2.2 Oceanographic Condition

2.2.1 General

Oceanographic conditions for the existing ports of Manila and Batangas have already been discussed in the previous investigation and study reports namely, JICA reports Manila South Harbor 1987 and Batangas Port 1985. These conditions are, principally, applied for the planning and design of these existing port expansions in this study, while reviewing and updating those in consideration of the additional data and information collected.

As for Naic/Cavite and Sangley Point newly proposed as port development sites, only limited discussions were made in the previous reports. Therefore, based on the available data and information collected as well as site observation and survey conducted, in this study, it is analyzed and discussed for the oceanographic conditions for these new port sites.

2.2.2 Tides

The tide levels for the ports of Manila, Batangas and Subic have been established by PPA as shown in Table 2-2, which were determined based on the astronomical and anomalous tidal values measured and estimated by BCGS.

Table 2-2 Design Tide Levels

Tide Level	MNL South	MICT	MNL North	Batangas	Subic	Remarks
HHWL	+1.77	-				
HWL	+1.26	+1.26	+1.26	+1.41	+1.20	
MHHW	+1.01	+1.01	+1.01	+1.10	+0.91	
MHW	+0.85	+0.75	+0.75	-	-	
MLHW	-	-	-	-	-	
MTL	+0.49	+0.49	+0.49	+0.52	+0.46	
MHLW	-	-	-	-	-	
MLW	+0.10	+0.09	+0.09	-	-	
MLLW	±0.00	±0.00	±0.00	±0.00	±0.00	Datum Level
LML	-0.23	-0.23	-0.23	-0.32	-0.20	
DLT	-0.35	-0.35	-0.35	-0.40	-0.35	
LLWL	-0.67	-0.67	-	-0.58	-0.52	

* Source: Design Manual issued by PPA on 25 Sept. 1992

Though the tide levels at Naic/Cavite and Sangley Point have not been reviewed, in this study, the tide levels at the port of Manila can be applied for both sites taking into account that the sites are located in the same bay as Manila Port and moreover the distances from Manila Port are only 10 and 40 km respectively. (Refer to Fig. 2-7)

In order to confirm the tide phenomena and values at Naic/Cavite, the study team conducted the tide observation for a period of one month (refer to Fig. 2-3). It is found that small differences of tide levels between Manila and Naic/Cavite are only encountered, although both are situated in contrasting locations: near the mouth of the bay and the most inner side of bay, as shown in Table 2-3. Therefore, the differences are insignificant for planning and design of port facilities in this study.

Table 2-3 Tide Levels Observed at Naic/Cavite

Site	MHHW	MLHW	MTL	MHLW	MLLW	Remarks
Maragandon Point, Naic	+0.954	+0.935	+0.566	+0.196	-0.084	
Manila (Design Level)	+1.01	-	+0.49	-	±0.00	by PPA

From the plots in Fig. 2-2 the tide at Naic/Cavite is diurnal tide phenomena the same as the port of Manila though it can be seen that a semi-diurnal component is important around neap tides. The tide planes shown in Table 2-3 have been calculated from the harmonic analysis and prediction, and are relative to the datum of recordings set at Mean Lower Low Water (MLLW). There is a small difference between the calculated MLLW and this datum, which could be due to a number of causes: small inaccuracies due to the length of the recording period, seasonal changes in mean water level (MWL), meteorological effects etc.

The harmonic constants resulted by the tidal harmonic analysis are described in the Appendix which will be utilized for the future studies, i.e. tidal current simulation of environmental survey.

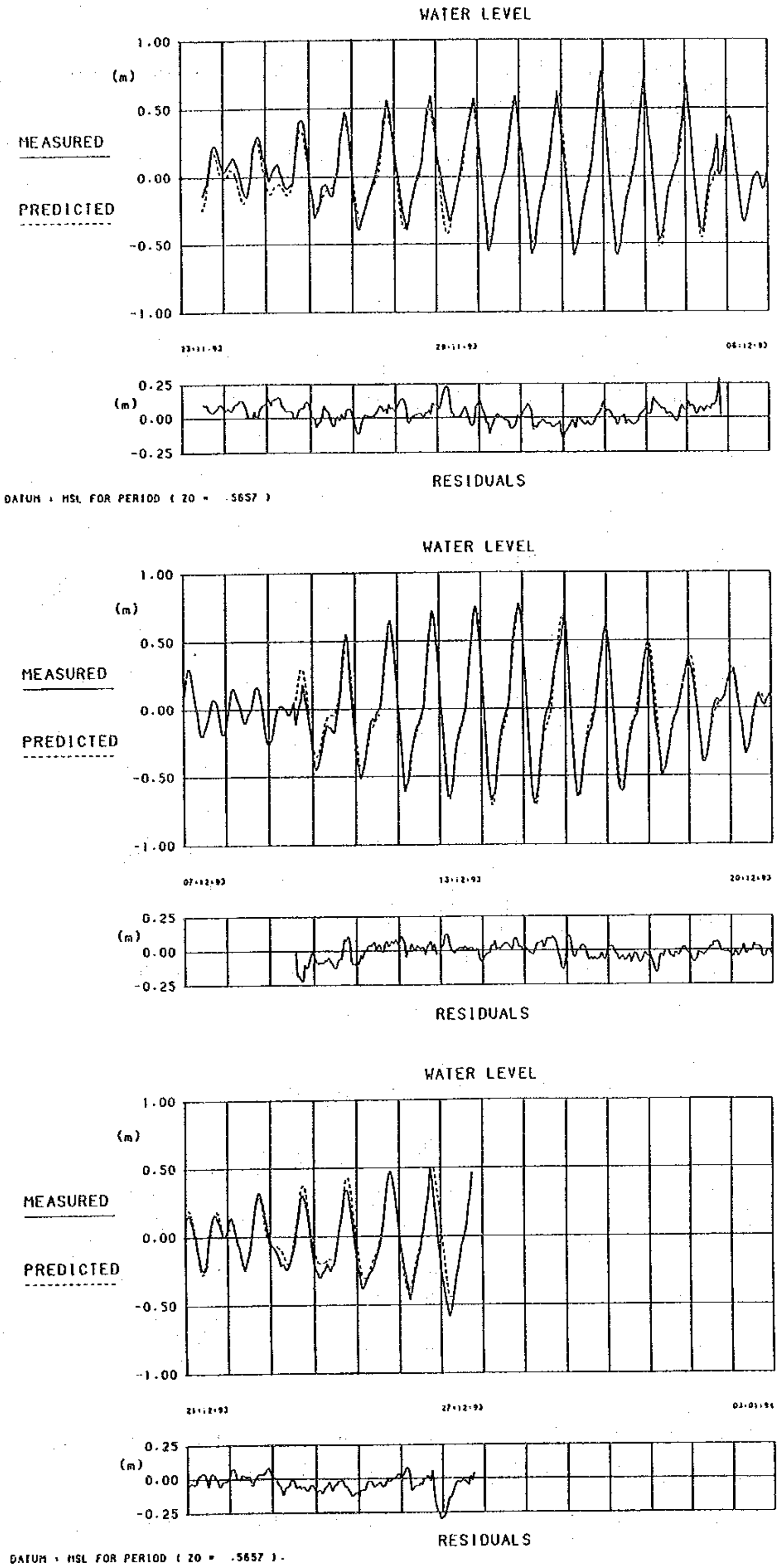


Figure 2-2 Water Levels Measured and Predicted at Naic/Cavite

The extremely highest and lowest tides in the Manila bay observed on Jul. 23, 1911 and on Feb. 3, 1912 as follows:

- Highest observed tide : +1.770 m (above MLLW)
- Lowest observed tide : -0.670 m (Ditto)

2.2.3 Currents

Since the objective sites in the study are situated at inner bays of Manila and Batangas where tide amplitude is only 1.5 m more or less, tide current at each site is only observed in relatively small velocity.

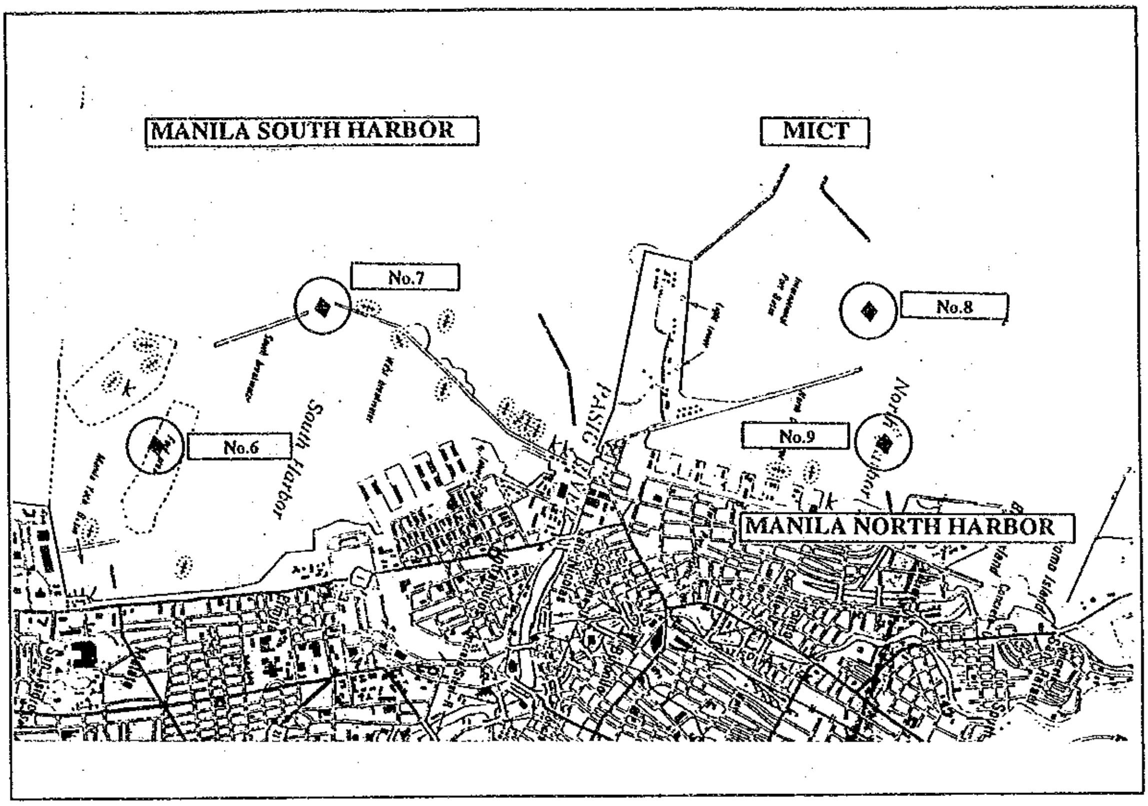
In order to confirm the actual situation in current phenomena, the current observation and analysis are conducted at ten points in total; 6 points at Naic/Cavite and 4 points at the port of Manila as shown in the location map of Fig. 2-3. One point at Naic/Cavite has one month continuous current observation, while the others have only one day current observation, in a period from Nov. 27, 1993 to Jan. 21, 1994.

The observation and analysis reveals a low energy current regime with some tidal influence on a net south-westerly drift. The current speed over the recording period that is exceeded 50 % of the time was 0.07 m/s. Analysis of tidal current constituents is also carried out on east-west, and north-south components. Positive directions is chosen as east and north. The harmonic analysis allows the definition of 20 constituents. Table 2-4 shows the maximum current observed at each port site and detailed results of records and analysis are compiled on the Appendix.

Table 2-4 Maximum Current Observed

Port	No. of Station	Maximum Velocity
Manila South	2	0.11 m/s
MICT	2	0.15 m/s
Naic/Cavite	6	0.33 m/s

In the previous stage, the tide current studies were executed at the bays of Manila and Batangas. In the Sewage and Sanitation Master Plan Report for Metro Manila as the result of current observation conducted from Dec. 1976 to May 1978 at 5 points



