29	26,762	1,505 (6%)	3,715 (14%)	1,658 (6%)	3,577 (13%)	1,305 (5%)	10,427 (39%)	1,242 (5%)	3,333 (12%)
604	Cordova	13	4,006	311 (8%)	712 (18%)	58 (1%)	275 (7%)	251 (6%)	2,227 (56%)	92 (2%)	80 (2%)
700	Cebu city	81	114,597	40,710 (36%)	36,942 (32%)	6,133 (5%)	15,080 (13%)	2,611 (2%)	2,926 (3%)	4,580 (4%)	5,615 (5%)
TOTAL		1,205	518,392	76,132 (15%)	123,063 (24%)	24,034 (5%)	95,558 (18%)	20,864 (4%)	81,047 (16%)	67,251 (13%)	30,443 (6%)
NATIONAL TOTAL (1,000 Households)			10,535	2,507 (24%)	1,675 (16%)	1,696 (16%)	1,697 (16%)	Incl.in (3)&(4)	1,734 (16%)	957 (9%)	269 (3%)

(c) Photo voltaic pumping project (solar pumping system)

Photo voltaic pumping project was implemented in five sites as shown in Table 10.3.3 under the agreement between the GOP, DOE-NCER, GTZ, PG-PVP on 1992 in order to provide potable water in remote rural areas. WRC has been delegated the task to implement the water distribution network in the project area. Olango Island, Lapu-Lapu City also has had photo voltaic pumping system for seven or eight years now installed by another project. Maintenance of technical part of these system is supported by WRC.

TABLE 10.3.3 PHOTO VOLTAIC PUMPING PROJECT

Unit : Peso

PROJECT NAME	LOCATION	COST					
		GTZ	DOE-NCED	PROVINCE	RAFI	CUP	TOTAL
PVP-BAGTIK	San Remingo	3,000,000	128,000	1,909,763	-	-	5,037,763
PVP-CAWASAN	Aloguinsan	2,300,000	128,000	1,067,594	150,000	-	3,645,594
PVP-HILANTAGAAN	Santa Fe	1,150,000	128,000	1,391,502	-	-	2,669,502
PVP-NANGKA	Boljo-on	870,000	128,000	-	-	600,000	1,598,000
PVP-TABLA	Liloan	1,350,000	128,000	631,141	150,000	-	2,259,141
TOTAL		8,670,000	640,000	5,000,000	300,000	600,000	15,210,000
OLANGO ISLAND	Lapu-Lapu City	No Data					

(4) Potable Water of Urban Area

(a) Toledo City

Toledo city has high level water supply system which composes of three water sources of deep well near or in Toledo City with electric pumps and water tanks. The service area covers barangay Poblacion, Ibo, Ilihan and Sangi and has installed a service connection faucet of 1,076 units in 1993. The water tariff of the locality is 37.5 Pesos/month until 10 cu.m./month and additional charge 3.00 to 3.75 pesos/cu.m above 10 cu.m/month. The organization of the water service is under the City Government.

The city has proposed two spring development projects, namely; Sagay spring and Cantabaco spring. Sagay spring development has three schemes which generate 25,000 cu.m/day. The construction cost is 118,422 million pesos in 1992 price. Cantabaco spring development has two schemes which generate 7,000 cu.m/day with a construction cost of 37 million pesos in 1992 price.

(b) Danao City

Danao City has a Level 3 water supply system in the barangay Poblacion, Saba and Looc. Water is originated from three springs with two electric pumps. Recently, existing distribution pipe network which was constructed before the Second World War was rehabilitated and extended. Water charge is 25 pesos/20 cu.m/month. Since present water demand exceeds the supply capacity, potable water is supplied with hourly scheduling for each area.

Danao City plans to extend the service area and development of additional water source. But this plan is still pending due to lack of funding.

(c) MCWD (Metro Cebu)

MCWD covers the urban area of Metro Cebu such as Talisay, Compostela, Liloan, Consolacion, Mandaue City, Lapu-Lapu City and Cebu City. Figure 10.3.6 indicates the supplied area of MCWD. The supplied area except Cebu City is only along national road or a major road. Even in the service area, private wells are still used. Present water use condition (1990 year) is shown below.

Water demand (a)	172,810	cu.m/day	
Domestic	146,844	cu.m/day	(85% of (a))
Commercial and Industry	23,401	cu.m/day	(14% of (a))
Others	2,565	cu.m/day	(1% of (a))
MCWD's water Production (b)	80,000	cu.m/day	
User consumption	49,000	cu.m/day	(28% of (a), 61% of (b))

Estimated discharge diagram of MCWD's water supply in 1993 is shown in Figure 10.3.7. This Figure shows that main water sources are Liloan, Consolacion and Cebu and water is conveyed from these areas to main consumption area, Cebu City.

It is clear that withdrawal of MCWD's and private wells is above the safe yield of the aquifer and Mananga project should be implemented.

A report "Cebu Water Supply Project, Phase I" in 1986 was carried out the ground water model study. The study suggested that MCWD water production in existing wellfields in the coastal aquifer can safely proceed at the following rates with actual water production on 1993:

TABLE 10.3.4 DAILY WATER PRODUCTION

Unit: cu.m/day

Wellfield	Recommended Average Daily Water Production (cu.m)	Present Actual Production (Aug., 1993)
Canamucan	1,000	590
Cabadiangan	9,600 (7,200 after 1995)	-
San Vicente	23,300 (17,500 after 1995)	15,954
Consolacion	14,200	11,792
Talamban	21,600	22,000
Old Wells	3,900 (Phase out by 1992)	24,977
Tisa/Pardo	12,500	9,287
Mananga (Tabunok)	6,000	9,025
Total MCWD Production from Coastal Aquifer:	92,100 (83,900 after 1995)	93,625 (Excluding Mactan Is.)