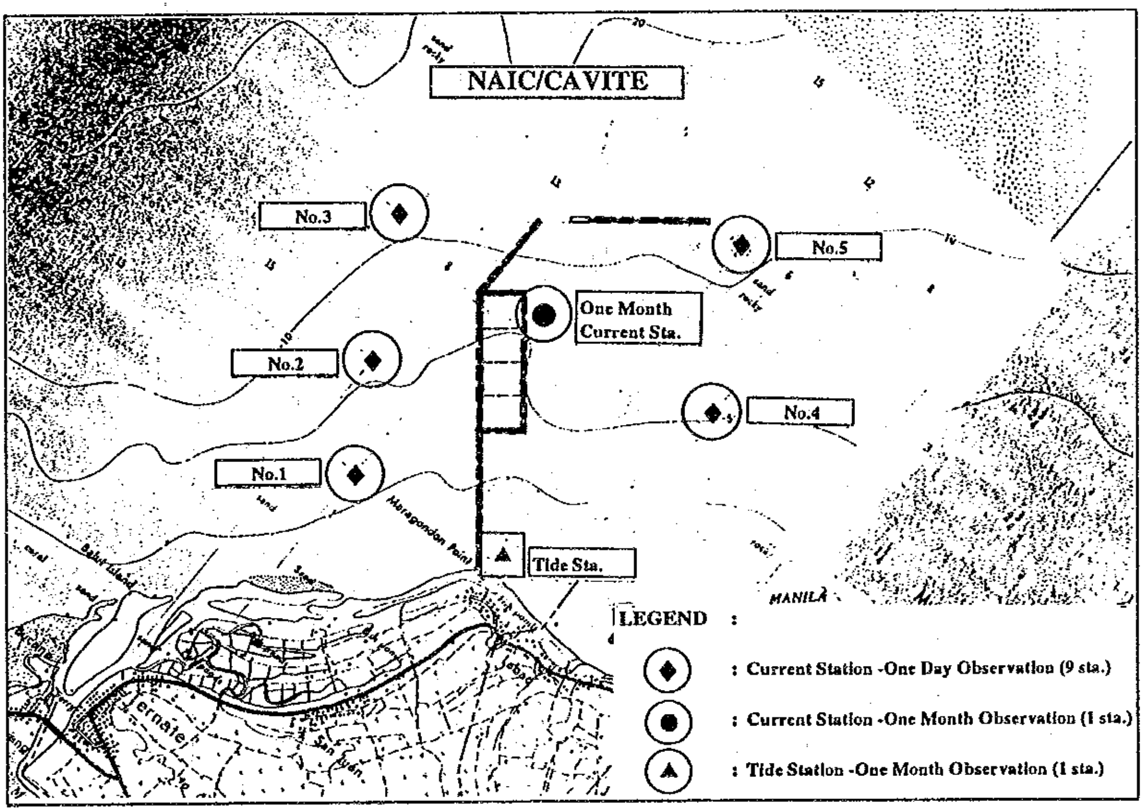


Figure 2-3 Location of Current and Tide Stations

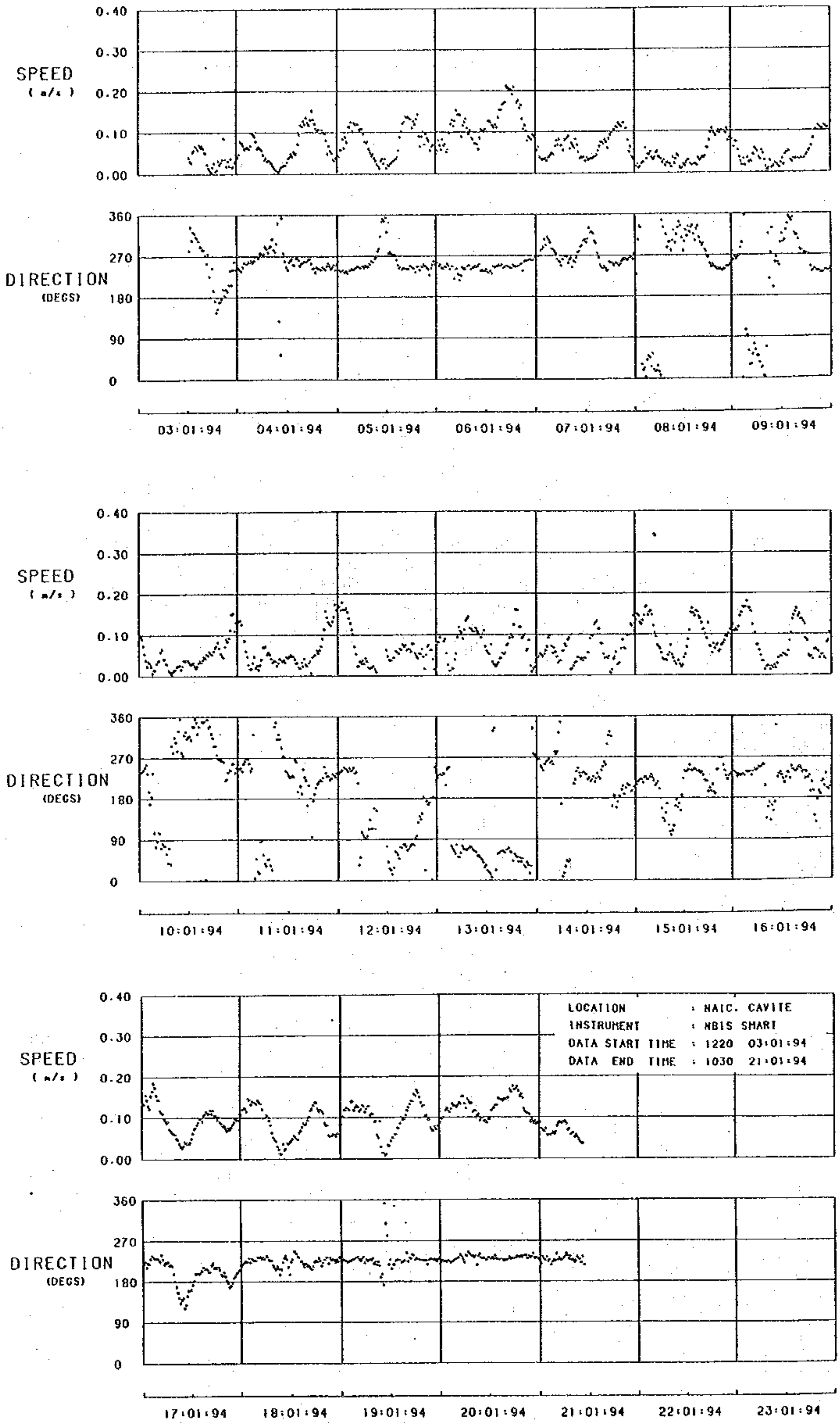


Figure 2-4 Current Speed - Direction Observed at Naic/Cavite

covering the bay of Manila, the maximum current velocity in the bay was recorded only in the order of 0.20 m/s.

As for Batangas bay, the Siltation Study was conducted by BCGS from 1982 to 1983 and the result indicates 0.49 m/s in maximum current velocity at the vicinity of Batangas Port. Therefore, it is obviously recognized that the currents in the areas of port development do not seriously affect functions of port facilities and ship maneuvering.

2.2.4 Waves

The objective sites in this study are well protected by the capes and island at the bay entrances. However, typhoon and monsoon winds attacking Luzon island affect safe berthing and operation of vessels in the port areas. The typhoon accrossing Luzon island in the latitude of these areas usually pass from westward to northward and generate waves of strong intensity although the scale of typhoon is still small and the period of wind duration is rather short period.

With approaching the typhoon to the objective areas, the wind wave in the bay is grown into larger scale, however, wave in the open area of South China Sea is not developed yet in this stage. The sea wave generated in the South China Sea reaches and enters the bay as the swell wave in the next stage after the typhoon leaves from Luzon and runs into the sea. Therefore, the wind wave generated in the bay and the swell reached from the sea would not occur simultaneously. In this study, the wind wave which would be larger one of these waves be adopted as the design wave for port development planning.

As for ports of Manila and Batangas, in the previous study, it is already estimated for wind wave generated in the bay for planning and design of port development as shown in Table 2-5.

Table 2-5 Design Wave at Ports of Manila and Batangas

Port	Height (1/3)	Period	Direction
Manila	2.69 m	6.5 sec.	W
Batangas	3.24 m	5.2 sec.	SW

In this study, these design waves are applied for the port development planning and design at Manila and Batangas. However, the design waves of Naic/Cavite and Sangley Point are not established yet. The estimation of the design waves for both sites is reviewed in this section.

The wind wave generated in the bay is estimated by using the significant wave method well-known as SMB method, based on the wind velocity, wind duration and fetch length. The wind velocity at sea was estimated by calculating gradient winds using the Bretchneider formula and converting its gradient wind into wind velocity at 10 meters above the sea surface wind.

The wind duration is assumed as same period as typhoon passing time along the effective fetch length in the Manila bay. The effective fetch lengths are enumerated in Table 2-6 and Appendix A-4 for each port site.

Table 2-6 Effective Fetch Length (Km)

	Fetch in Each Direction			Effective Fetch
Port of Manila	WNW 42	W 36	WSW 37	- 36
Naic/Cavite	NNE 44	N 46	NNW 48	- 44
Sangley Point	NNW 30	NW 41	WNW 38	- 35

Among 73 typhoons shown in Table 2-7 which affected Manila Bay area and its vicinity for a period of 21 years from 1972 to 1992, twenty one typhoons having maximum wind velocity estimated at Manila Bay in each year are selected and

Table 2-7 Typhoon Affected Manila Bay from 1972 to 1992

Year	Month	Typhoon No.	Forward Speed(Vf) (km/h)	Pressure: at Cent.(Pc) (mb)	Pressure: Δp=1013-Pc (mm)	Typhoon Track: Dist.to Bay (km)	Wind Recorded: Cent.Radius (mile)	Wind Recorded: Max.Speed (kt)	Gradient Wind Estimated(Ur) (m/s)	Remarks
1972	Sep.	18	10	1004	7.0	60	20	35	15.73	Select
	Nov.	27	30	985	21.2	210	12	50	15.43	
1973	Oct.	18	35	965	36.3	120	30	85	33.96	Select.
	Nov.	21	10	994	14.5	200	-	30	7.81	
1974	Jun.	5	25	975	28.7	130	-	25	25.71	
	Jul.	10	30	955	43.8	160	18	100	28.48	
	Oct.	24	25	975	28.7	180	45	60	19.77	
	Oct.	27	25	990	17.5	96	20	20	24.66	
	Nov.	29	45	1008	4.0	109	-	-	15.31	
	Nov.	30	20	980	25.0	89	25	160	28.66	Select.
1975	Sep.	11	30	970	32.5	170	20	100	23.76	Select.
	Oct.	16	30	1002	8.5	120	-	40	15.60	
	Nov.	18	30	1006	5.5	93	-	55	15.30	
1976	May	5	15	940	55.0	200	25	60	20.90	
	Jun.	7	25	965	36.3	150	10	90	25.71	Select.
	Aug.	16	30	996	13.0	300	-	40	5.13	
	Sep.	20	15	990	17.5	180	60	65	12.14	
1977	Jul.	3	30	990	17.5	103	-	-	25.21	
	Aug.	10	35	1000	10.0	200	-	35	11.02	
	Nov.	19	20	935	58.8	80	6	90	43.76	Select.
1978	Apr.	2	25	990	17.5	140	25	65	18.83	
	Aug.	14	20	992	16.0	200	-	50	11.09	
	Sep.	20	25	996	13.0	94	-	25	21.50	
	Sep.	21	30	980	25.0	104	-	45	29.74	
	Oct.	23	30	980	25.0	104	-	45	29.73	
	Oct.	26	30	905	81.3	96	20	116	52.36	Select.
1979	Apr.	3	10	985	21.2	150	20	50	15.14	
	May	4	10	985	21.2	74	25	35	25.40	
	Sep.	14	15	985	21.2	82	-	65	25.94	Select.
	Oct.	19	10	1000	10.0	70	20	35	17.43	
	Nov.	21	20	920	70.0	220	7	100	23.98	
	Dec.	24	20	994	14.5	150	25	60	14.50	
1980	May	4	20	998	11.5	100	20	60	17.77	
	Jul.	9	25	910	77.5	250	-	-	24.42	
	Oct.	21	20	930	62.5	180	25	40	26.82	Select.
	Oct.	22	35	1000	10.0	105	-	35	20.25	
1981	Jun.	6	25	992	16.0	96	-	60	23.66	
	Jul.	7	20	996	13.0	120	-	44	16.57	
	Nov.	25	25	985	21.2	100	20	44	26.49	
	Nov.	26	30	950	47.5	120	20	100	35.86	Select.
	Dec.	29	30	960	40.0	130	20	60	31.69	
1982	Jul.	8	20	985	21.2	150	-	50	18.25	
	Aug.	14	20	960	40.0	85	15	80	36.17	Select.
	Sep.	17	15	985	21.2	82	20	60	25.94	
	Dec.	25	20	980	25.0	120	-	30	23.69	
1983	Jul.	2	20	1002	8.5	120	20	70	12.87	
	Jul.	3	25	980	25.0	97	30	50	29.19	Select.
	Oct.	14	30	996	13.0	130	-	50	18.37	
1984	Jul.	4	20	1004	7.0	140	-	50	9.70	
	Aug.	11	30	990	17.5	200	35	50	14.46	Select.
1985	Oct.	22	20	925	66.3	80	13	90	46.43	Select.
	Oct.	24	25	996	13.0	120	20	50	18.06	
1986	Oct.	19	10	1006	5.5	65	-	-	12.99	
	Oct.	20	30	992	16.0	120	-	50	21.79	Select.
	Oct.	22	25	994	14.5	120	-	52	19.18	
	Nov.	23	25	996	13.0	200	-	30	10.65	
	Nov.	24	30	996	13.0	170	-	-	14.37	
1987	Dec.	23	15	970	32.5	150	-	-	20.95	Select.
1988	Jan.	1	25	990	17.5	96	-	-	24.66	
	Jun.	5	50	990	17.5	150	-	-	25.11	Select.
1989	May	3	30	994	14.5	102	-	20m/s	23.17	
	Jun.	5	25	985	21.2	100	-	25m/s	26.49	
	Jul.	7	30	985	21.2	220	-	25m/s	14.60	
	Jul.	10	35	1002	8.5	104	-	-	18.92	
	Oct.	26	40	970	32.5	117	-	30m/s	34.77	Select.
	Oct.	27	25	940	55.0	200	-	45m/s	24.72	
	Nov.	30	15	970	32.5	130	-	35m/s	23.44	
1990	Jun.	4	45	1004	7.0	115	-	-	18.68	Select.
1991	Jun.	5	20	990	17.5	130	-	23m/s	18.43	
	Jul.	6	25	996	13.0	94	-	18m/s	21.50	
	Nov.	27	20	992	16.0	88	-	20m/s	23.10	Select.
1992	Jul.	5	40	965	36.3	150	-	35m/s	31.07	Select.
	Oct.	26	30	980	25.0	104	-	30m/s	29.74	

Note: Pc: Pressure Observed at the Center of Typhoon
Ur: Max.Gradient Wind Speed Estimated at the Bay

Source: JICA Study Team

hindcasted in wind wave. The result of hindcasting is shown in Fig. 2-5. The typhoon T8522 caused the highest wave of 2.7 m with wave period of 5.4 sec at the Naic/Cavite, and three typhoons having wave height over 2.0 m hit the Manila bay during the period. The probability of return period is also calculated on the basis of twenty one typhoons as shown in Fig. 2-6 and Table 2-8. It is indicated that the wave height of 50-years and 10-years return period are of 3.18 m and 2.24 m at Naic/Cavite and 2.75 m and 1.95 m at Sangley Point respectively.

Table 2-8 Probable Waves at Naic/Cavite and Sangley Point

Site	2-years	5-years	10-years	20-years	50-years	100-years
Naic/Cavite	1.18 m	1.82 m	2.24 m	2.65 m	3.18 m	3.57 m
Sangley Point	1.02 m	1.58 m	1.95 m	2.30 m	2.75 m	3.10 m

The wave heights for design of port facilities are calculated based on the offshore wave height indicated in the above table considering the reflection and shoaling factors affected at each facilities.

2.2.5 Wave Calmness

In order to secure the calmness of water in front of the proposed wharf, construction or extension of breakwaters as shown in Table 2-9 are proposed at Manila North Harbor, MICT and Naic/Cavite as discussed in the Section 6.4, Required Scale and Quantity of Port Facilities. To ensure the functional port operation adopting these proposed length of breakwaters, in this section, wave hindcasting and berth availability analysis are executed and assessed against the wave height at the most critical part of the proposed new wharves.

Table 2-9 Proposed Length of Breakwater Construction

	Manila North Harbour	MICT	Naic/Cavite
Breakwater Length	Extension 300m	Extension 400m	New Construction 1,200m+820m

Year	Month	Typhoon No.	Marine Wind Velocity (m/s)	Estimated Wave Height(Ho)	
				Sangley Point (m)	Naic/Cavite (m)
1972	Sep	18	8.65	0.75	0.85
1973	Oct	18	18.68	1.00	1.25
1974	Nov	30	15.76	0.90	1.05
1975	Sep	11	13.07	0.75	0.85
1976	Jun	7	14.14	0.90	1.05
1977	Nov	19	24.07	2.20	2.50
1978	Oct	26	28.80	2.05	2.40
1979	Sep	14	14.27	1.05	1.20
1980	Oct	21	14.75	1.10	1.30
1981	Nov	26	19.73	1.25	1.50
1982	Aug	14	19.89	1.70	1.95
1983	Jul	3	16.06	1.05	1.25
1984	Aug	11	7.95	0.40	0.45
1985	Oct	22	25.54	2.35	2.70
1986	Oct	20	11.99	0.65	0.75
1987	Dec	23	11.52	0.90	1.00
1988	Jun	5	13.81	0.85	1.00
1989	Oct	26	19.12	1.05	1.15
1990	Jun	4	10.27	0.40	0.50
1991	Nov	27	12.71	0.90	1.00
1992	Jul	5	17.09	0.90	1.00

Figure 2-5 Hindcasted wave at Naic/Cavite and Sangley Point

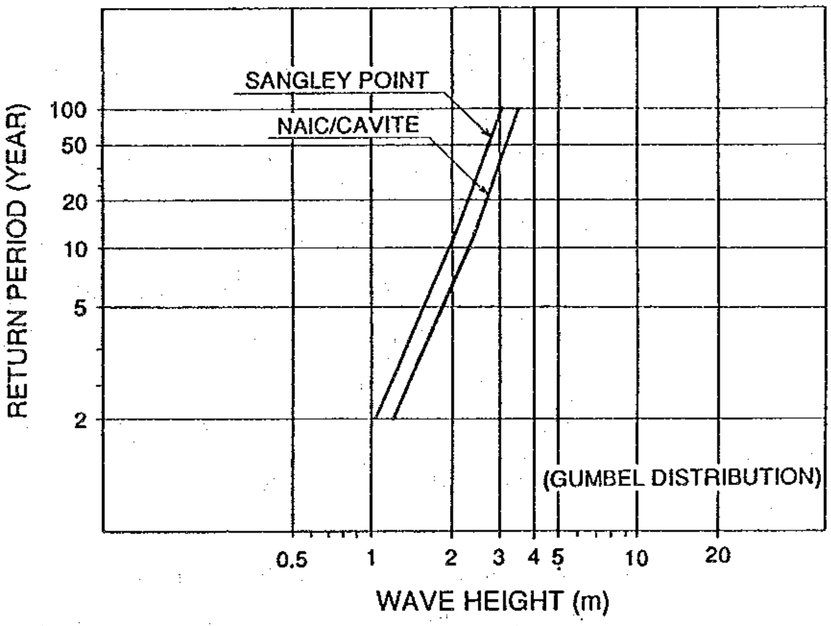


Figure 2-6 Return Period and Wave Height at Naic/Cavite and Sangley Point

The critical wave height (H1/3) at the new wharves is designed at 50 cm to attain at least 95 % workable days throughout the year and ensure continuous cargo handling operations of large vessels. The wave which passes at the breakwater and progresses to shallow water area, reaches the vicinity of the new berth with diffraction and shoaling deformation. Then wave height at each particular point is calculated as follows:

H = Ho * KD * KS where :

H : Wave at point
Ho : Wave height at entrance of port
KD : Diffraction coefficient
KS : Shoaling coefficient

The diffraction coefficient is determined at each calculation point by the directional spectral analysis with maximum value (Smax=10) for concentration of predominant wind wave. The shoaling factor is determined with reference to the typical wave period of 5 sec and the average water depth in each port basin. Table 2-10 shows the results of diffraction and shoaling analysis at the most critical points for Manila North Harbor, MICT and Naic/Cavite with the proposed breakwater lengths. (Refer to Appendix A-5~8)

Table 2-10 Result of Diffraction and Shoaling Analysis at Critical Point of Berth

Port	Manila North			MICT			Naic/Cavite		
Wave Direct.	WSW	W	WNW	WSW	W	WNW	NNW	N	NNE
Coefficient	0.544	0.611	0.595	0.469	0.535	0.624	0.602	0.709	0.758

As for the berth utilization, wave hindcasted in 1986 is considered in the analysis because there were more high and rough waves compared with other years. Wind wave is estimated by SMB method, while assuming the mean wind velocity from the weather observation data and the effective fetch in Manila Bay. The effective fetch length for each site is shown in Table 2-6 in the previous section.

The hindcasted result clearly shows that the lengths of breakwaters proposed in this study would be able to get more than 95 % berth availability in 50cm of wave height at the new berths for each port site. Further details of the analyses are shown in the Appendix.

2.2.6 Littoral Transport

The objective sites of port development at Manila, Sangley Point and Batangas are located at the most inner sides of the bays where no serious problems in littoral transport can be found. Along the Cavite coast where the construction of Naic/Cavite port is proposed, however, it is recognized for considerable littoral transport. Some problems in littoral transport would be expected arising along the coast due to interruption of the littoral drift by the proposed port facilities. (refer to Fig. 2-7)

The dominant phenomena of littoral transport is obviously recognized from westward to eastward which are clearly indicated by the directions of river mouth bars and littoral sand deposits at the groins in the coast, although the littoral transport phenomena is mainly generated by the south-west and north-east monsoons in the period of May to September and November to February respectively. The extent of littoral transport along the Cavite Coast is spread approximately 46 km from Calungpang pt. at west end to Sangley Point at east end. Supply sources of littoral drift are envisaged for both cliff erosion on the west end parts of the coast and sediment transport from the rivers which catchment areas are covered by the volcanic ash of Tagaytay Volcano.

The proposed construction site of Naic/Cavite port will be located a quarter of the way along the coast from the west end. Approximately 1.0 km westward of the proposed site, there exists the Maragondon River mouth. Moreover, eastward of the proposed site, there are many villages, towns and resort areas along the coast as shown in Fig. 2-7.

Therefore, the deposition phenomena westward from the port and erosion phenomena eastward from the port should be examined before the construction of the port. Due to constraint of the scope of work, detailed study has not been taken at this stage. It is recommended to undertake further detailed investigation of littoral drift along the Cavite coastal area in the future stage.

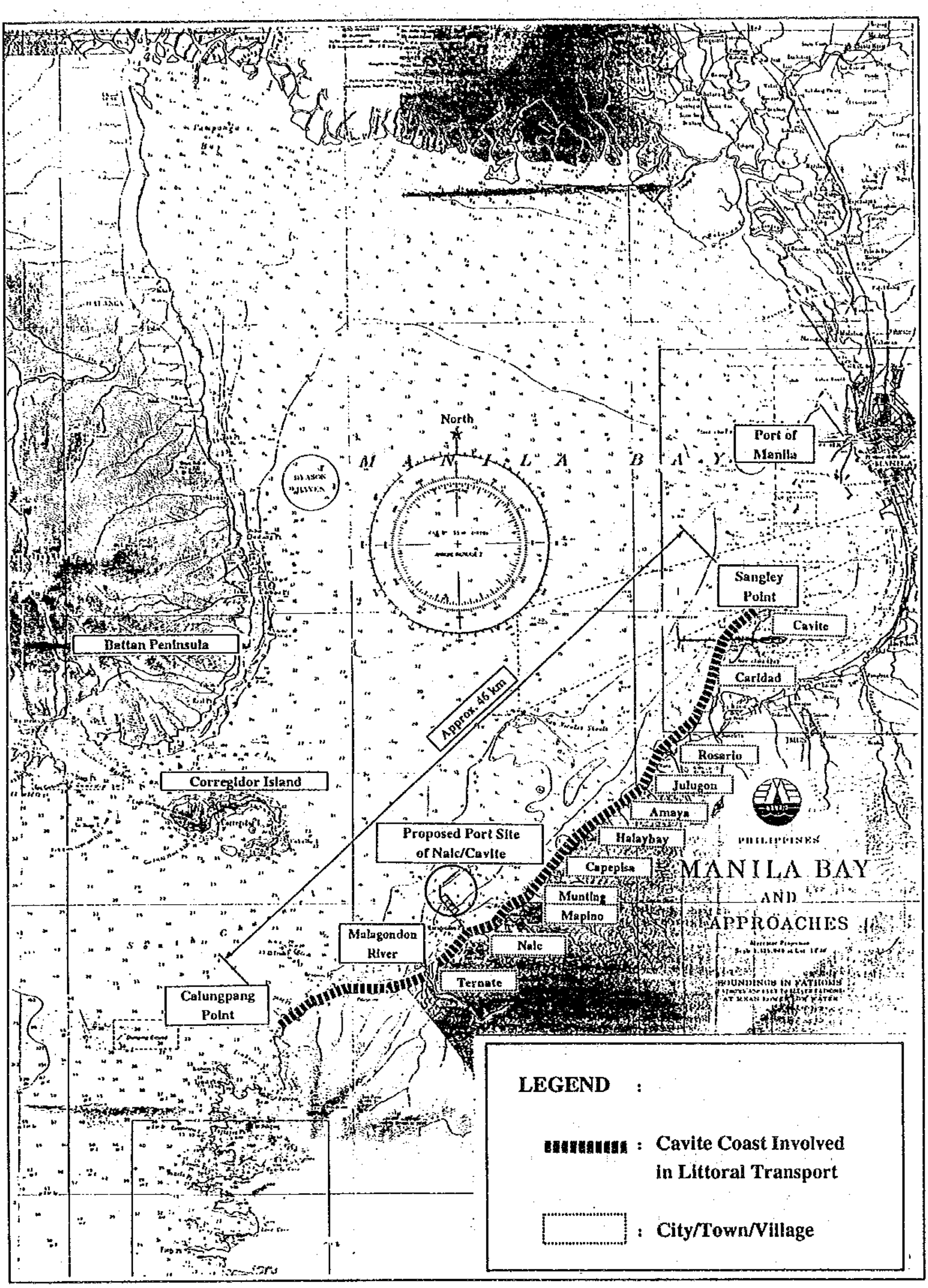


Figure 2-7 Cavite Coast Involved in Littoral Transport

2.3 Topographical Condition

The Philippine Archipelago consists of an irregular land formation. It is covered with mountains areas and partly close to the sea.

A range of mountains runs from North to South along the axis of Luzon Island. These mountain ranges (the Ilocos, the Sierra Madre and the Cordillera) are distinctive features of the country.

The Cordillera mountain range being the most prominent and serves as the backbone of Luzon. It runs from Central Plain toward the north coast of the Pacific Ocean and parallel to the west coast of Luzon. The mean height of this mountain range is approximately 1,800 m.

GCR, located at the central part of Luzon and facing Manila Bay, Lamon Bay and Laguna Bay is situated in the southern marginal part of the Central Plains. Main characteristics of GCR by province are outlined below:

Cavite; The provincial land slopes generally from foot slopes in the south, through terraces, to alluvial plains in the north. Hills and mountains constitute some 20 % and coastal plains 2 %.

Laguna; Alluvial plains extend mainly in the low lands along the southern to the eastern lakeshore of Laguna de Bay, accounting for 25 % of the provincial land. Hills, mountains and volcanic combined occupy 34 % of the total land area.

Batangas; Plateaus formed by volcanic activities extend in large part of the province. Terraces and foot slopes constitute 41 % of the provincial land, and hills, mountains and volcanic account for 31 %.

Quezon; The provincial land is dominantly hilly to mountains covering two-thirds of the total land area. The northern part is the Sierra Madre covered mostly by forests. Alluvial plains are limited to the lowland near Infanta, deltaic lowland of small rivers and the areas around Lucena City, consisting 15 % of the land.

Rizal; The main part of the province is the middle to upper catchment areas of the Marikina river. Hills and mountains occupy 57% of the total land area. Another 14% is classified as hills. Alluvial plains concentrate along the northern lakeshore of Laguna de Bay, occupying 7% of the land area.

2.4 Bathymetric Condition

2.4.1 General

The mouth of Manila Bay is about 56 kms, Southwest of the City of Manila.

Entrance to the bay is by way of the North Channel between Mariveles and the Corregidor Island and the South Channel between Cavite and the Caballo Island. Both of these channels have enough depth (mean depth of 40 m each) to enable ocean-going vessels to enter the City.

The Manila Bay has a gentle seabed slope along the shore especially between the north and the east coasts. East of the bay is the Manila Harbor, which is about 6 kms south of the Navotas Port and some 15 kms NE of a huge sand pit located in Cavite.

The harbor is divided into two by the Pasig River, the North Harbor and the South Harbor.

The International Container Terminal site is located beyond the NW breakwater of the North Harbor.

The mouth of Batangas is about 20 kms, SW of the City of Batangas. Entrance to the city is by way of the Verde Island Passage, between Maricaban Island and the Matoco Point.

Approach channel has enough depth of more than 300 m to enable ocean-going vessels to enter the bay.

The Batangas Bay has a steep seabed along the shore and average sea depth of 200 m in center of the bay.

East of the bay is the Batangas Harbor which is about 2 kms west from the city center of Batangas City.

The harbor is well sheltered from the wave by Mindoro Island and the sea depth is 20 m at the point of 200 m from the shore.

There are two river mouths near the north side of the harbor, namely Majuia and Calumpau rivers.

Maintenance dredging is requested every three years due to siltation from these rivers.

2.4.2 Port of Manila

The hydrographic survey was conducted to find out the exact and precise data of seabed elevation of the proposed wharf site at Manila South and North Harbor for the preliminary design of the port facilities.

Water depth was measured by a "Raytheon Echosounder Fathometer". The direction of the survey vessel was aligned perpendicular to the axis of the breakwater by a Topcon Total Station, set-up on the baseline points previously established. Two-way radio was used for communication between the vessel and the party on the breakwater. Every time sea depth was marked on the chart, the distance of the vessel from the baseline was simultaneously measured by Topcon Total Station and recorded together with the corresponding time. During the hydrographic survey, tide reading was taken every 15 minutes. The fathometer was checked and calibrated daily in the morning before the start of the sounding and in the afternoon after the sounding.

Results of the hydrographic survey are as follows;

(1) South Harbor

Along the west breakwater, the area of approximately 150 ha was surveyed from November 24 to December 8, 1993. Sounding lines were run at 30 m interval with direction of perpendicular to the breakwater.

The bathymetric map is shown in Figure 2-8. The map shows typical seabed configuration with elevations based on MLLW at one meter interval. The following features are notable from the survey.

a) Depth along the breakwater is only from -0.5 m to -2.0 m.

b) Depth inside South Harbor ranges from -10 m to -12 m.

c) The seabed slope from breakwater to harbor is from 1/7 to 1/10.

d) Depth at outside breakwater is shallower and contour line is parallel to the shoreline. (seabed slope; 1/200)

(2) North Harbor

Along the north breakwater, the area of approximately 140 hectare was surveyed from December 8 to 21, 1993. Sounding run was performed at 30 m interval with direction of perpendicular to the breakwater.

The bathymetric map is shown in Figure 2-9. The map shows typical seabed configuration with elevations based on MLLW at one meter interval. The following features are notable from the survey.

a) Depth inside North Harbor is about -7m.

b) The seabed slope from breakwater to harbor is gentle, 1/50.

c) Outside breakwater (MICT side), shallow area where depth less than -3 m exists approximately 250 m from breakwater.

2.4.3 Naic/Cavite

The hydrographic survey was also performed at Naic/Cavite for the preliminary design of the port facilities.

Horizontal positioning and vessel guidance was provided by a Magnavox Global Positioning System (G.P.S.) receiver interfaced to a computer. Water depths were measured by a "ODOM ECHOTRAC" digital echo sounder. The echo sounder was also interfaced to the navigation computer for data recording processing and plotting. During the hydrographic survey, tide reading was taken every 15 minutes. Bar checks for echo sounder was performed before and after the sounding daily. The field survey was conducted from 14 December 1993 to 12 January 1994. The field survey was adversely affected by typhoon and rough sea condition.

The sounding areas are as follows;

a) For port area: 800 ha.

Width (paralleled to the shoreline)	; 4,000 m
Length	; 2,000 m
Sounding lines at 50 m interval	

b) For approach channel: 250 ha.

Length (from the port area)	; 2,500 m
Width	; 1,000 m
Sounding lines at 100 m interval	

The bathymetric map is shown in Figure 2-10. The map shows typical seabed configuration with elevations based on MLLW at one meter interval. The following features are notable from the survey.

a) There is a reef located approximately 500m from the shoreline.
b) From the edge of the reef to seaward, the seabed slopes gently (1/200) to a depth of -18 m at the limit of the surveyed area.
c) The reef alignment is generally from a north/east to south/west direction.
d) Distance from the shoreline to the depth more than -13m (proposed channel depth) is approximately 3,500 m.