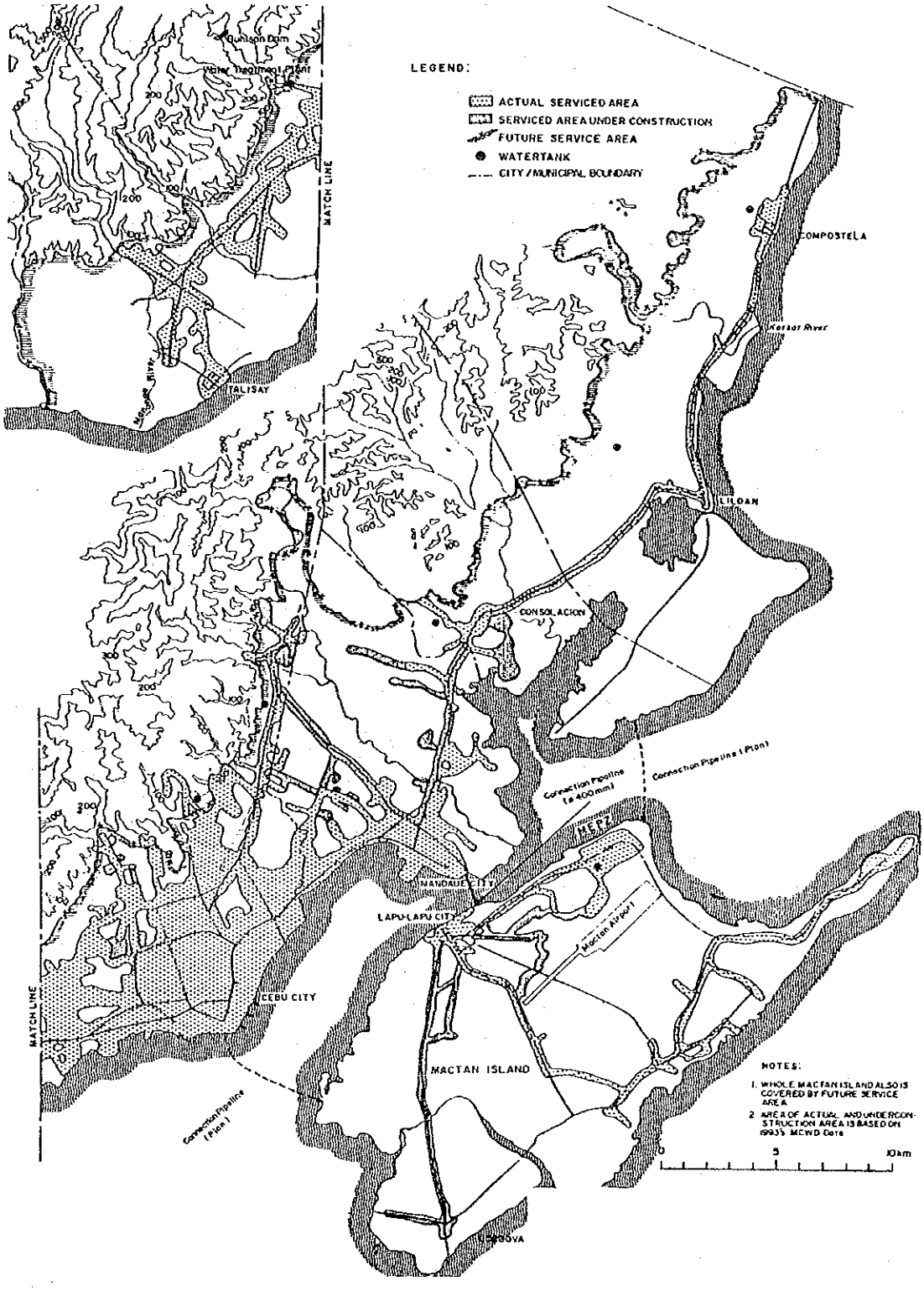


FIGURE 10.3.6 SERVICE AREA OF MCWD

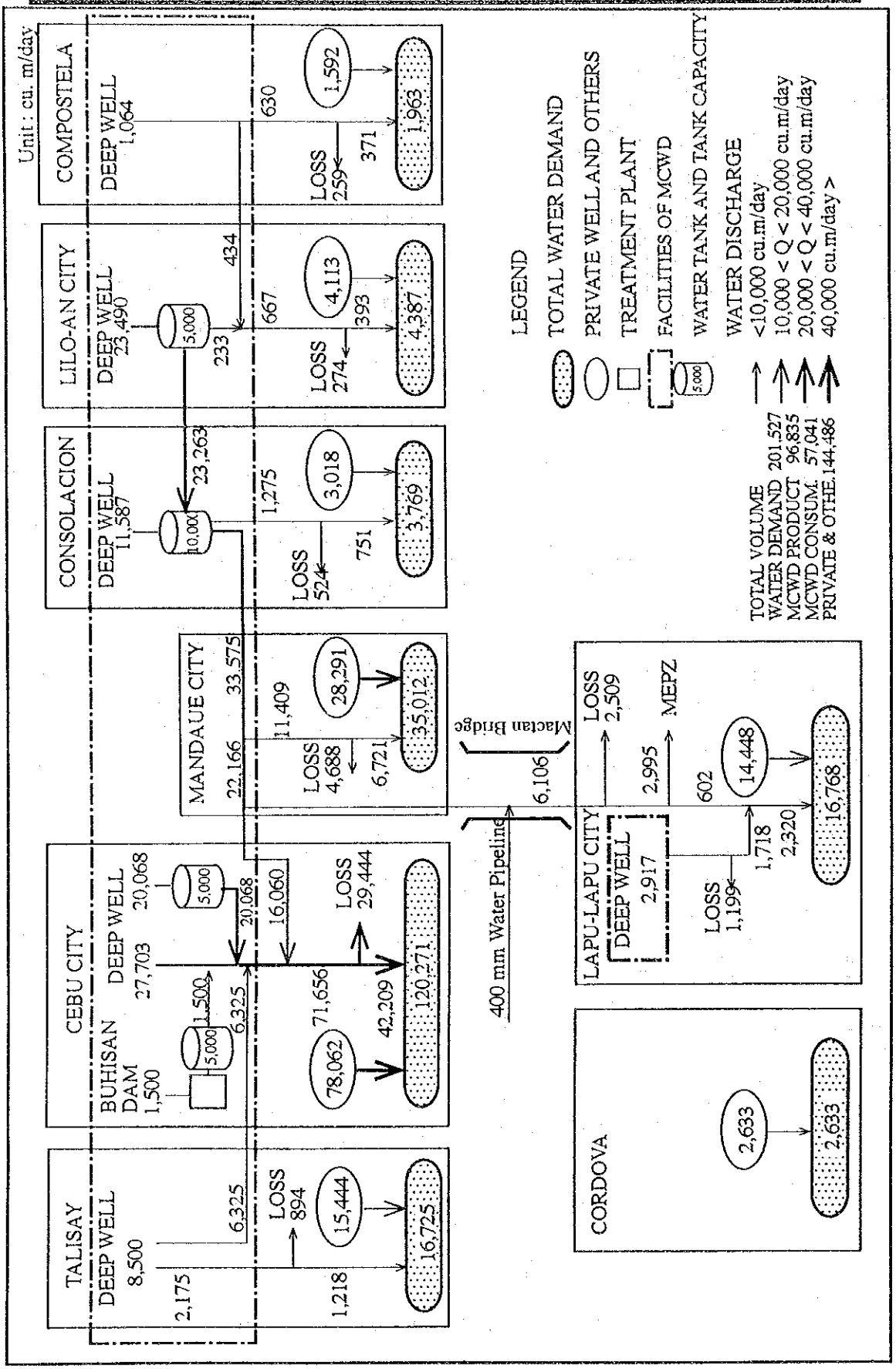


FIGURE 10.3.7 FLOW DIAGRAM OF PRESENT WATER SUPPLY OF METRO CEBU

The water withdrawal of private wells can also be expected to keep the safe yield within 92,000 cu.m/day and this is the same as MCWD's safety yield. Therefore, the total safe yield discharge is expected to be approximately 184,000 cu.m/day.

Buhisan dam (29 m high) which was constructed before the Second World War is still functional and supplied the water of about 500 cu.m/day in dry season to 2,800 cu.m/day in wet season to Cebu City through the existing water purification plant.

Water loss ratio figures in the Philippines is large, about 40% against 10% in Japan, but it is very difficult to reduce its ratio because the existing pipe network has no blocking system and no water meter on the main pipes as well as old and very much complex. Most places cannot maintain the specified water pressure, 7 m that LWUA specifies.

Collection of water charge is handled in its head office in Cebu City and branch offices in every municipality and city or through major banks. Ratio of collecting water charge to all consumers was reported to be more than 80%.

Reportedly, water of some wells owned by MCWD is contaminated by heavy metal which will be deduced to come from illegal industrial waste dumping. Heavy metal contents ratio is still less than maximum allowable value. A few wells in Mactan island have high chlorine and intend to increase its ratio.

(5) Industrial Water

The factories at rural area uses the water from private wells. At the urban area, they use MCWD supplied water or private wells. Especially, the large-scale factories at Mactan island uses the water supplied from MCWD.

(6) Fish Pond

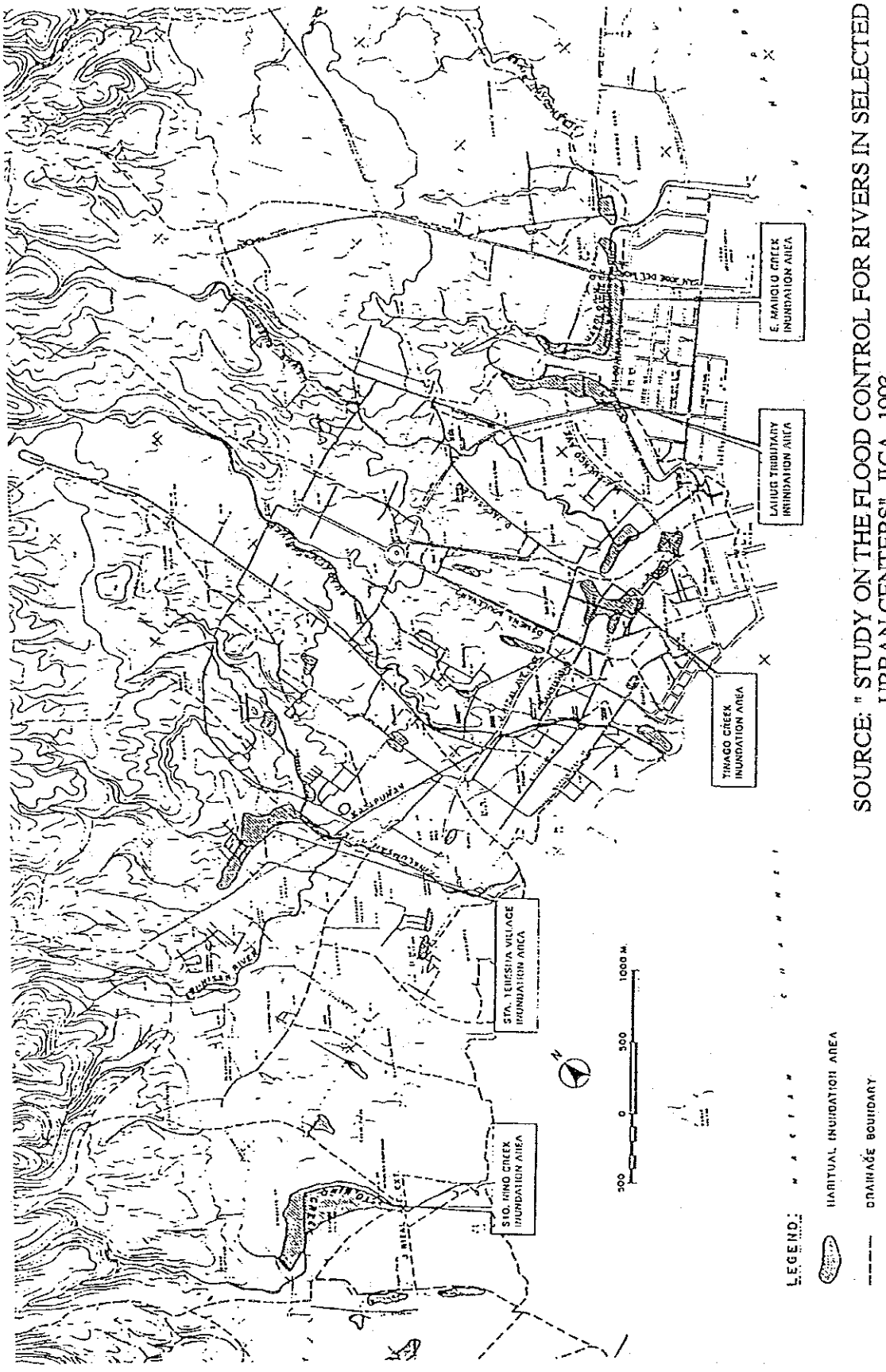
Fish ponds also use much fresh water. It uses both fresh water and sea water. The ratio of fresh water and sea water volume is varied due to the kind of fish, growth process of fish, and so on. There is no data about water consumption of fish pond where the report of DAR-7 mentioned Talisay, Minglanilla, Argao, Carcar, Dalaguete, Asturias, Toledo City, Balamban, Pinamungahan, Consolacion, Liloan and Lapu-Lapu city. And total operational area in the Province is 8,047 ha in 1990 using DAR-7 data.