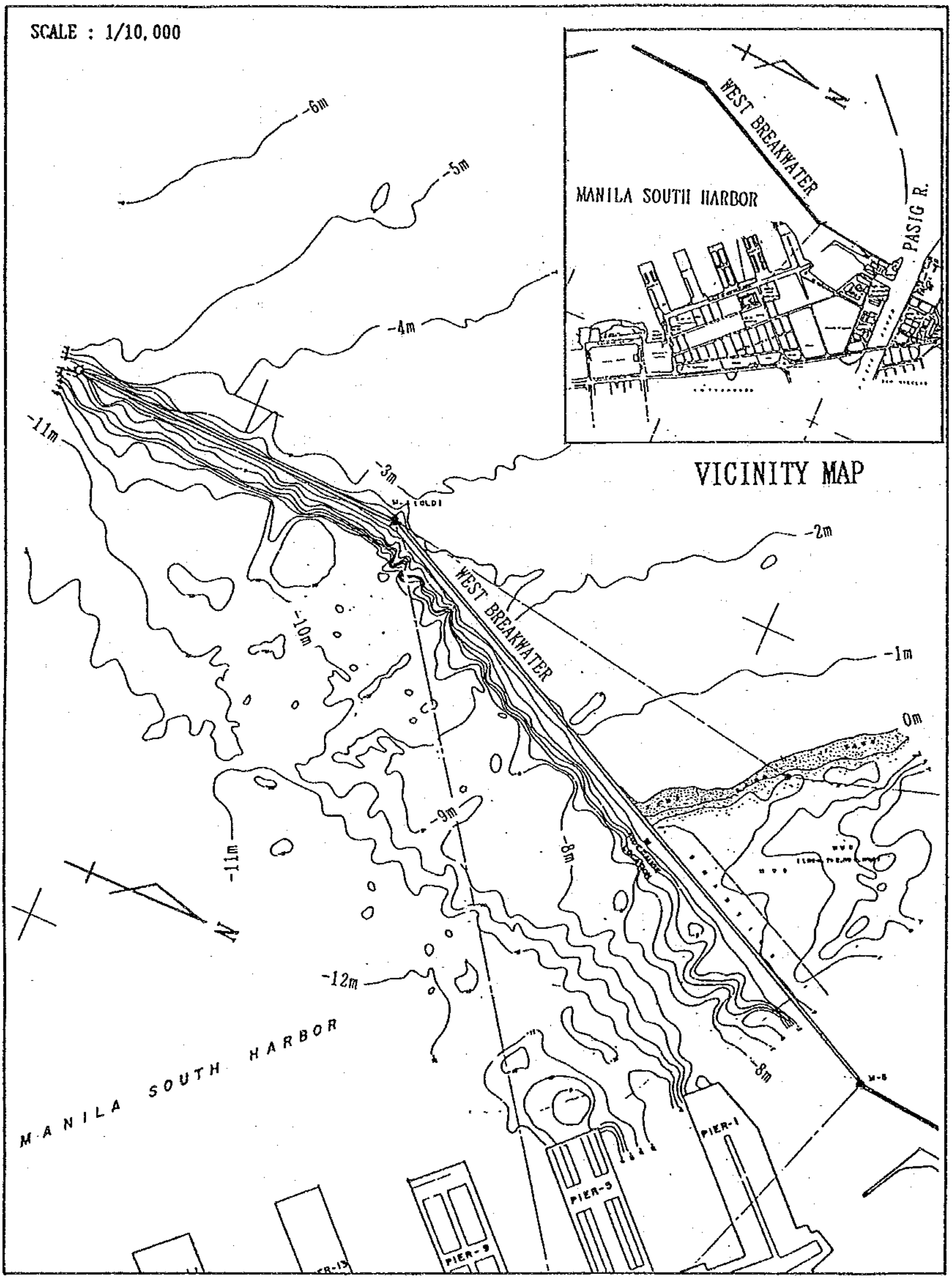


Figure 2-8 Bathymetrical Map at Manila South Harbor (Dec. 1993)

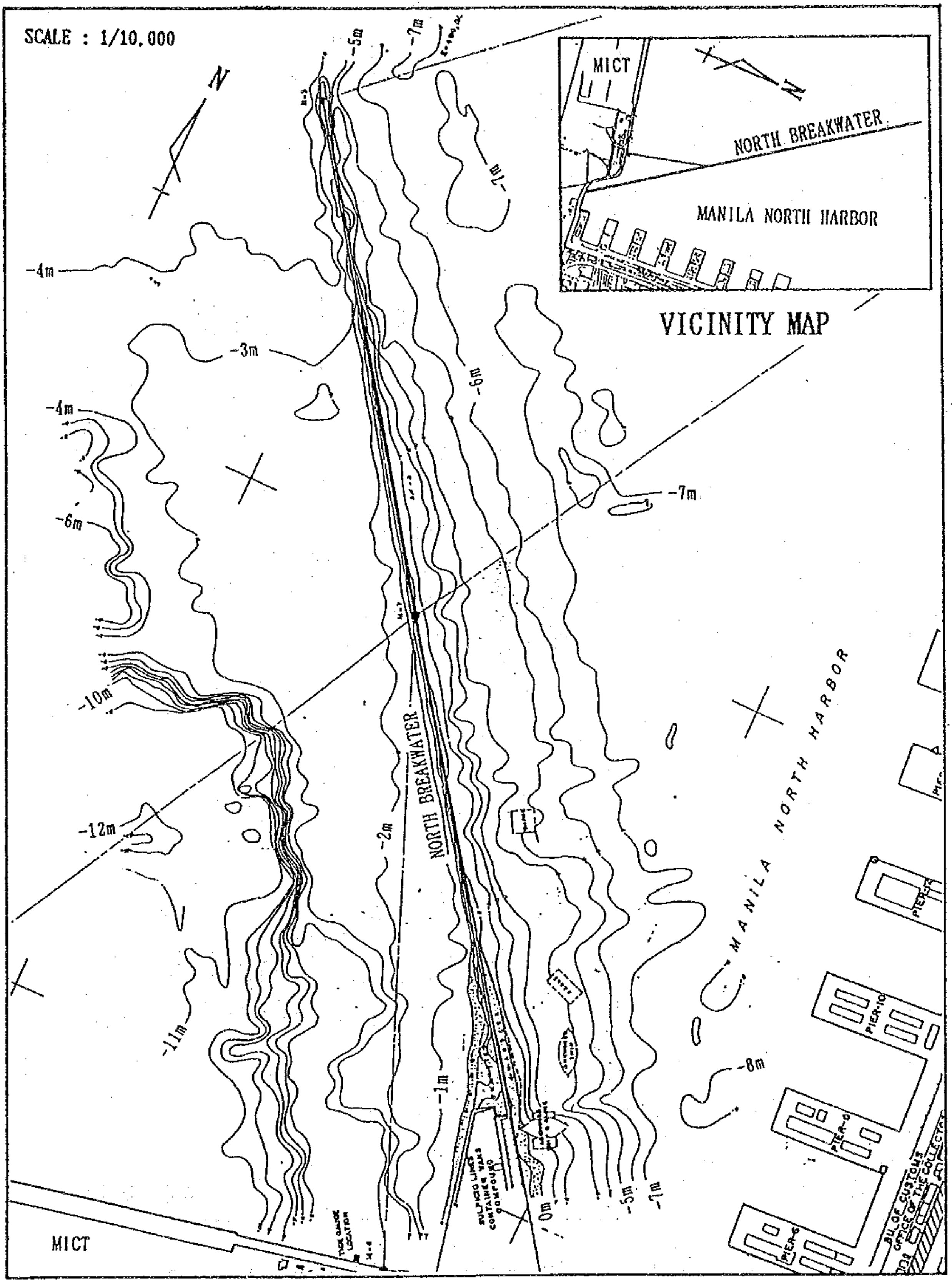


Figure 2-9 Bathymetrical Map at Manila North Harbor (Dec. 1993)

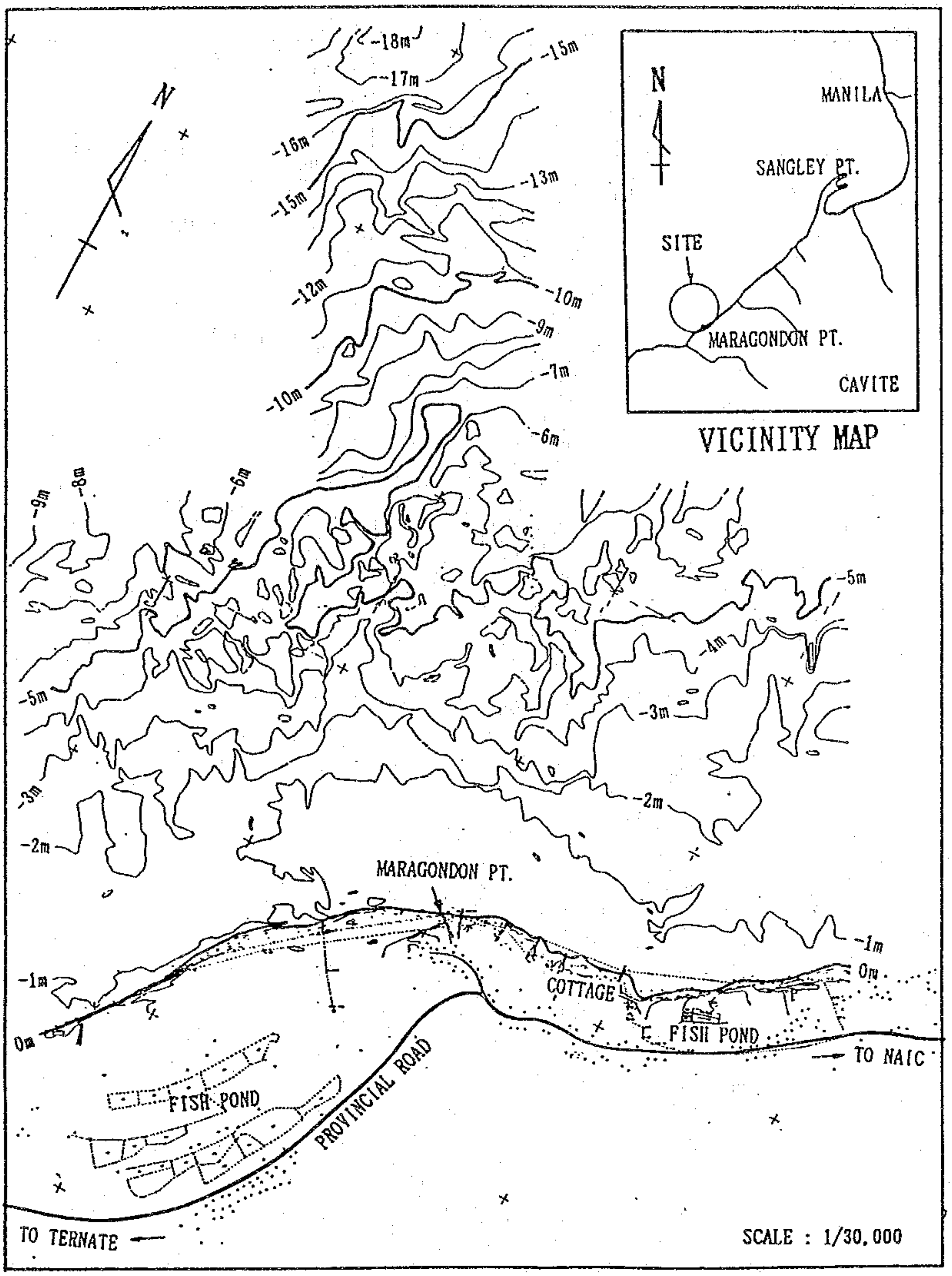


Figure 2-10 Bathymetrical Map at Naic/Cavite (Dec. 1993)

2.5 Geological Condition

2.5.1 General

The Philippines, particularly the Luzon Island, is rich with igneous and volcanic rocks over the highlands and sedimentary and metamorphic rocks in the lowlands. From the three prominent mountain ranges; at the Ilocos and Zambales rang along the West, there is widespread submarine andesite and/or basalt flow, intercalated with pyroclastic and clastic sedimentary rocks and/or reef limestone lenses; in the center over the Cordillera range, looms marine and terrestrial and transgressing pyroclastics and tuffaceous sedimentary rocks, associated with reef and clacerenite/silty lime stone; and along the Sierra Madre over the East, sporadic existence of volcanic rocks and terrace gravel deposits is predominant.

At Manila Harbor area and the Manila Bay, as well, are extremely overlain by sedimentary and metamorphic rocks, such as, alluvium, fluviatile, laucstrine, paludal and beach deposits coming from North and South-east areas. From farther East and down South, there abound reef limestone with pyroclastics. In the West, from the Bataan mountains, vast areas are of volcanic plain or volcanic piedmont deposit associated chiefly with pyroclastics.

The greater parts of Cavite are composed of volcanic materials, tuffs, cinders, basalt, breccia, agglomerate and interbeddings of shales, sandstones and agglomerates. The drainage system are deeply entrenched in the tuffs, eroding thin interbedded sandstone and conglomerates which are the sources of little reserves of sand and gravel in the large stream. Cavite coastal areas have marl and conglomerate, and igneous rocks are prominent in the high mountainous regions of Western Cavite. Big volume of sand and gravel materials reserve in Ternate, Maragondon, Noveleta and Imus. These materials are found as river deposits.

2.5.2 Manila Harbor

Manila Harbor is located at the estuary of the Pasig River facing to Manila Bay. This river especially during flood season carries plenty of sedimentary materials to the Bay. So, the harbor area is overlained by a thick dposit of alluvium which consist of very soft clayey soil.

(1) North Harbor

Four(4) borings were conducted along the north breakwater. The subsoil condition of this area is distinguished by three kinds of soils as follows;

The uppermost horizon is dark gray high plastic silty clay with sand and shell fragments. The thickness varies from 8 meters to 15 meters. In general, the N-values for the horizon is less than 2.

The second horizon is grayish brown medium to high plastic clayey sand/sandy clay. This horizon ranges from 6 meters to 15 meters in thick and from 5 to 50 in N-values.

The third horizon is brown very dense gravelly sand. This horizon undulates between MLLW -12 m to MLLW -29 m.

Based on the results of the boring and the laboratory test on the samples taken in the boreholes, the typical soil profiles and the various constants of subsoil that shall be used for designing the port facilities are as shown in Figure 2-11.

Existing ground level	-2.5 → -4.5m
Very Soft Silty CLAY	-
$C = 2$ t/sq.m	-
$\gamma' = 0.5$ t/cu.m	-
	-20 m
Medium Dense Clayey SAND (Sandy CLAY)	-
$\phi = 30^{\circ}$	-
$\gamma' = 1.0$ t/cu.m	-
	-29 m
Very Dense Gravelly SAND	
$\phi = 35^{\circ}$	
$\gamma' = 1.0$ t/cu.m	

Figure 2-11 Soil profile at Manila North Harbor Along the Existing Breakwater

(2) South Harbor

Two(2) borings were conducted along the west breakwater. The subsoil condition of this area is distinguished by three kinds of soils as follows;

The uppermost horizon is dark gray high plastic silty clay with sand and shell fragments. The thickness varies from 17 meters to 23 meters. In general, the N-values for the horizon is less than 2.

The second horizon is grayish brown dense to stiff silty sand/sandy clay. This horizon ranges from 6 meters to 22 meters in thick and from 4 to 50 in N-values.

The third horizon is brown very dense gravelly sand. This horizon undulates between MLLW -26 m to MLLW -47 m.

Based on the results of the boring and the laboratory test on the samples taken in the boreholes, the typical soil profiles and the various constants of subsoil that shall be used for designing the port facilities are as shown in Figure 2-12.