It is reported that the farm and private wells around the pond are damaged due to excessive withdrawal of the fishery pond wells in Carcar and some area in the Province.

10.3.4 FLOOD CONTROL AND DRAINAGE SYSTEM

In Mananga river, Argao river, Kotkot river and some other rivers in the Province not only floods occurs but soil erosion because of changes in water flow route. Recently, the construction of dike in Argao river is underway funded by CDF (Countrywide Development Fund).

In Cebu City, inundation area is shown in Figure 10.3.8. Rivers of Cebu City have steep banks, short concentration time and deep sediments near the river mouth.



SOURCE: " STUDY ON THE FLOOD CONTROL FOR RIVERS IN SELECTED URBAN CENTERS", JICA, 1993

FIGURE 10.3.8 HABITUAL INUNDATION AREA (A4 LANDSCAPE)

By National Disaster Coordinating Council (NDCC), DND, the flood damage from 1982 to 1991 is listed in Table 10.3.5.

TABLE 10.3.5 FLOODING DAMAGE FROM 1982 TO 1991

Damage	Amount
Casualties	
Dead	49 persons
Injured	66 persons
Missing	7 persons
Population affected	638,209 persons and 123,026 families
Homeless	180,546 persons and 30,091 families
House destroyed	
Totally	30,091 families
Partially	81,078 families
Infrastructure	104.224 Million ₱
Crop, livestocks and fisheries	0.728 Million ₱
Private properties	172.881 Million ₱

Drainage system gathers domestic, commercial and industrial waste water as well as rainfall. Most of the systems are made by concrete pipes and pits, and not an open channel type in the urban area. These system are difficult to maintain if it plugged by sludge or garbage than open type. Some cover plate at drain pits are lost and these pits are laid without cover or covered with large concrete lump instead of concrete cover. Most of them are not functional or deteriorated by a sediment and garbage. The reason for this degradation is not only due to lack of maintenance, but also people's low morals as illustrated with throwing garbage into drainage. Downtown where elevation is low tend to inundate due to heavy rains.

10.3.5 SEWER

Public sanitation poses very serious problem in Cebu City. At present, there is no existing public sewerage system in Cebu City. The storm water drainage conveys waste flow and septic tank effluents. In most cases, the storm drains are not properly designed and sometimes cannot accommodate the volume of water. This often occurs during heavy rains and when flooding takes place, septic tank effluents are carried out into the streets.

An existing sewage treatment plant serves a soft drinks company and a local supermarket. It was designed to serve the industrial and commercial establishments to be constructed within the area reclaimed by the Public Estates Authority (PEA). Presently it is operated by Cebu City's Department of Public Service (DPS). This plant has a treatment capacity of 5,000 cu.m/day using the aerated lagoon system. The system consists of a single lagoon with four sets of submersible mechanical aerator. The effluent from the lagoon is being directly discharged to the sea. The existing sewer lines are the 300 m of 300 mm diameter and 700 m of 450 mm diameter pipes along 7th Avenue, Reclamation area. These lines serve, however, only

two establishments: a major soft drinks bottling plant and a leading supermarket in Cebu City. The collected waste water is conveyed to the lone existing treatment plant nearby at Queen City Garden.

Lapu-Lapu City is anxious to establish a sewage treatment system because of increasing waste water from resorts industrial and commercial establishment. It has no plan of studying the sewerage system presently.

10.4 MAIN PROJECTS AND STUDIES RELATED TO WATER RESOURCES

10.4.1 CVRMC

The Central Visayas Resource Management Center (CVRMC) was established by the RDC as an interim office to handle the following:(1) winding up of CVRP I financial and administrative matters, (2) custody, transfer and disposal of CVRP I properties, (3) sustain and expand Community-Based Resource Management (CBRM) learnings initiated by CVRP I through trainings and extension, and (4) project preparation of CVRP Phase II.

The center is operated under the supervision of the RDC VII utilizing structures, equipment, facilities and excess funds of CVRP I.

10.4.2 CUP

The Cebu Upland Project (CUP) was created on mid of 1986 through an agreement between the Government of the Philippines and the former Federal Republic of Germany (FRG). The project aims to improve the living condition as well as initiate the rehabilitation and stabilization of the natural environment in Alcoy, Boljoon and Oslob all of Cebu Province.

The provision of water supply facilities is a part of the component being implemented in communities covered by the project.

10.4.3 CVRP

The Central Visayas Regional Project, phase 1 (CVRP-I) was funded by the World Bank. It used the community-based resource oriented approach in achieving economic development in selected watersheds (including the entire province of Siquijor) in Region VII. It also included water supply development in some of its project sites.

10.4.4 CDOP

The Community Development Outreach Project (CDOP) was conceived by the Provincial administration of Governor Vicente de la Serna. It aims to deliver basic services up to far barangays of Cebu Province using an integrated approach. The project envisions to introduce a new kind of community development approach that will address the community needs. The project has the following components to

address its envision: (1) agriculture and fisheries, (2) environmental and natural resources, (3) health, (4) education, and (5) cooperative and livelihood.

Under the environmental and natural resources component, the construction of mini-dams and other water catchment facilities are being implemented to stabilize the underground water acquifer of Cebu Island.

10.4.5 CVWSP

The Central Visayas Water and Sanitation Project (CVWSP) is a joint project between the Government of Australia (GOA) and the Government of the Philippines (GOP). It is administered at the regional level by the Regional Development Council (RDC); implemented at the Provincial level by the provincial governments of Bohol, Cebu, Negros Oriental and Siquijor with the support of DPWH, DOH and DILG. The GOA through AIDAB provides technical assistance and hardware. The project began in April 1991 and will continue for five years upto the middle of 1996.

10.4.6 METRO CEBU WATER SUPPLY PROJECT

Metro Cebu Water Supply project of the Metro Cebu Water District (MCWD) has five projects as follows:

1. Mananga River Phase 1, Maghaway Valley Development
2. Mananga River Phase 2, Mananga Dam Project
3. Lusaran Dam Project
4. Inabanga-Bohol Project, Phase 1
5. Inabanga-Bohol Project, Phase 2

(1) Mananga River Phase 1

This project involves the construction weir along the Mananga River at the Maghaway Valley, at the location where natural geological formations allow the infiltration of the water into the aquifer, for subsequent pumping, treating, and distribution. Layout is shown in Figure 10.4.1

• Components:	• Diversion weir 7.5 m height x 60 m crest length. • Infiltration and sedimentation basin. • 19 deep wells. • Reservoir, high level raw water balancing reservoirs (2,000 cu.m) and service reservoir with chlorination facilities (5,000 cu.m). • Collection, transmission, and distribution mains (5 km); purchase of pipes, fittings, and valves; service connections (15,000); and the necessary power line extensions.
• Supply Capacity:	• 3,000 cu.m/day
• Project cost and schedule:	• Total cost is P838.8 million funded by ADB and the detailed design was already finished on 1990.

(2) Mananga River Phase 2

Mananga Dam Project, involves the construction of a dam on the Mananga River 3 km upstream of the Maghaway Valley and the transmission of water from the dam through a transmission tunnel to water reservoir in Tisa where the water is treated for distribution. Project feature is given in Figures 10.4.2 and 10.4.3.

• Components:	• Mananga Dam, 90 m high and gravity concrete dam • Transmission tunnel of 3.8 km • Mini-Hydro power plant of 660 kW. • Reservoir/treatment/distribution; 3 units x 5,000 cu.m reservoir in Tisa, water treatment plant and 100 km of transmission and distribution pipeline
• Supply Capacity:	• 95,000 cu.m/day
• Project cost and schedule:	• Total cost is ₱3.307 billion funded by ADB and the detailed design will be started soon.

(3) Lusaran Dam Project

This project involves the construction of a dam on the Balamban River and the 8.3 km transmission of water from the dam reservoir through a transmission tunnel of 7.6 km to water reservoir in Talamban where the water is treated for distribution. Project feature is given in Figure 10.4.4.

• Components:	• Lusaran Dam, 100 m high and earth dam • Transmission tunnel of 7.6 km • Construction of reservoir, treatment and distribution
• Supply Capacity:	• 160,000 cu.m/day
• Project cost and schedule:	• Total cost is ₱4.7 billion and the detailed design was finished in 1979, but it is necessary to modify the design.

(4) Inabanga-Bohol Project, Phase 1

This project involves the construction of diversion weir on the Inabanga River and transmission pipeline and treatment plant. Project feature is given in Figure 10.4.5 and 10.4.6.

• Components:	• Diversion weir • Intake pumping station and standby power station • Water treatment plant and treated water storage at Bohol. • Treated water transmission main to the coast • Treated water receiving reservoir tank and distribution pumping station at Mactan island.
• Supply Capacity:	• 130,000 cu.m/day

• Project cost and schedule:	• Total cost is P4 billion and MCWD collects the basic data presently.

(5) Inabanga-Bohol Project, Phase 2

involve the 60 m high dam on the Inabanga River, hydro-power station and treatment plant. Project feature is given in Figure 10.4.7.

• Components:	- 60 m high dam - Hydro-power station - Extension of water treatment plant
• Supply Capacity:	- 260,000 cu.m/day
• Project cost and schedule:	- Total cost is P6.5 billion and MCWD collects the basic data presently.

10.4.7 RURAL WATER SUPPLY IV

The Rural Water Supply IV is being implemented nationwide by the Department of Public Works and Highways (DPWH). The project started in 1991 and will be completed by the end of 1994. All the provinces in Central Visayas are covered by this project. This project covers the construction and rehabilitation of deepwell pumps, installation of shallow well pumps and the development of springs.

The project is funded under the 16th Yen credit package of OECF.

10.4.8 BELGIAN WATER SUPPLY PROJECT

On November 1988, the Government of the Philippines (GOP) and the Government of the Kingdom of Belgium (GOB) came into an agreement relative to the provision of water supply system to five municipalities in Cebu. The municipalities benefited by the project are Borbon, Carcar, Dalaguete, Pinamungahan, and Moalboal. Under the agreement, the Belgian government provided a grant in terms of materials (pipes) in the amount of Forty Million Belgian Francs (BF 40,000,000) while the Philippine Government bear the other cost not covered by the grant.

The project was being implemented by the Local Water Utilities Administration (LWUA) in coordination with the Provincial Government of Cebu.

10.4.9 JICA'S FLOOD CONTROL STUDY IN METRO CEBU

JICA "Study on The Flood Control For Rivers in The Selected Urban Centers" team is studying Cebu city's five rivers, namely Bilacao, Kinalumsan, Guadalupe, Lahug and Subang Daku rivers from west since January 1993. They have a program of the study; 1st, making the master plan of flood control about selected such four cities as Iloilo city, Cebu city, Ormoc city and Tacloban city, 2nd preparing the feasibility study the one city in above four cities until end of 1994.

10.4.10 RETARDING DAM PROJECT IN METRO CEBU

Feasibility study of "Retarding Dam Project in Metro Cebu " was done in 1991 about Phase 1 requested by Cebu City and in 1992 about Phase 2 by the Province.

Both projects proposed 1.8 m high mini dam construction made by gabion. And its functions are as follows:

1. Enhancement of groundwater recharge,
2. To prevent further loss of eroded soil and to retain eroded soil and thus prevent siltation of the downstream drains and esturaries,
3. To reduce the magnitude of flood peaks due to excess runoff during heavy rains, and
4. To improve ecological balance through immovable soil and recharge of groundwater.

Phase 1 studied the Metro Cebu rivers such eight rivers as Pardo, Kinalumsan, Guadalupe, Lahug, Mahiga, Nasipit, Budlaan, and Butuanon-Cambaog and recommended 87 mini dams construction as the urgent work. Phase 2 also did the critical watersheds in Western Central Cebu area, namely: Himatugan, Cabagdalan, Singsing-Baliwagan, Buanoy, Ma-ingit, Cantabaco, Pondol, and Talavera and recommended 283 mini dams construction immediately.