Existing ground level	-2.5 → -3.5m
Very Soft Silty CLAY $C = 2$ t/sq.m $\gamma' = 0.5$ t/cu.m	-25 m
Medium Dense to Dense Sility SAND (Sandy CLAY) $\phi = 30^\circ$ $\gamma' = 1.0$ t/cu.m	-47 m
Very Dense Gravelly SAND $\phi = 35^\circ$ $\gamma' = 1.0$ t/cu.m	

Figure 2-12 Soil profile at Manila South Harbor
Along the Existing Breakwater

2.5.3 Naic/Cavite

Borings, sub-bottom profiling by sonic prospecting and bottom sediment sampling were conducted at the offshore of Naic.

(1) Boring

Four(4) borings at proposed port area and one(1) boring at proposed access channel area were carried out. This area consists of deep deposit of alluvium which are marine and terrestrial sediments transported from uplands by rivers.

The subsoil condition at proposed port area is distinguished by two kinds of soils. The upper horizon is dark gray dense to very dense silty sand. The thickness varies from 6 meters to 12 meters. In general, the relative density is progressively increasing with depth, the N-values are between 14 and 50. The second horizon is brownish gray stiff to very hard sandy silty clay.

Based on the results of the boring and the laboratory test on the samples taken in the boreholes, the typical soil profiles and the various constants of subsoil that shall be used for designing the port facilities are as shown in Figure 2-13.

The subsoil condition at proposed access channel area is dark gray very dense sandy silt/silty sand with N-values more than 30.

Existing ground level	-3 → -7 m
Dense Silty SAND	-
$\phi = 30°$	-
$\gamma' = 1.0$ t/cu.m	-
	-15 m
Stiff to Hard Sandy Silty CLAY	
C = 10 t/sq.m	
$\gamma' = 1.0$ t/cu.m	

Figure 2-13 Soil profile at Naic (proposed port area)

(2) Sub-bottom profiling by sonic prospecting

Sub-bottom profiling was conducted simultaneously with the echo sounding. Sub-bottom profiling systems operate on the theory of a transmitted sonic pulse being reflected from sub surface sedimentary layers. To register a reflection it is necessary to have a distinct change in sediment classification.

The equipment utilized on this survey was "EDO Western Sub-bottom Profiler". The 10 kw transducer was mounted on a catamaran and towed behind the survey vessel.

Within the survey area, the sediment classification as identified by the borehole logs was generally homogeneous and there were no distinct layers observed on the records.

(3) Bottom sediment sampling

Bottom sediment samples were taken at the site and laboratory test (specific gravity and grain size analysis) were carried out. The position of sampling was water depth from -1 m up to -10 m by 3 m pitch on the four(4) lines which was established perpendicular to the shoreline at 1,000 m interval (total 16 positions).

Based on the result of the laboratory test, bottom sediments of this area are as follows;

a) Bottom sediment is predominantly consist of dark gray fine sand with 1 to 38 percent (average 8 percent) of silt contents.

b) Specific gravity of sediment is 2.65 to 2.69 (average 2.66).

2.5.4 Batangas

Based on the collected previous boring data, the subsoil condition at proposed site is assumed as follows;

Existing ground level	±0 m
Loose to medium Dense Silty SAND	-
ϕ= 30°	-
γ'= 1.0 t/cu.m	-12 m
Dense to very Dense Silty SAND	
ϕ = 35°	
γ'= 1.0 t/cu.m	

Figure 2-14 Soil profile at Batangas

2.5.5 Sangley Point

Boring data at the proposed site is not available. Figure 2-15 is subsoil profile at offshore of Rosario Town which is located approximately 10 km south-westward from Sangley Point. The study Team assumed below subsoil conditions for preliminary design and cost estimate of port facilities at Sangley Point.

Existing ground level	-2 m
Dense Silty SAND	-
ϕ= 30°	-
γ'= 1.0 t/cu.m	-
	-15 m
Stiff to Very Stiff Clayey SILT	-
C = 10 t/sq.m	-
γ'= 1.0 t/cu.m	-
	-30 m
Very Dense Silty SAND	
ϕ= 35°	
γ'= 1.0 t/cu.m	

Figure 2-15 Soil profile at Rosario (Offshore)

The Soil Profile and Borehole Log for Naic/Cavite and Port of Manila are shown in Appendix-A in this report.

2.6 Earthquake

The Philippine archipelago lies between two major tectonic plates of the world.

The northwestward moving Pacific Plate is presently pushing the Philippine Sea Plate beneath the eastern side of archipelago at the rate of about seven cm per year.

The ocean parts of the slow-moving Eurasian Plate are being subducted along the western side of Luzon and Mindoro at the rate of three cm per year.

The identified earthquake generators in the Philippines are the following:

a. Philippine Trench
b. East Luzon Trench
c. Manila Trench
d. Collisional Zone between Palawan and Mindoro
e. Negros trench
f. Collisional Zone between Zamboanga and West Mindoro
g. Sulu Trench
h. Cotabato Trench
i. Davao Trench
j. Philippine Faults Zone

Most of the islets are of volcanic origin. There are many volcanoes, five of them in frequent intermittent activity, namely, Mayon and Bulusan in Albay and Sorsogon, respectively, in Region V, Taal Volcano in Batangas in Region IV, Kanlaon Volcano in Negros Island in Region VI, and the Hibok-Hibok Volcano in Camiguin Island in Region X.

Above mentioned two types of natural earthquakes will occur every year in the Philippine archipelago.

The typical examples near GCR in the recent years are Baguio earthquake by tectonic and an eruption of Mt. Pinatubo by volcanic.

In 1991, DPWH announced the revision of guide specifications and design manual for earthquake resistance design of building and related structures due to severe damage of buildings by Baguio earthquake.

Major revised part is the seismic factor will be 0.4.
The Philippines is considered as a single zone corresponding to zone 4.

The Epicentre Map of GCR is shown in Figure 2-16.

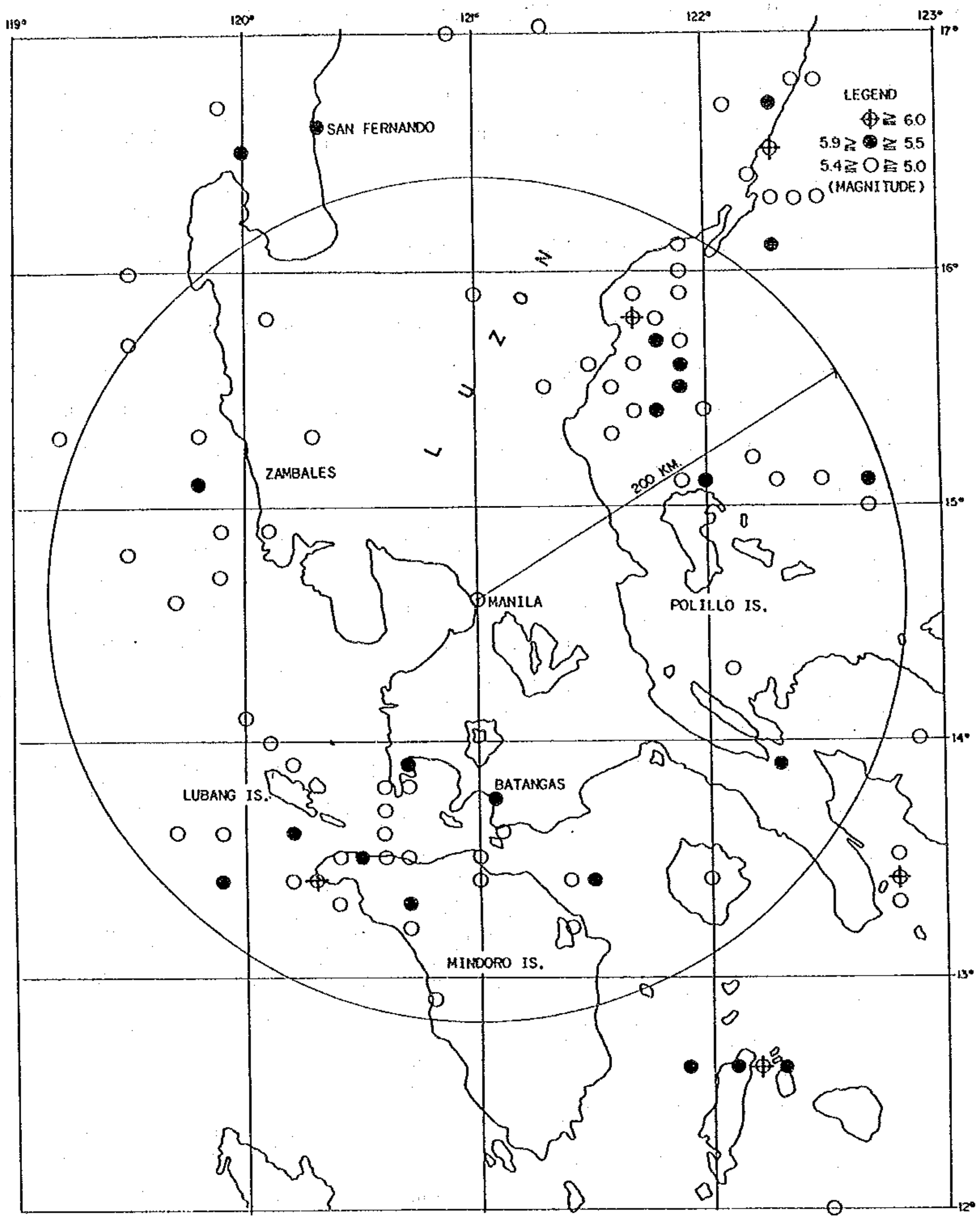


Figure 2-16 Epicentre Map

CHAPTER 3 OUTLINES OF CALABARZON DEVELOPMENT PROJECT

The following description is cited mostly from the "The Master Plan Study on the Project Calabarzon" conducted by JICA and their Philippine counterpart in 1991.

3.1 Present Situation of CALABARZON Region

The CALABARZON region is defined as the jurisdictions of the provinces of Cavite, Laguna, Batangas, Rizal and Quezon, contiguous to the capital region of Metro Manila. This is not an administrative unit. The Region is a part of the planning unit of region IV(Southern Tagalog), which occupies the southern central portion of the Luzon island. The total area of the Region is 16,229 km^2.

(1) Population

The population of each province in CALABARZON is shown in Table 3-1. The population of CALABARZON was 6.348 million in 1990, accounting for 10.5% of the Philippine population. The population density of three provinces of CALABARZON, namely Cavite, Laguna and Rizal which are contiguous to Metro Manila, is high compared to that of the Philippines (See Table 3-2). On the other hand, that of Quezon is lower than that of the Philippines.

Table 3-1 Population

Province /Region /Country	Area (Km^2)	Population (x1,000)	Population Share (%)	Population Density (per ha)
CALABARZON				
Cavite	1,288	1,153	1.9	8.95
Laguna	1,760	1,374	2.3	7.81
Batangas	3,165	1,476	2.4	4.66
Rizal	1,309	973	1.6	7.43
Quezon	8,708	1,373	2.3	1.58
Total	16,229	6,349	10.5	3.91
Region IV	46,926	8,261	13.7	1.76
Metro Manila	636	7,832	13.0	123.14
Philippines	300,048	60,477	100	2.10

Source: The Master Plan Study on the Project CALABARZON

Table 3-2 Growth Rate of Population
(% per annum)

Province etc.	1970-80	1980-90
CALABARZON		
Cavite	4.0	4.1
Laguna	3.4	3.5
Batangas	2.4	2.3
Rizal	6.1	5.8
Quezon	2.3	2.0
Total	3.2	3.3
Metro Manila	4.1	2.8
Philippines	2.8	2.3

Source: National Statistic Office

The average growth rate of population per annum, for the periods 1970-80 and 1980-90 is shown in Table 3-2. Rizal continues to have the highest growth rate(6.1% in 1970-80 and 5.8% in 1980-90) in the Region, followed by Cavite(4.0%, 4.1%) and Laguna(3.4%, 3.5%). The rate for Metro Manila declined from 4.1% in 1970-80 to 2.8% in 1980-90. This largely reflects that the social increase in CALABARZON is not only due to inflow from rural areas such as Bicol and Visayas but also due to migration out of Metro Manila.

Table 3-3 shows the population of cities and major municipalities with more than 50,000 persons of population in 1990 (Infanta in Quezon is included in the Table although its population is below 50,000)(See next page). Conspicuous increase of population is seen in San Pedro(Laguna), Antipolo and Cainta(Rizal) which are contiguous to Metro Manila. Dasmarinas also increased by more than one and half times from 1980 to 1990 supposedly with the progress of the Relocation Project of the National Housing Authority (NHA).

Table 3-3 Population of Cities and Major Municipalities in Calabarzon (1980/1990)

Province	City/Municipality	1980	1990	Growth Rate (%)
Cavite	Cavite	87,666	91,641	4.5
	Tagaytay	16,322	23,739	45.4
	Trece Martires (Cap.)	8,579	15,686	82.8
	Bacoor	90,364	159,685	76.7
	Dasmarinas	51,894	136,556	163.1
	Gen. Alvarez	-	65,977	
	Gen. Trias	39,745	52,888	33.1
	Imus	59,103	92,125	55.9
	Naic	38,243	51,629	35.0
	Silang	52,321	93,790	79.3
	Tanza	43,675	61,785	41.5
Laguna	San Pablo	131,655	161,630	22.8
	Binan	83,684	134,553	60.8
	Cabuyao	46,286	66,975	44.7
	Calamba	121,175	173,453	43.1
	Los Banos	49,555	66,211	33.6
	San Pedro	74,556	156,486	109.9
	Santa Cruz (Capital)	60,620	76,603	26.4
	Santa Rosa	6,432	94,719	47.3
Batangas	Batangas (Capital)	143,570	184,970	28.8
	Lipa	121,166	160,117	32.1
	Balayan	43,486	53,870	23.9
	Bauan	43,560	59,256	36.0
	Lemery	42,783	53,932	26.1
	Nasugbo	59,405	75,515	27.1
	Rosario	54,252	66,923	23.4
	San Juan	59,345	67,741	14.1
	Santo Tomas	43,010	59,209	35.3
	Tanauan	74,020	92,754	25.3
Rizal	Antipolo	68,912	21,058	205.6
	Binangonan	80,980	127,561	57.5
	Cainta	59,025	126,839	114.9
	Rodriguez	41,859	67,074	60.2
	San Mateo	51,910	82,310	58.6
	Tanay	40,443	58,410	44.4
	Taytay	75,328	112,403	49.2
Quezon	Lucena (Capital)	107,880	150,624	39.6
	Calauag	57,907	64,856	12.0
	Candelaria	54,629	69,969	28.1
	(Infanta)	27,814	35,564	27.9
	Lopez	58,422	66,037	13.0
	Sariaya	74,148	91,081	22.8
	Tayabas	42,137	54,355	29.0
	Tiaong	48,606	54,355	11.8

Source: 1990 Census of Population and Housing
National Statistics Office

(2) Gross Regional Domestic Product(GRDP)

The GRDP in Region IV was 147,600 million pesos at current prices (101,346 million pesos at constant 1985 prices) in 1990, accounting for 14.4% of the Gross Domestic Product of the Philippines as shown in Table 3-4. (The GRDP in Metro Manila accounts for 31.6% of the GDP.)