SOURCE: " MANANGA RIVER PHASE I " , LWUA & MCWD, 1991

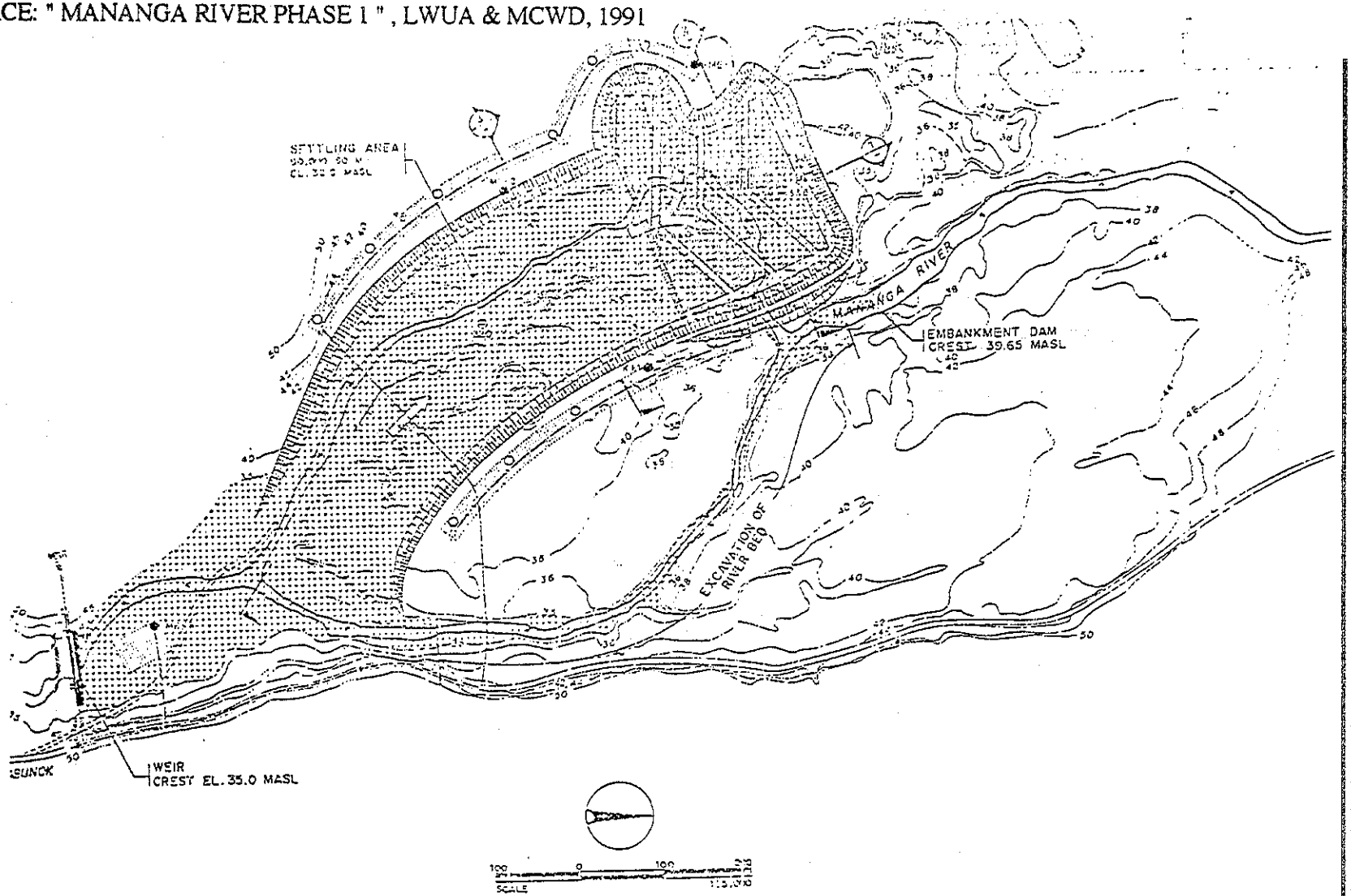
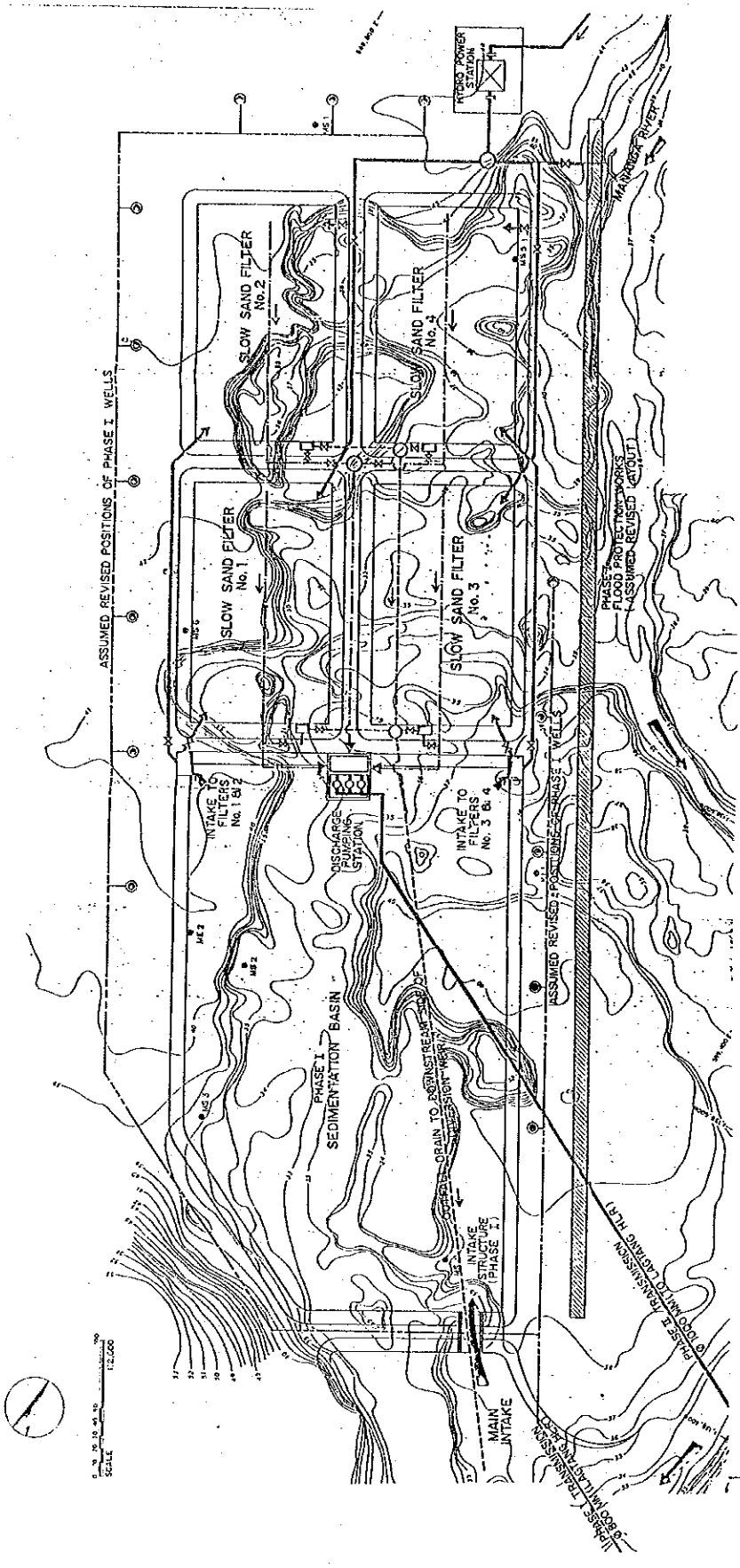


FIGURE 10.4.1 LAYOUT OF MANANGA PHASE I