Table 3-4, 3-5 and 3-6 show GRDP etc. in Region IV or CALABARZON. (See Appendix) The sectoral share of industry in GRDP increased from 33.4% in 1987 to 40.8% in 1991.

Table 3-4 Gross Regional Domestic Product in Region IV, 1987-1991
(in Million pesos, at 1985 prices)

Year	Value	Annual Growth Rate(%)
1987	87,800	
1988	93,523	6.42
1989	100,560	7.52
1990	102,764	2.19
1991	103,058	0.29

Average annual rate (1987-1991) = 4.3%
Source: Medium-Term Southern Tagalog Region Development Plan 1993 - 1998

Table 3-5 Sectoral Share in GRDP in Region IV, 1987 - 1991
(in percent)

Sector	1987	1988	1989	1990	1991	Net Increase (1987-1991)
Agriculture	32.1	30.0	29.4	29.4	29.1	11.3
Industry	33.4	39.7	40.9	40.9	40.8	27.8
Service	34.6	30.1	29.7	29.7	30.1	10.6

Source: Medium - Term Southern Tagalog Region Development Plan 1993 - 1998

Table 3-6 GRDP and Employment in CALABARZON, 1988

Sector	Employment (x1,000)	Employment coeficient (Px1,000per capita)	Value-added (PxMillion)
Agriculture, forestry and fishery	606 (29.0)	30	18,180 (18.8)
Industry	544 (26.0)	75	40,800 (42.2)
Services	942 (45.0)	40	37,680 (39.0)
Total	2,092	-	96,660

(% share in parenthesis)
* in 1988 price

Source: The Master Plan on the Project CALABARZON, JICA

(3) Land Use

Table 3-7 shows the present general land use in the Region. (See Appendix) Rizal has the largest built-up land share with 11.8% and the smallest agricultural land share with 14.3% in the Region. Cavite has the largest agricultural land share with 68.9%, followed by Batangas with 62.2%. Quezon has the largest forest and woodland share with 35.7%.

(4) Agriculture

Contribution of the agriculture in the Region to the national product is relatively small, but it specializes in crops for supply to Metro Manila.

As shown in Table 3-7, among the five provinces of CALABARZON, Cavite has the largest area planted with banana(12,000 ha) and coffee (10,000 ha). Agricultural land use is well diversified in this province. In addition, saltbeds exist along the seashore between Bacoor and Noveleta with a total area of 500ha.

Laguna has a large share of coconut area with 69,000 ha or 40% of the total provincial land. The land area used for sugarcane has decreased in the last five years, reflecting the decline in international market prices for sugar. Irrigation, especially for palay, is most developed. Piggery operation, duck raising and dairy farming recently started to develop.

Agriculture in Batangas is dominated by two commercial crops: coconut and sugarcane. Poultry activities for chicken are concentrated in Lipa City. Corn production

Table 3-7 Present General Land Use

(ha)

Land Use	Cavite		Laguna		Batangas		Rizal		Quezon		CALABARZON	
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
Total Provincial	128,775	100.0	175,974	100.0	316,581	100.0	130,894	100.0	870,660	100.0	1,622,883	100.0
Agricultural Crops	88,707	68.9	107,117	60.9	196,847	62.2	18,764	14.3	455,610	52.3	867,044	53.4
Paddy; Irrigation	15,169	11.8	22,296	12.7	2,301	0.7	3,564	2.7	40,098	4.6	83,428	5.1
Paddy; Non-Irrig.	7,146	5.5	1,320	0.8	16,433	5.2	3,982	3.0	13,175	1.5	42,057	2.6
Other Seasonals	7,544	5.9	1,232	0.7	25,979	8.2	44	0.0	16,312	1.9	51,112	3.1
Fruit Trees	6,528	5.1	1,092	0.6	607	0.2	7,839	6.0			16,065	1.0
Banana	12,371	9.6			990	0.3	1,215	0.9			14,575	0.9
Coconut	21,513	16.7	69,317	39.4	80,234	25.3	2,119	1.6	385,932	44.3	559,114	34.5
Sugarcane	10,503	8.2	11,860	6.7	70,304	22.2					92,667	5.7
Other perennials	7,933	6.2							93	0.0	8,026	0.5
Foerest and Woodland	8,854	6.9	26,079	14.8	19,453	6.1	17,771	13.6	310,463	35.7	382,620	23.6
Bamboo	1,612	1.3			10,149	3.2	4,733	3.6			16,495	1.0
Grassland and Shrubland	15,259	11.8	29,968	17.0	76,984	24.3	69,855	53.4	68,858	7.9	260,924	16.1
Wetland & Special Area	921	0.7	2,147	1.2	3,884	1.2	442	0.3	33,289	3.8	40,683	2.5
Built-up Area	8,251	6.4	10,576	6.0	7,040	2.2	15,237	11.6	2,424	0.3	43,528	2.7
Mining and Quarring	17	0.0	70	0.0	276	0.1	1,520	1.2	16	0.0	1,899	0.1
Other Built-up Area			17	0.0							17	0.0
Unclassified Areas	5,155	4.0			1,948	0.6	2,572	2.0			9,674	0.6

Source: The Master Plan Study on the Project CALABARZON, JICA has been increasing to meet the feed requirements for the hog and poultry industry mainly, in the eastern part of the province.

In Rizal, irrigated palay is the main crop in the lowland and fruit trees in upland. Some agricultural land had been encroached upon by the urbanization/industrialization from Metro Manila.

Quezon is dominantly planted with coconut, the area for which accounts for 86% of the agricultural land. Forest and woodland account for 25% of the provincial land.

Production of Main crops produced in CALABARZON and their average yields are compared in Table 3-8 with the national average. Average agricultural yield in Calabarzon is generally low except for coconut and calamansi.

Crops with high share in national production are blackpepper(50%) and calamansi (31%).

Table 3-8 Production and Yield of Main Crops in CALABARZON, 1988

Crop	Production (1,000tons/year)	Share in National Production(%)	Average Yield(ton/ha)	
			CALABARZON	Philippines
Paddy	413.7	4.6	2.44	2.64
Corn	199.3	4.5	0.91	1.18
Tomato	18.1	10.9	8.77	9.16
Banana	104.9	3.4	3.24	10.41
Mango	23.3	6.1	4.16	6.48
Calamansi	14.6	31.0	9.73	4.22
Pineapple	43.6	3.6	11.19	20.02
Coconut	1,814.1	14.5	4.64	3.87
Sugarcane	1,939.2	12.5	69.01	72.09
Coffee	16.9	11.9	0.94	1.00
Balckpepper	0.1	50.0	0.50	0.79

Source: The Master Plan Study on the Project CALABARZON, JICA

(5) Industry

Table 3-9 shows the composition of estimated value added and employment in CALABARZON in 1988. Petroleum & coal products ranks first with 42% of value added in the Region, the firms of the industry are concentrated around the Port of Batangas, followed by food manufacturing with 23% and textiles with 8.5%. With regards to the number of employment, food manufacturing and foot wear/wearing apparel have almost the same share, 23-24%, followed by textiles.

Table 3-9 Estimated Value Added and Employment in CALABARZON in 1988

	I Value Added in million pesos	II Employment (in Persons)	III Productivity (I / II)
ALL INDUSTRIES	43,133	360,000	119.8
Food Manufacturing	9,860	86,830	113.6
Beverage Manufacturing	1,487	4,880	340.7
Textiles	3,671	68,420	53.7
Footwear, Wearing Apparel	2,240	84,550	26.5
Wood and Cork Productivity	121	6,320	19.2
Furniture and Fixtures	28	1,430	19.9
Paper and Paper Products	541	8,740	61.9
Publishing and Printing	44	1,980	22.1
Leather and Leather Products	57	2,480	22.8
Rubber Products	42	1,840	22.9
Chemicals & Chemical Products	1,829	11,210	163.1
Petroleum & Coal Products	18,128	3,620	5,007.8
Non-Metallic Meneral Products	731	18,390	39.7
Basic Metal Industries	325	6,850	47.5
Metal Industries	1,090	9,730	112.1
Machinery except Electrical	188	4,820	39.0
Electrical Machinery & Equipment	1,353	18,030	75.0
Transportation Equipment	435	8,280	52.6
Other Manufacturing Industries	963	11,600	83.0

Source: 1988 Census of Establishment

Table 3-10 shows provincial distribution of BOI approved projects in 1988-1992(See Appendix). The maximum project cost in this term appeared in 1990. The share of project cost of CALABARZON in the country peaked in 1991 at 31%. According to the Table, big projects were approved in Batangas in 1990 and 1991. The CALABARZON's share reduced to 18% in 1992 from 42% in 1991. Increment of employment with the projects was 15,000 to 40,000 persons per year. Its share in the country in 1992 was 30%.

Table 3-11 shows the Cavite EPZ performance in 1987-1992. The trade balance in 1992 was nineteen million US dollars, and the average employment was twenty thousand persons.

Table 3-12 shows features of the operating firms. Textile industry accounts for 40% in the number of firms, followed by electrical machinery with 14%. From the point of view of the average employment per firm, the rubber product industry ranks first with 2,034 persons per firm, electrical machinery comes in second with 580 persons, while the average firm employment of 58 companies occupied in 1991 was about 300 persons. On the other hand, the average firm's area ranges from 0.5 ha to 1 ha.

Table 3-10 Provincial Distribution of BOI Approved Projects

Year	Province	Firms No.	Cost (P000)	Equity Investment (P000) Total	Local	Foreign	Employment
1988	Cavite	18	1,173,729	515,534	216,496	299,038	5,850
	Laguna	36	1,870,564	1,339,060	1,044,869	294,191	7,919
	Batangas	13	692,127	321,590	134,650	186,940	760
	Rizal	36	594,581	316,133	136,459	179,674	5,374
	Quezon	2	25,872	25,872	25,872	0	81
	CALABARZON	105	4,356,873	2,518,189	1,558,346	959,843	19,984
			15.2%	17.6%	23.4%	1.3%	15.6%
	Philippines	647	28,720,161	14,313,857	6,655,046	74,658,811	128,052
1989	Cavite	37	2,661,929	1,674,526	573,881	1,100,645	5,643
	Laguna	73	7,548,574	4,724,628	3,248,536	1,476,092	14,409
	Batangas	26	1,754,494	462,098	149,711	312,385	3,190
	Rizal	56	11,608,422	4,178,365	2,761,348	1,417,017	15,594
	Quezon	3	47,366	13,963	13,963	0	343
	CALABARZON	195	23,620,785	11,053,580	6,747,439	4,306,139	39,179
			37.9%	35.6%	35.6%	35.5%	25.5%
	Philippines	1,023	62,303,895	31,045,479	18,932,514	12,112,965	153,490
1990	Cavite	37	7,483,169	4,301,087	1,277,897	3,023,190	10,798
	Laguna	56	5,634,403	3,666,146	3,176,119	490,027	6,136
	Batangas	27	24,000,949	5,271,997	616,009	4,655,988	2,760
	Rizal	45	1,175,423	853,754	302,868	550,886	6,657
	Quezon	7	222,031	48,917	31,974	16,943	1,435
	CALABARZON	172	38,515,975	14,141,901	5,404,867	8,737,034	27,816
			38.6%	35.3%	24.6%	48.1%	24.6%
	Philippines	767	99,895,449	40,109,963	21,961,378	18,148,585	113,290
1991	Cavite	40	2,199,991	1,289,052	980,275	308,777	4,533
	Laguna	50	2,718,511	1,664,737	980,261	684,476	5,645
	Batangas	26	25,200,918	13,855,785	6,368,415	6,695,298	4,428
	Rizal	37	716,832	259,503	169,190	98,313	5,790
	Quezon	3	7,294	7,294	3,090	4,204	52
	CALABARZON	156	30,843,546	17,076,371	8,501,231	7,791,068	20,448
			41.6%	51.7%	44.8%	55.5%	32.4%
	Philippines	498	74,179,828	33,005,328	18,968,808	14,044,528	63,068
1992	Cavite	35	7,599,429	1,704,639	345,074	1,359,565	4,743
	Laguna	41	4,503,397	2,147,938	1,146,080	1,001,858	4,359
	Batangas	13	3,978,319	1,208,111	807,290	400,821	1,791
	Rizal	30	538,544	273,415	200,933	72,482	4,266
	Quezon	3	42,983	30,233	27,131	3,102	183
	CALABARZON	122	16,662,972	5,364,336	2,526,508	2,837,828	15,342
			17.8%	20.8%	12.5%	50.7%	30.8%
	Philippines	390	93,397,315	25,836,327	20,238,838	5,597,489	49,856

Source: BOI

Table 3-11 Cavite EPZ Performance

	1987	1988	1989	1992
Number of Firms Operating	1	4	14	90
Average Employment	99	323	3,294	20,204
Salaries and Wages (P000)	876	6,017	43,497	711,316
Local Sales (P000)			1,364	
Local Purchases (P000)		277	4,418	
Exports (US$000)	739	3,021	15,306	251,855
Imports (US$000)	712	2,843	11,631	232,668
Trade Balance (US$000)	27	178	3,675	19,187

Source: EPZA

Table 3-12 Features of the Operating Companies by PSIC code (As of Aug., 1991)

PSIC Code	Number of Company	(%)	Average Employment per Firms (Persons)	Average Area(m2) per Firms	Total Employ-ment (Persons)	(%)	Total Land Area Occupied (m2)	(%)
312	1	1.7		5,000	0	0.0	5,000	1.1
321	3	5.2	142	8,333	425	3.3	25,000	5.4
322	23	39.7	216	4,689	4,317	33.6	107,836	23.3
331	1	1.7		5,000	0	0.0	5,000	1.1
341	2	3.4	98	4,002	195	1.5	8,003	1.7
355	1	1.7	2,034	31,077	2,034	15.8	31,077	6.7
356	1	1.7		5,000	0	0.0	5,000	1.1
369	1	1.7		5,000	0	0.0	5,000	1.1
371	1	1.7	7	10,000	7	0.1	10,000	2.2
372	1	1.7	40	10,000	40	0.3	10,000	2.2
381	5	8.6	113	10,000	565	4.4	50,000	10.8
382	2	3.4	293	11,642	586	4.6	23,284	5.0
383	8	13.8	580	18,725	4,062	31.6	131,076	28.4
384	1	1.7	26	5,000	26	0.2	5,000	1.1
385	1	1.7	39	3,003	39	0.3	3,003	0.6
390	6	10.3	113	6,331	564	4.4	37,984	8.2
	58	100.0	308	8,110	12,860	100.0	462,263	100.0

Source: EPZA,

Note: PSIC (Phipipine Standand Industrial Classification)

312	Food	371	Iron & Steel Basic Products
321	Textiles	372	Non-ferrous Metal Products
331	Wood & Wood Product	381	Fabricated Metal Products
332	Furniture & Fixtures	382	Mashinery except electrical
341	Paper & Fixtures	383	Electrical Mashinery
351	Industrial Chemical	384	Transport Equipment
355	Rubber Products	385	Other Equipment & Infrastructure
356	Plastic Products	390	Other Manufacturing Industries
369	Non-metalic Mineral Products		

The imported/exported cargo volumes to/from Cavite EPZ in 1991 and 1992 are as follows:

	Imported (ton)	Exported (ton)	No. of Firms
1991	20,156	14,664	58
1992	28,554	21,839	75

Among the above-mentioned cargoes, the number of those transported by container were as follows:

	Imported		Exported	
	20'Footer	40'Footer	20'Footer	40'Footer
1992	268	1,068	576	804

The major firms with large cargo volume are shown in Table 3-13.

Table 3-13 Major Firms with large cargo volume in Cavite EPZ

No.	Code	Cargo Volume (ton) 1991		1992 Export Import		Packing Type	
		Export	Import			Export	Import
1	38	2,141	1,670	2,856	2,015	1 & 2	1 & 2
2	32	658	1,681	1,907	2,752	1 & 2	1 & 2
3	38			1,713	2,736	1 & 2	1 & 2
4	31	2,607	2,693	2,016	2,279	1 & 2	1 & 2
5	38	1,306	1,361	2,270	2,018	1 & 2	1 & 2
6	38	1,768	2,476	1,158	1,286	2	1 & 2
7	38	337	520	777	913	1 & 2	1 & 2
8	35	907	558	729	721	1 & 2	1 & 2
9	32	268	369	611	802	1 & 2	1 & 2
10	32	66	444	601	807	1 & 2	1 & 2
11	38	635	455	647	689	1 & 2	1 & 2
12	32	327	507	421	654	1 & 2	1 & 2

note 1) The relationship the code number in the Table and PSIC 31:311-312, 32:321-323, 35:351-356, 38:381-385

note 2) Packing type in the Table in that when transported from/to Cavite EPZ; type 1: container, type 2: carton

Source: Cavite EPZ

From Table 3-12 and 3-13, the major manufacturing industries with respect to cargo volume, are now electrical machinery, garment, food and rubberindustry. The materials for processing and the final products are transported in/out the Cavite EPZ by container or carton.

Table 3-14 shows industrial estates development projects registered with BOI(See Appendix). The industrial estates shown in the Table are mainly located in Cavite and Laguna Provinces, that is, in the Rosario-Imus Industrial Area(IA), Carmona-Trece Martinez IA, Laguna west IA and Upland Industrial Center.

(6) Transportation

The CALABARZON region, due to its geographical advantages, is relatively well served by national transportation system. Major roads radiating from Metro Manila provide transport arteries in the Region. The main line railway (Manila Line South of PNR) passes through the Region, an international airport(Ninoy Aquino International Airport) and an international port(Port of Manila) are accessible via these roads. The region is further linked with a number of islands through a couple of regional ports(Batangas and Lucena)

1) Road Infrastructure

Table 3-15 and Table 3-16 show road length(Km) by system classification and standard, 1990(See Appendix). The concreted and asphalted roads are 28.5% in length of total road in Region IV-A(CALABARZON and Aurora); those in NCR are 89% and those in the Philoppines are 14.5%.

a) Road Network

Table 3-17 and Figure 3-1 (See Appendix) show road network within Metro Manila and within CALABARZON.

Table 3-14 Profiles of Industrial Estates (IE) and EPZ Operating or Proposed in Region IV (as of June 1991)

Province	Name of Industrial Estate	Total Area (in ha)	Available Land	Location
Cavite				
Operating	Gateway Business Park	160	74	Cen. Trias
	First Cavite IE	155	40	Dasmarias
	Cavite EPZ	Note 1)		Rosario
	Dasmarinas IE	11.81	5.77	Dasmarinas
	Gen. Mariano Alvarez IE	15.68	10.99	Gen. Mariano
	People's Technology Complex	52	3.32	Carmona
	Anabu I & II IE	200	200	Gen. Trias
	New Cavite IE	43.89	8.84	Gen. Trias
	First Cityland Heavy IC	32.1	1.3	
Proposed	Sahud-Ulan & Tres Cruses IC			
	Timalan IE			
	Trece Martirez Special IE			
	Ajinomoto IE			
	Don Bosco IE			
	Eastern Silang IC			
	First Cityland Heavy IC			
	Manggahan IE			
	Pasong Buwaya-Tanzang Luma IC			
Laguna				
Operating	Carmelray Industrial Park	535	315	Calambang
	Light Industry & Science of the Philippines	143	143	Cabuyao
	Laguna Technopark	220.6	98	Sta. Rosa
	Canlubang Industrial Park	768	60	Canlubang
	Laguna Int'l Ind'l Park	117	79	Binan
Proposed	Pinugay IE			
	San Mateo IE			
Batangas				
Operating	Shell Gas Philippines, Inc.			Tabangao
Proposed	Batangas IC			Bauan
Rizal				
Proposed	Pinugay IE			Tanay
	San Mateo IE			San Mateo

Note 1) Land Area: Implementation plan 145.2ha
(Phase I 39.2ha, Phase II 38.6 ha, Phase III 30.3ha
Phase IV 37.1ha, Phase V 26.3ha)
Future Plan 171.5ha

Source: DTI

Table 3-15 Existing Road Length (Km) by System Classification and Standard, 1990

	Philippines	NCR	Region IV-A	Region III-A
Total	160,560	2,987	10,702	6,091
National	26,272 16.4%	888 29.7%	2,284 21.3%	835 13.7%
Provincial	29,156 18.2%	-	1,870 17.5%	901 14.8%
City	3,949 2.5%	1,274 42.7%	226 2.1%	128 2.1%
Muninipal	12,819 8.0%	554 18.5%	874 8.2%	391 6.4%
Barangay	88,363 55.0%	271 9.1%	5,448 50.9%	3,835 63.0%

Region III-A: Bataan, Bulacan, Pampanga
Source: DPWH

Table 3-16 Existing Road Length (Km) by Standad, 1990

	Philippines	NCR	Region IV-A	Region III-A
Total	160,560	2,987	10,702	6,093
Concrete	10,358 6.5%	1,185 39.7%	1,151 10.8%	871 14.3%
Asphalt	12,753 7.9%	1,479 49.5%	1,891 17.7%	516 8.5%
Gravel	128,953 80.3%	311 10.4%	7,299 68.2%	4,223 69.3%
Earth	8,497 5.3%	12 0.4%	361 3.4%	181 3.0%

Table 3-17 Road Network with Metro Manila and within the Region

	Major road Corridor (MRC)	Category of Road
1	Metro Manila - Calamba	South Super Ilighway
	Calamba - San Pablo - Lucena	national road
2	Metro Manila - Calamba	South Super Ilighway
	Calamba - Lipa - Batangas	national road
	(Batangas - Calapan (Mindro))	(by ferry)
3	Metro Manila - Cavite City	national road
4	Metro Manila - Antipolo	national road

	Main Secondary Links (MSL)	Province
1	Cavite/Rosario - tagaytay	Cavite
2	Calamba - Sta. Cruz	Laguna
3	Batangas - Balayan - nasugbu	Batangas
4	Nasugbu - Tagaytay - Sto. Tomas	Batangas
5	Carmona - Trece Martines - Cavite	Cavite
6	Sta. Cruz - Famy - Real - Infanta	Laguna - Quezon
7	Marikina - San Mateo - Montalban	Metro Manila - Reza
8	Cainta - Teresa - Tanay - Famy	M. M. - Rezal - Quezon
9	Sta. Cruz - Lucena - Taybas	Laguna - Quezon

No 1 of Major Road Corridor(MRC)(Metro Manila - Calamba - Lucena) in the above Table forms part of the backbone of the country, extending further to the more southern parts of Luzon Island and connecting the Region with Camarines, Albay and Sorsogon. New industrial estates are located/planned along a part of the South Supper Highway.

No 2 of MRC extends to the suburbs of Batangas City and will play and essential role in port-oriented commodities upon completion of the extension of the diversion road to the Port of Batangas.

No 3 of MRC(Metro Manila - Cavite City) now provides a main traffic network forimported/exported commodities from/to Cavite EPZ, connecting the area with the Port of Manila, as well as providing a network for commuters working in Metro Manila and for business.

No 4 of MRC connects Antipolo with Metro Manila, Antipo is the largest populated municipality in Rizal, with a growth rate(1990/1980) of more than 200% and plays as one of the arterial roads for commuters in Rezal to Metro Manila the same as No 8 of the Main Secondary Links(MSL)(Cainta - Tanay - Famy).

Nos 3(Batangas - Balayan - Nasugbu), 4(Nasugbu - Tagaytay - Sto. Tomas) and 9(Sta.Cruz - Lucban - Tayabas) of MSL will form the main tourism circuits in the Region.

No 5(Carmona - Trece Martines - Cavite) of MSL will play an essential role for the land/sea transportation of cargoes from/to Carmona-Trece Martines Industrial Area(See 3.3.1 and Table 3-14) connecting the Ports of Manila and Batangas through No2 of MRC.

The mountainous road of Famy-Real section of No 6 of MSL is now under

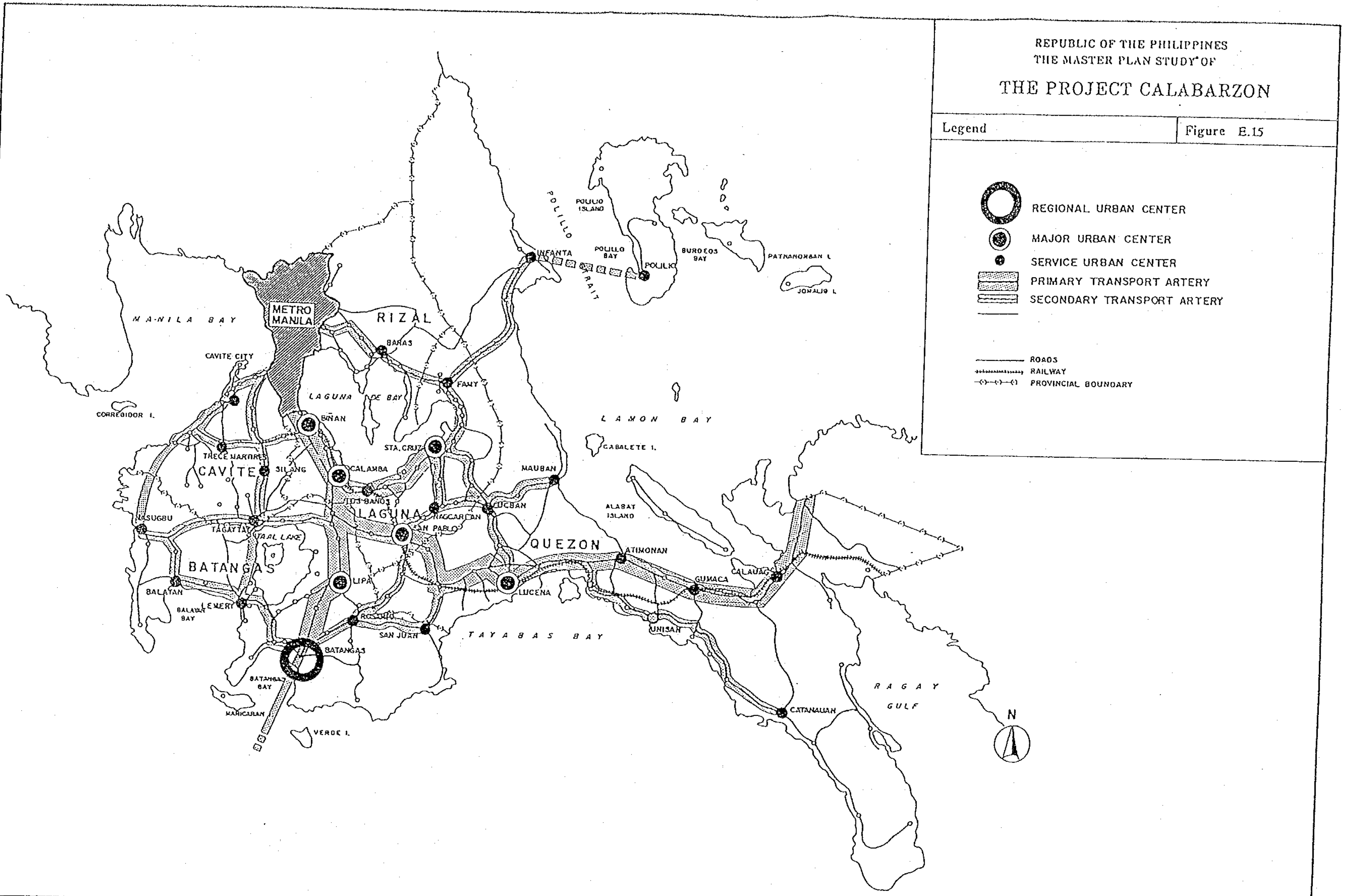


Figure 3-1 Transport Arterial Network for CALABARZON

Department of Trade and Industry

Japan International Cooperation Agency

reconstruction. No 6 of MSL will play an essential role for the development of the municipalities of Infanta(population in 1990 was 35,500), Real, General Nakar, Polilio Island and others, and also for the development of the Ports of real and Dalahican(Infanta).

b) Freight Traffic

Freight traffic movement in CALABARZON relies almost exclusively upon road transport, while all inter-island traffic movements are by sea. PNR's contribution, at present, is negligible, Metro Manila is the hub for most domestic movements, particularly for road movements in Luzon.

Table 3-18 Commodity Flow Pattern in South Luzon

Commodity	% of Trucks	
	From Manila	To Manila
Unprocessed Agricultural	10.5	33.9
Processed Agricultural	3.5	4.9
Soft Drink/Beer	4.2	2.3
Tmber/Firewood	1.0	1.8
Maneral Oils	3.1	3.8
Construction Materials	6.8	2.2
Others	9.9	10.5
Empty	61.0	40.7
Total	100.0	100.0

Source: The Master Plan Study on the Project CALABARZON

Limited surveys conducted in NTPP in the early 1980s(OD survey at Sto. Tomas) give and indication of commodity flow pattern in South Luzon as shown in Table 3-18. The largest commodity by volume is unprocessed agricultural products from/to Manila, of which the commodity from Manila is mostly from other islands through the Port of Manila.

c) Road Vehicular Traffic

The characteristics of road traffic volume in CALABARZON are as follows:

i) Heavy traffic is observed on the roads radiating from Metro Manila in four directions; east into the province of Rizal, south east along the South Super

Highway/Manila South road, south of Bacoor and Imus, and southwest along the coast of Cavite.

ii) Traffic volume consistently decreases on each of these roads as the distance from Metro Manila increases.

iii) Other relatively heavy traffics are observed only at a few road sections away from Metro Manila.

2) Railways

a) Railway Network and facilities

The PNR network is divided into two operating systems(Figure 3-1 See Appendix):

i) Main Line North: running from Tutuban Station(km 0) to San Fernando, La Union(km 266), with a branch line from Tarlac(km 119) to San Jose(km 174); and

ii) Main Line South: running from Tutuban(km 0) to Legaspi(km 478.5) with the following two major branch lines:

East Line: Sta. Mesa(km 6.5) to Guadalupe(km 13)(stopped operation since 1982), and

Carmona Line: San Pedro(km6.5km) to Carmona(km 40)

The rehabilitation of the track structure for the Main Line South has been carried out for the section between Paco and Naga since 1977 under an ADB loan. However, no significant achievement was made. At present, an additional rehabilitation work is on-going under OECF to improve the facilities and operation.

Commuter services are available using the Main Line South and the Main Line North. Current service frequencies are low except for the Manila-Carmona route(Figure 3-1, See Appendix). Particularly along the Main Line North, service frequencies are negligible compared to buses/jeepneys.

b) Freight Traffic

The Tonnage carried by PNR had continuously deteriorated from 1.2 million tons in 1960-61 to 0.3 million tons in 1974-75, 142 thousand tons in 1980, 54 thousand tons in 1985, and to only 32 thousand tons in 1990. Of the total tonnage, 24% generates from Tagkawayan, 23% from Manila, 16% from Hondagua and 11% from Ragay, while 50% are attracted to Manila, 15% to Lucena, 12% to Ligo and 10% to Naga. Manila accounts for 73% of the total generating and attracted tonnage of goods.