SOURCE:" MANANGA RIVER PHASE I", LWUA & MCWD ,1991

FIGURE 10.4.2 GENERAL PLAN OF MANAGA PHASE PROJECT

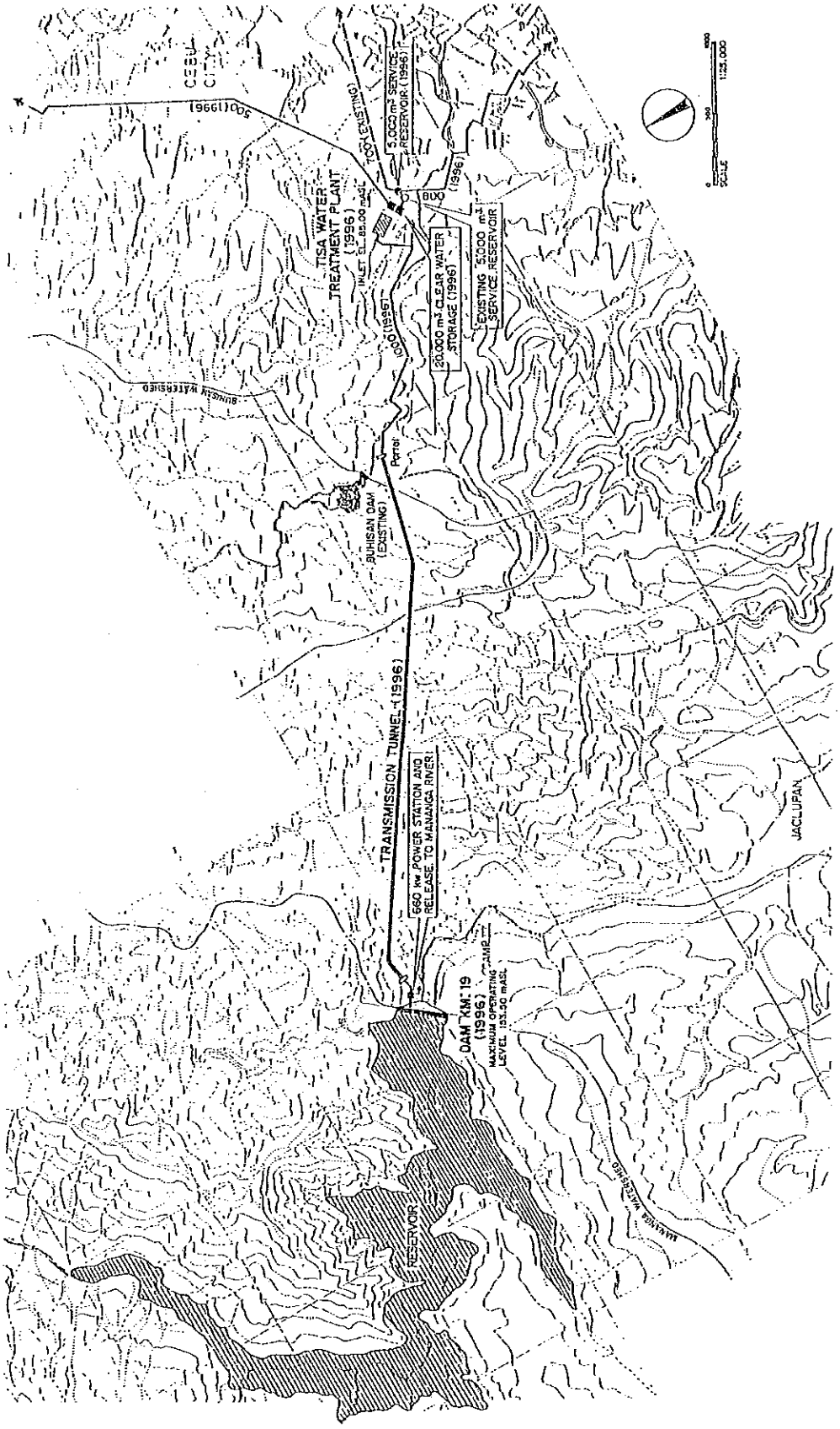
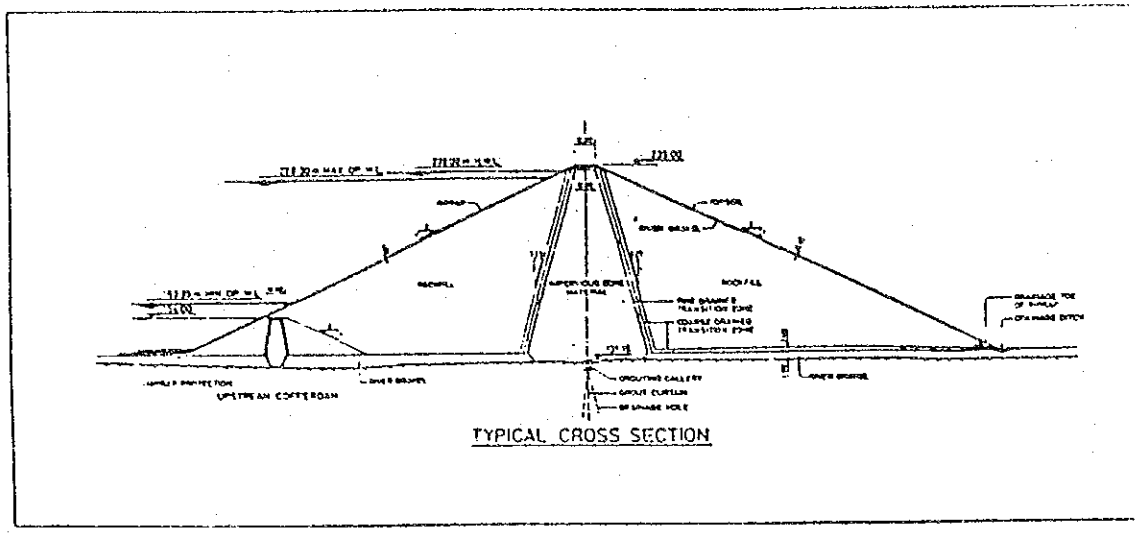
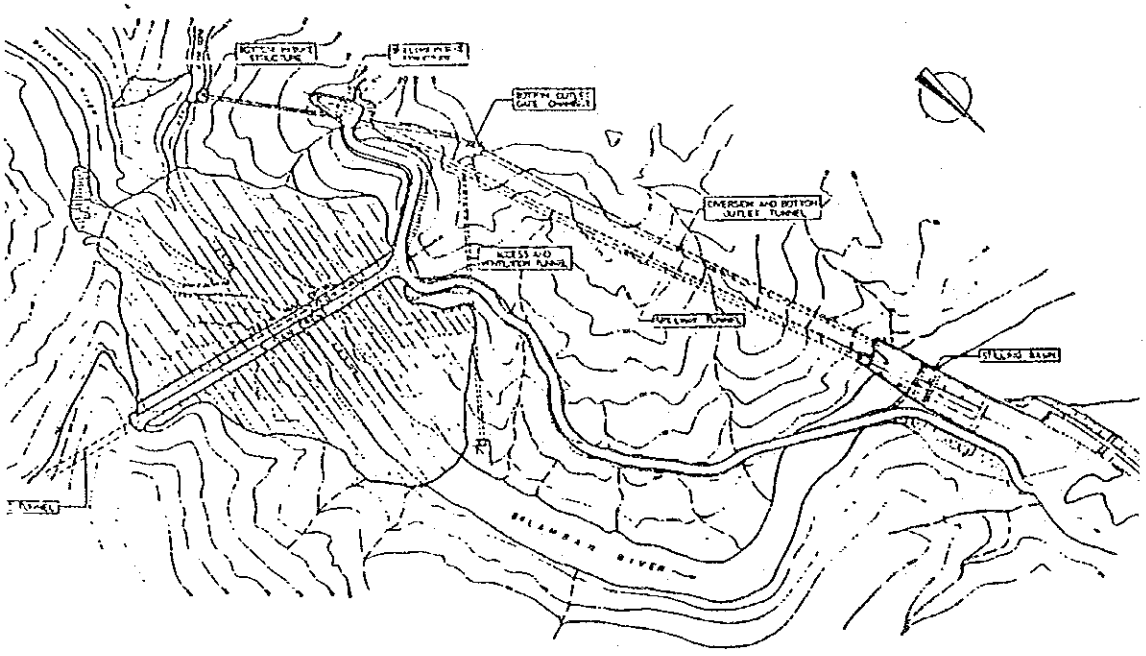


FIGURE 10.4.3 GENERAL PLAN OF MANANGA PHASE 2



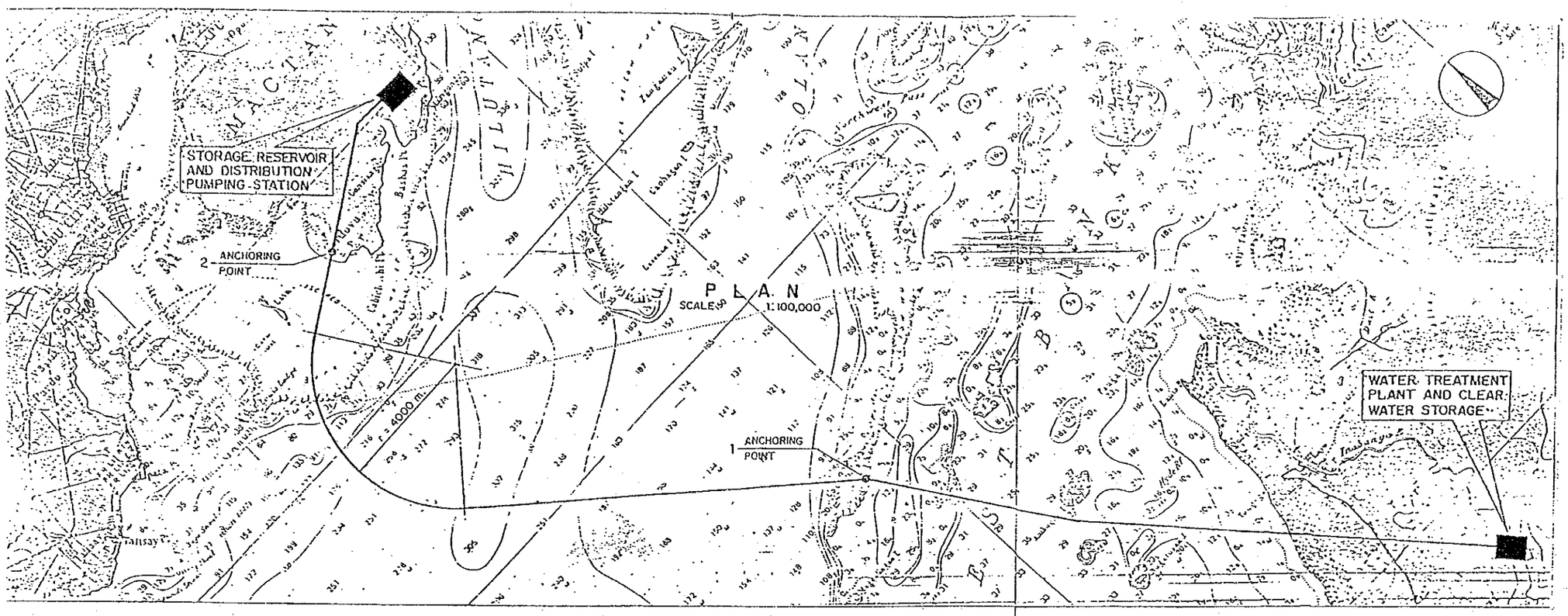
TYPICAL CROSS SECTION

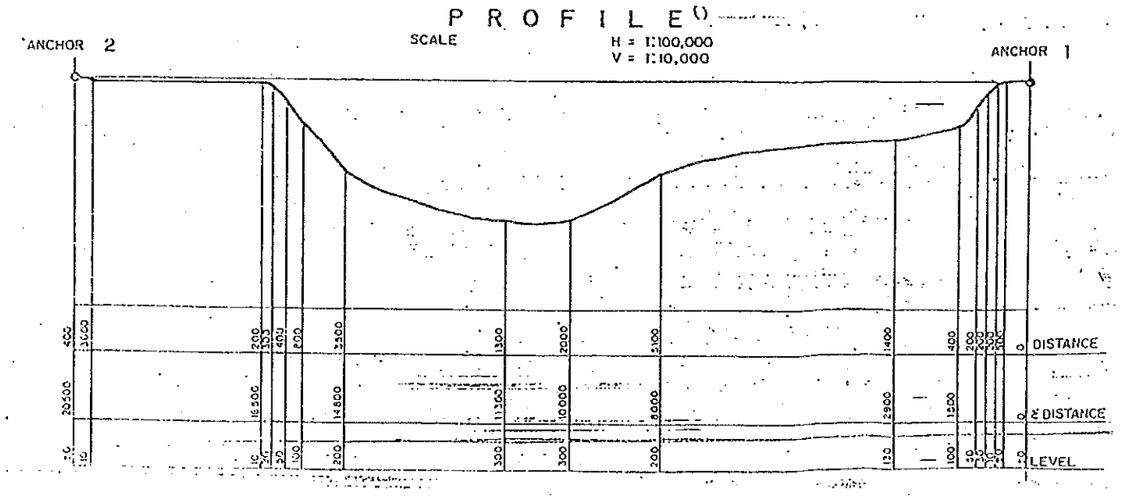


LUSARAN DAM

SOURCE : " METROPOLITAN CEBU WATER DISTRICT PROJECT", LWUA, 1979

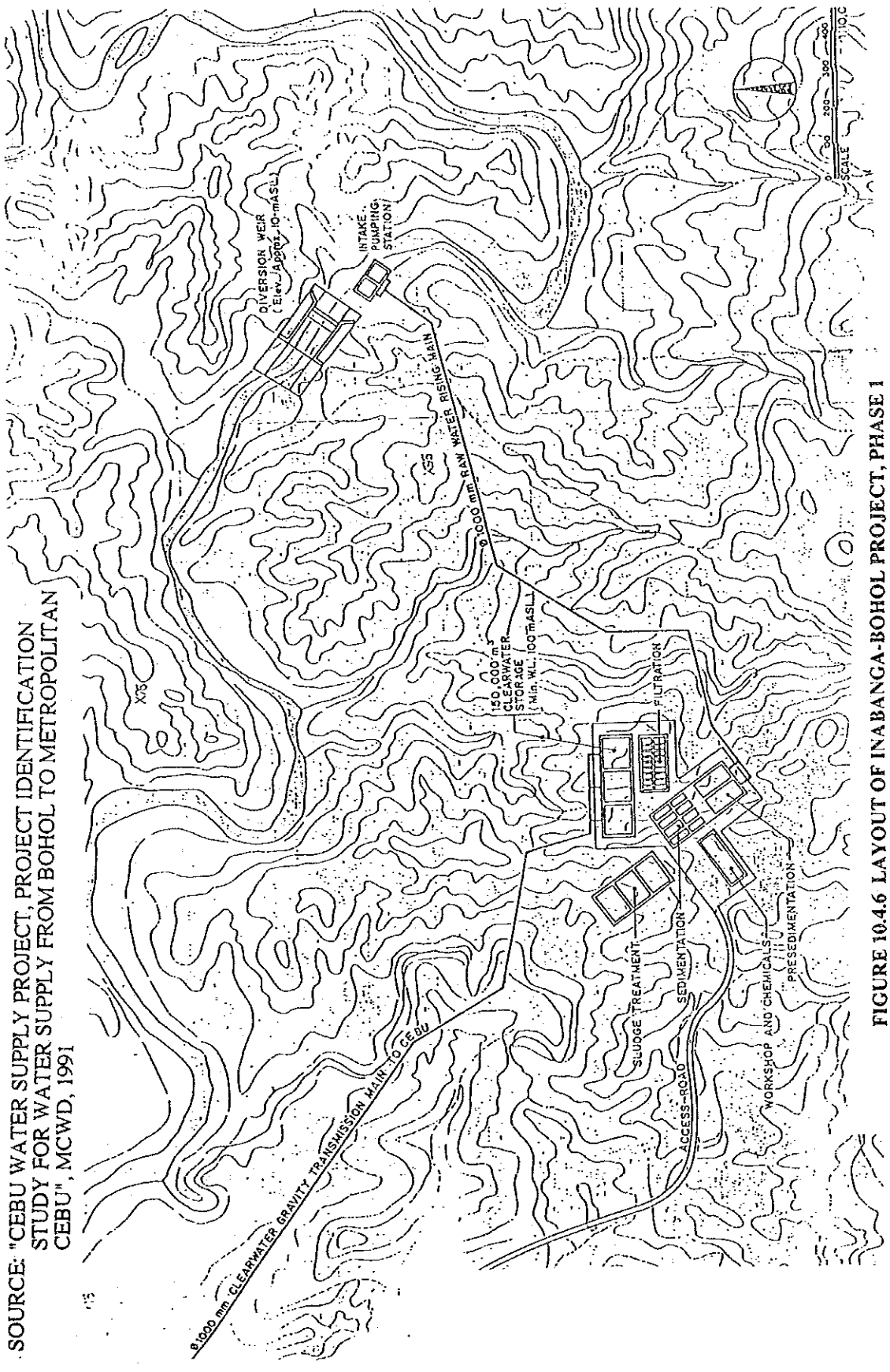
FIGURE 10.4.4 LUSARAN DAM





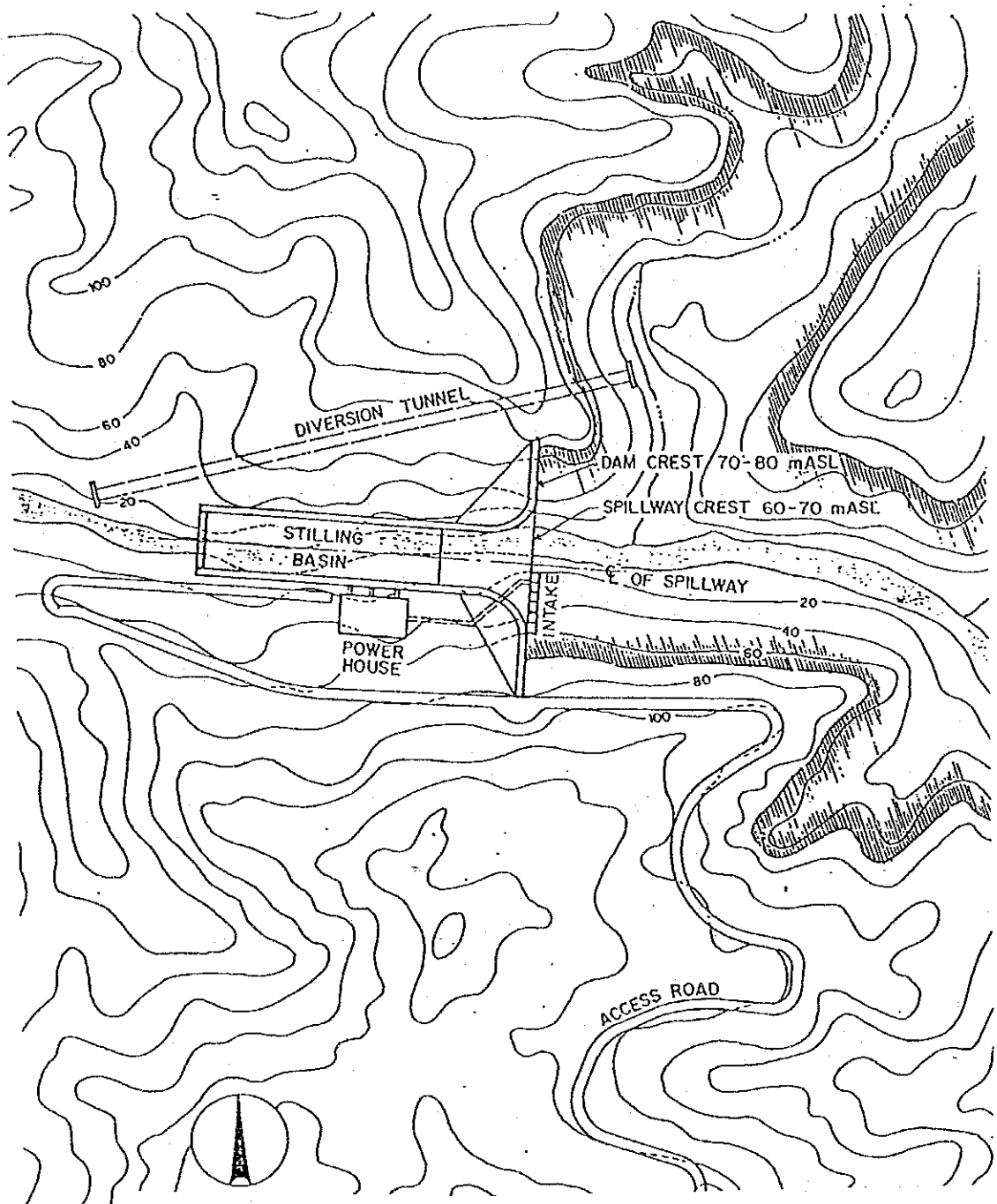
SOURCE:" CEBU WATER SUPPLY PROJECT , PROJECT IDENTIFICATION STUDY FOR WATER SUPPLY FROM BOHOL TO METROPOLITAN CEBU ", MCWD, 1991

FIGURE 10.4.5 GENERAL LAYOUT OF INABANGA-BOHOL PROJECT



SOURCE: "CEBU WATER SUPPLY PROJECT, PROJECT IDENTIFICATION STUDY FOR WATER SUPPLY FROM BOHOL TO METROPOLITAN CEBU", MCWD, 1991

FIGURE 10.4.6 LAYOUT OF INABANGA-BOHOL PROJECT, PHASE 1



SOURCE: "CEBU WATER SUPPLY PROJECT, PROJECT IDENTIFICATION STUDY FOR WATER SUPPLY FROM BOHOL TO METROPOLITAN CEBU", MCWD, 1991

FIRURE 10.4.7 LAYOUT OF INABANGA DAM

10.5 WATER POTENTIAL AND PROSPECTS

Water potential is composed of surface water and ground water. Generally, preliminary evaluation of water potential has been carried out on the basis of the mean annual rainfall and runoff maps and observed annual rainfall and stream discharge.

Runoff ratio can be calculated using mean annual rainfall and observed discharge data by each river. The data for calculating the ratios of runoff in the Province is not so much, there are only two reports, namely, the "Cebu River Basin" by NWRC in 1982 and the "Hydro Power Potential of Cebu Island" by the Philippine German Special Energy Program (PGSEP) by GTZ in 1988. Runoff coefficient in two reports is shown in Table 10.5.1. According to the report on "Hydro Power Potential of Cebu Island" the estimated value of runoff discharge is not precise and the mean run-off coefficient of 0.4 is adopted under the consideration of mis-estimation of discharge and rainfall. Since there are no data available, the runoff coefficient of 0.4 is employed as far as the study is concerned. In addition to the above, "Rapid Assessment of Water Supply Source (province of Cebu)" conducted by NWRB in May 1982, mentioned about ground water. In this report, safe yield concept is adopted to assess ground water potential, that is, ground water is part of the hydrologic cycle and a water resource replenished by a rainfall. Safe yield is estimated with the assumption that the ground water recharge is 10% of the annual rainfall in the area.

The water potential of surface water and ground water in the Province can be obtained by the following assumption:

Surface water: 40% of the annual rainfall (runoff ratio = 0.4)
Ground water: 10% of the annual rainfall.

The water potential for each city and municipality can be obtained by multiplying the average annual rainfall as shown in Figure 10.5.1 and river basin. The result of the calculation is shown in Table 10.5.1.

TABLE 10.5.1 RUNOFF COEFFICIENT

River	Mean Annual Runoff Depth (mm/yr)	Mean Annual Rainfall (mm/yr)	Discharge Coefficient
1) "Cebu River Basin" Data [1]			
Balamban	1,475	1,400	0.61
Guinabasan	1,490	2533	0.53
Kotkot	1,426	2,262	0.63
Mananga	1,423	2,207	0.64
Spang Daku	1,462	2,293	0.64
Aggregate[2]	1,447	2,321	0.62
2) "Hydro Power Potential Of Cebu Island" Data			
Balamban	972.3	1,540	0.65
Mananga	1,250.6	2,000	0.63
Kotkot	1,869.2	1,526	1.22
Pitogo	354.8	1,509	0.24
Carcar	396.7	1,478	0.27

Notes: 1) Mean rainfall and runoff depths were estimaed using the reciprocal distance method of interpolation.
2) Includes minor river basins and watersheds having a total land area of 4,406 sq. km.

TABLE 10.5.2 WATER POTENTIAL OF CEBU

CODE	NAME	CATCHT AREA (SQ.km)	MAIN RIVER	ANNU. AVE. RAINFALL (mm/year)	SURFACE WATER VOL. (MCM/year)	SURFACE WATER VOL. (1,000cu. m /day)	GROUND WATER VOL. (MCM/year)	GROUND WATER VOL. (1,000cu. m /day)	TOTAL DISCH. VOL. (MCM/year)	TOTAL DISCH. VOL. (1,000cu. m /day)
100	DISTRICT I	504.0			305.960	838	76.490	210	382.450	1.048
101	Talisay	90.2	Mananga	1,800	64.944	178	16.236	44	81.180	222
102	Minglanilla	64.0		1,700	43.520	119	10.880	30	54.400	149
103	Naga	56.1	Pandan	1,500	33.660	92	8.415	23	42.075	115
104	San Fernando	67.7		1,500	40.620	111	10.155	28	50.775	139
105	Carcar	142.4	Carcar	1,400	79.744	218	19.936	55	99.680	273
106	Sibonga	83.6	Dumalo	1,300	43.472	119	10.868	30	54.340	149
200	DISTRICT II	1,174.9			619.828	1,698	154.957	425	774.785	2.123
201	Argao	194.1	Argao	1,300	100.932	277	25.233	69	126.165	346
202	Dalaguete	98.8	Tapon	1,500	59.280	162	14.820	41	74.100	203
203	Alcoy	50.6		1,400	28.336	78	7.084	19	35.420	97
204	Boljoon	65.5	Lapasan	1,200	31.440	86	7.860	22	39.300	108
205	Oslob	125.8	Lagnasan	900	45.288	124	11.322	31	56.610	155
206	Santander	28.5		1,100	12.540	34	3.135	9	15.675	43
207	Samboan	60.7		1,100	26.708	73	6.677	18	33.385	91
208	Ginatilan	33.8	Ginatilan	1,200	16.224	44	4.056	11	20.280	56
209	Malabuyoc	67.0	Looc	1,200	32.160	88	8.040	22	40.200	110
210	Alegria	38.9	Malutinao	1,300	20.228	55	5.057	14	25.285	69
211	Badian	140.8	Badian	1,600	90.112	247	22.528	62	112.640	309
212	Moalboal	40.9		1,500	24.540	67	6.135	17	30.675	84
213	Alcantara	34.0		1,500	20.400	56	5.100	14	25.500	70
214	Ronda	54.0	Talaba	1,500	32.400	89	8.100	22	40.500	111
215	Dumanjug	141.5	Putaw	1,400	79.240	217	19.810	54	99.050	271
300	DISTRICT III	1,262.5			708.648	1,942	177.162	485	885.810	2.427
301	Barili	95.0	Sta. Ana	1,500	57.000	156	14.250	39	71.250	195
302	Aloguinsan	67.6	Aloguinsan	1,600	43.264	119	10.816	30	54.080	148
303	Pinamungahan	133.5	Cabiangon	1,600	85.440	234	21.360	59	106.800	293
304	Toledo City	255.2	Sapang Daku	1,500	153.120	420	38.280	105	191.400	524
305	Balamban	283.9	Balamban	1,300	147.628	404	36.907	101	184.535	506
306	Asturias	160.2	Guinabasan	1,300	83.304	228	20.826	57	104.130	285
307	Tuburan	267.1	Luyang	1,300	138.892	381	34.723	95	173.615	476
400	DISTRICT IV	694.0			416.371	1,141	104.093	285	520.463	1.426
401	Tabuelan	137.4	Baluang	1,500	82.440	226	20.610	56	103.050	282
402	San Remegio	114.6		1,500	68.760	188	17.190	47	85.950	235
403	Daanbantayan	93.7	Dallngding	1,500	56.220	154	14.055	39	70.275	193
404	Medellin	69.7		1,500	41.820	115	10.455	29	52.275	143
405	Bogo	64.3		1,500	38.580	106	9.645	26	48.225	132
406	Tabogon	93.5		1,500	56.100	154	14.025	38	70.125	192
407	Santa Fe	18.8		1,500	11.290	31	2.823	8	14.113	39
408	Bantayan	75.9		1,500	45.540	125	11.385	31	56.925	156
409	Madridejos	26.0		1,500	15.620	43	3.905	11	19.526	53
500	DISTRICT V	739.0			433.933	1,189	108.483	297	542.416	1.486
501	Borbon	67.0		1,300	34.840	95	8.710	24	43.550	119
502	Sogod	80.2	CatmonSogod	1,400	44.912	123	11.228	31	56.140	154
503	Catmon	76.5	Maghaljn	1,400	42.840	117	10.710	29	53.550	147
504	Carmen	48.7	Luyang	1,500	29.220	80	7.305	20	36.525	100
505	Danao City	103.5	Danao	1,600	66.240	181	16.560	45	82.800	227
506	Compostela	36.5	Kotkot	1,600	23.360	64	5.840	16	29.200	80
507	Liloan	120.6		1,600	77.184	211	19.296	53	96.480	264
508	San Francisco	88.5		1,400	49.578	136	12.394	34	61.972	170
509	Poro	56.5		1,400	31.616	87	7.904	22	39.520	108
510	Tudela	30.6		1,400	17.125	47	4.281	12	21.406	59
511	Pilar	30.4		1,400	17.018	47	4.255	12	21.273	58
600	DISTRICT VI	163.4			102.260	280	25.565	70	127.825	350
601	Consolacion	39.6		1,600	25.344	69	6.336	17	31.680	87
602	Mandaue City	66.3	Mandaue	1,600	42.432	116	10.608	29	53.040	145
603	Lapu-Lapu City	49.5		1,500	29.701	81	7.425	20	37.126	102
604	Cordova	8.0		1,500	4.783	13	1.196	3	5.979	16
700	Cebu city	94.7		1,700	64.396	176	16.099	44	80.495	221
	TOTAL	4,632.4			2,651.395	7,264	662.849	1,816	3,314.244	9,080