Table 3-19 shows the major commodities handled by freight, 1990. Composition of major commodities varies considerably by year. The data in the Table are only indicative.

Table 3-19 Major Commodities Handled by Freight, 1990

Commodity	1990 Volume Handled(tons)	% of Total
1. Copra/Coconut	13,121	42.7
2. Other Mined products	3,520	11.4
3. Firewood	3,154	10.3
4. Lumber & Plywood	2,970	9.7
5. Misc. Categories	2,146	7.0
6. Beer/Wine/Liquor/Soft drinks	2,016	6.6
7. Salt	1,196	3.9
8. Cement	1,015	3.3
9. Rice/Paddy/Husk	860	2.8
10. Sand/Gravel/Stones	759	2.5
Total	30,757	100.0

Source: The Master Plan Study on the Project CARABARZON, JICA

3) Ports

In Luzon Islands, there are two Port District Offices(PDO), namely Manila and Luzon. In the CALABARZON region, there is a Port Management Office(PMO) Batangas under the PDO of Luzon, The administration area of Batangas PMO covers five provinces, that is, Batangas, Quezon, Oriental Mindoro, Occidental Mindoro and Marindugue. Under the supervision of PMO Batangas, there are one base port (Batangas), two terminal ports (Calapan, San Jose) and twenty-six municipal ports according to the Port Inventory Project Report and twenty-two private ports. The Ports of Romblon Province are under the supervision of PMO North Harbor of Manila.

Table 3-20 a) and b) show domestic port cargo and passenger statistic at the ports under PMO Batangas and Port of Romblon(See Appendix). Port of Batangas handled 3,533 MT of exported cargoes and 113,275 MT of imported cargoes in addition to 913 thousand MT of domestic cargoes. Detailed Batangas port activity is mentioned in Chapter 5. Port of Real, located on the Quezon west coast, is now used by cargo/passenger vessels plying between Real and Polilio of Polilio Island. Incoming cargoes are copra and outgoing cargoes are composed of household consumption goods. With the grading up of the existing road connecting the area with Metro Manila. Port of Real will be a strategic port on the west coast of Quezon. Along the coast of

Batangas, thirteen private ports have been constructed, of which two ports are not purely owned by private firm, but by a government-owned company and a government agency respectively. The type of Industry related to each private port is classified as follows:

1) Oil refinery -- two ports
2) Ship repair and building ---------------------------------- three ports
3) Purchase, storage & transportation of ---------------- two ports
   grains and other foods or chemicals
4) Coconut chemical industry or flour milling -------- two ports
5) Supply base for energy-related operation ----------- one port
6) Steel fabrication --- one port
7) Creosoting Plant -- one port
8) Lease of the facilities to private firms -------------- one port

Table 3-20a) Port Cargo and Passenger Statistics, 1990
(Base Port and Terminal Port)

Port	Domestic Cargo (MT)			Passenger (persons)		
	Inward	Outward	Total	Embarked	Disembarked	Total
Batangas	530,480	382,590	913,070	632,536	667,293	1,299,829
Siain	4,188	279	4,467	0	0	0
Calapan	325,906	385,900	711,806	305,767	477,488	783,255
Balanacan	40,198	21,324	61,522	115,257	131,902	247,159
Sta. Cruz	17,020	14,502	31,522	76,634	81,825	158,459
San Jose	74,849	123,542	198,391	33,339	27,584	60,923
Romblon	17,935	50,426	68,361	19,570	20,977	40,547

Source: Port Inventory Project Report, 1990

Table 3-20b) Port Cargo and Passenger Statistics, 1990
(Municipal Ports)

Port	Domestic Cargo (MT)			Passenger
	Inward	Outward	Total	Total
BATANGAS				
Anilao	346	499	845	65,104
Calatagan			5,600	1,600
Lemery	2,468	minimal	2,468	9,600
Lobo			7,500	
Nasugbu			3,400	29,600
Tingloy			130	9,000
Quezon				
Alabat	3,185	6,496	9,681	72,000
Atimonan	22,650	5,700	28,350	120,000
Calauang	1,920	1,470	3,390	30,000
Mauban			20,000	60,000
Pitogo	?	5,700	5,700	6,000
Pollio	16,586	13,200	29,786	60,000
Real	13,200	16,586	29,786	60,000
San Adres			3,500	10,000
Marinduque				
Cawit				
Or. Mindro				
Balatero	924	244	1,168	108,800
Bulalacao	641	522	1,163	20,640
Rekudo	627	780	1,407	23,200
Roxas			8,800	30,240
Occ. Mindro				
Abra/Ilog	1,411	1,731	3,142	49,500
Sablayan			11,530	
Tayamaan			16,800	
Tilik			1,761	100,000

Source: Port Inventory Project Report
(Municipal Ports), 1992

3.2 Development Scenarios and Frameworks

3.2.1 CALABARZON Regional Development Objectives

Base on the goal and expected roles of the CALABARZON Regional Development Project as well as the existing regional development objectives set by NEDA for Region IV, "The Master Plan Study on the Project CALABARZON BY JICA" has set the following four objectives for the mid- to long-term development of CALABARZON:

a) To enhance the income level on rural areas by creating employment opportunities in primary agriculture, agro-processing industry and service activities as well as by increasing productivity in agriculture;

b) To sustain the high level of growth on the balance between agriculture and industry by promoting complementary linkages between the two major sectors, improving the industrial structure, and inducing related service activities;

c) To contribute to a more equitable development, no generating the urban poor and squatters, but another uplifting the rural people from their poverty, and realizing better spatial distribution of population and economic activities

d) To create a better human environment and enhance social capacity for development by protecting/enhancing natural environment, improving the provision of physical infrastructure and social service, and incorporating socio-cultural values in project planning and implementation.

3.2.2 Development Alternatives

The future growth of CALABARZON will depend much on two components a) the natural and human resources and b) the Region's proximity to Metro Manila. Two distinct alternatives are conceived, each emphasizing either one of these aspects.

(1) Agro-based Strategy

This strategy will emphasize agriculture, agro-processing industry, and the development of services directed to the rural population. It will call on increasing the agricultural output to support the processing industries and changing the cropping patterns to exploit marketing opportunities.

(2) High Industrialization Strategy

Another distinct strategy may be to aim for the highest overall growth of industry. The high industrial growth will depend primarily on (i) how much incremental growth of Metro Manila based firms will take place in CALABARZON, and (ii) to what extent the export-oriented assembly type industry will induce the development of linkage industries including SME's. Many potential linkage industries are also located at present in Metro Manila. Thus this strategy corresponds largely to high spillover from Metro Manila.

Under this high spillover strategy, two alternatives may be conceived in terms of spatial development:

(a) Acceleration of the urbanization around Metro Manila, and

(b) More decentralized pattern of growth.

Three alternative have been defined to guide the formulation of a long-term development plan for CALABARZON region. These alternatives emphasize in different degrees the two distinct alternatives for development strategy (i) and (ii) mentioned above.

(1) Alternative 1: Agro-based Development

This alternative emphasizes agro-based strategy. More attention is directed to the rural population. Relationships between rural service and their respective hinterlands will be more important in overall development of the Region. In addition to agriculture and ago-related industries, various services will play important roles in employment creation and economic growth based on rural economy. Economic activities based on other indigenous resources will also be important.

(2) Alternative 2: High Industrialization

This alternative emphasizes the high industrialization strategy. High rates of increase in labor productivity and large spill over from Metro Manila are assumed. CALABARZON development under this alternative will be led by high industrialization particularly in the surburbanization areas near Metro Manila, while other areas will develop primarily by promoting linkages with Metro Manila and its vicinity.

(3) Alternative 3: Leap-frog Development

This alternative represents an intermediate path between Alternative 1 and Alternative 2. Growth momentum centering on Metro Manila will be effectively utilized, but the development will be directed also to selected urban centers in the outer areas. Spill over from Metro Manila will be moderate, and thus the alternative will be accommodated in CALABARZON in a more orderly manner.

3.2.3 Development Framework

The socio-economic indices used are the gross regional domestic products(GRDP) and its breakdown in agriculture, industry and services, population, employment and the per capita GRDP.

(1) Projection Method

i) For Alternative 1, the value-added in the agriculture sector is projected by determining crop production by major crop and livestock, poultry and fishery production individually.

ii) For Alternative 2 and 3, the value-added in the industry sector is projected by determining the level of spill over from Metro Manila and the resultant change in sub-sector composition. Growth of the agriculture sector under these alternatives is assumed at a rate lower than attained under Alternative 1.

iii) Service sector multiplier is assumed separately for agriculture and for industry in 1988 to reproduce the estimated service sector value-added in the same year. The multiplier value is assumed to increase differently under Alternative 1, 2 and 3.

iv) Rate ofincrease in labor productivity is 3.0% per annum for all the sectors under Alternative 1, 3.0% for agriculture and 3.5% for industry and services under Alternative 2 and 3.

Projection results are summarized in Tables 3-21 and 3-22(See Appendix). The growth ratio of GRDP(2010)/GRDP(1988) of each Alternatives is projected to increase as follows:

Table 3-21 Value-Added and its Projection for Three Auternatives in CALABARZON

(x million pesos in 1988 price)
(% share in parenthesis)

	Estimate	Projection					
		Alternative 1		Alternative 2		Alternative 3	
	1,988	2,010	G.R.	2,010	G.R.	2,010	G.R.
Agriculture, Forestry & Fishery	18,180 (18.8)	39,200 (8.2)	3.6	34,100 (4.5)	2.9	34,100 (5.5)	2.9
Industry	40,800 (42.2)	227,800 (47.8)	8.1	372,200 (48.6)	10.6	294,900 (47.7)	9.4
Serviced	37,680 (39.0)	209,700 (44.0)	8.1	358,900 (46.9)	10.8	289,300 (46.8)	9.7
GRDP	96,660	476,700	7.5	765,200	9.9	618,300	8.8

G.R.: Growth Rate (% p.a)(1988-2010)

Table 3-22 Employment and its Projection for Three Auternatives

(x hundred persons, % share in parenthesis)

	Estimate	Projection					
		Alternative 1		Alternative 2		Alternative 3	
	1988	2010	G.R.	2010	G.R.	2010	G.R.
Agriculture, Forestry & Fishery	600 (29.0)	682 (13.6)	0.5	593 (8.3)	-	593 (10.2)	-
Industry	544 (26.0)	1,585 (31.7)	5.0	2,328 (32.7)	6.8	1,844 (31.6)	5.7
Serviced	942 (45.0)	2,736 (54.7)	5.0	4,209 (59.0)	7.0	3,393 (58.2)	6.0
GRDP	2,092	5,003	4.0	7,130	5.7	5,830	4.8

G.R.: Growth Rate (% p.a.)(1988-2010)

Source: The Master Plan on the Project CALABARZON, JICA

		GRDP(2010)/GRDP(1988)
Alternative	1	4.9
	2	7.9
	3	6.4

The growth ratio of employment(2010)/employment(1988) of each Alternative is projected as follows:

		Employment in 2010/Employment in 1988
Alternative	1	2.4
	2	3.4
	3	2.8

3.2.4 Evaluation of Alternatives

The development alternatives may be evaluated from several points of view. The CALABARZON regional development objectives naturally provide a set of evaluation criteria, viz. economic growth equity, social aspects and environment. Another important criterion is public sector resource requirements including not only investment expenditure but also institutional supports. Evaluation by these criteria is summarized in Table 3-23 (See next page).

Alternative 1 for agro-based development and Alternative 2 for high industrialization are two extremes, presented here to clarify the range of choice for CALABARZON development. The CALABARZON development plan will be worked out for Alternative 3, as it represents the best and most practical alternative to achieve balance between agriculture and industry, and also between rural and urban areas.

Table 3-23 Evaluation of Three Development Alternatives

	Alternative 1 Agro-based development	Alternative 2 High development	Alternative 3 Leap-frog development
(1) Definltion	Emphasis on agriculture, agro-industries, other indigenous resources, and rural services	Emphasis on industrialization by maximizing spillover from Metro Manila	Balance between Alternative 1 and Alternative 2
(2) Spillover from Metro manila	Low	High	Medium
(3) Spatial development pattern	Dispersed	Polarized: high suburbanizization around Metro Manila	Decentralized
(4) Growth rates	Low	High	Medium
(5) Social and problems	Likely to be small	Large: urban poor, insufficient social services, imbalance between urban and rural economy, stress on environment	More manageable
(6) Public sector resource cost	Smallest investment costs	Increasingly high costs for infrastructure social services imbalance between urban and rural economy, stress on environment	larger public sector resource requirements for selective/strategic improvement of infrastructure etc. and for decentralization
(7) Other implications	SME's for agro-processing and provision of agricultural inputs, high degree of CARP implementation	SME's for parts/components supply	Full urban functions for selected urban center, including services to SME's

Source: The Master Plan on the Project CALABARZON, JICA

3.2.5 Development Phasing

CALABARZON regional development has to be planned in phases, as the expansion of resource base, financial capacity and related institutional development will take place over through time. The planning period is broadly divided into three phases: Phase 1 up to 1995, Phase 2 for 1996 to 2000, and Phase 3 for 2001 to 2010.

(1) Phase 1 (up to 1995): Trend Growth

1) Socio-economy

This phase is basically characterized by the continuation of ongoing development efforts. Agriculture will emerge from its recent stagnation and regain its past growth trend. In industry, growth trend will continue.

2) Infrastructure

The emphasis in this phase on infrastructure should be on full utilization of existing infrastructure and utilities with proper maintenance and rehabilitation as well as better management. However, those projects already in the pipeline should be implemented during this phase, including the first stage development of Port of Batangas, a few highway projects and the EPZ expansion.

3) Spatial Development

The integration of the Greater Capital Region will proceed with the extension/improvement of primary and secondary arteries. Urbanization areas around Metro Manila will further expand, and the area in the immediate vicinity of Metro Manila will form a conurbation. Limited expansion of urban/industrial activities will take place in the Southern Tagalog Region along major arteries. The otherwise substantial spatial development will be confined to Batangas City and Lucena City.

(2) Phase 2 (1996-2000): Trend Acceleration and Renewed Growth

1) Socio-economy

This phase is for trend acceleration and renewed growth. In agriculture, all the support activities during Phase 1 will be continued and expanded. New Crops, better varieties, breeds and species will be well established. In industry, active investments by domestic firms will be made in the full range of existing industries as the domestic growth accelerates. Use of domestic input suppliers and subcontracted firms by export processing industries will become a common practice. Some of them will establish further linkages with upstream and downstream industries including SME's. The spill over from Metro Manila will cause to increase more relocation of industries originally established in Metro manila. Industry composition in Metro Manila and its vicinity should change in favor of those industries capitalizing on their geographical advantages rather than just common labor availability. They include export oriented industries such as electronics and apparel, airport oriented industries such as precision instruments as well as electronics and technology intensive industries. Port-oriented, labor intensive and agro-/resource based processing industries will further develop in the Batangas area. Some of the latter will utilize raw materials transported from resource islands. A petrochemical complex in Bagangas will develop backward linkages.

2) Infrastructure

A few key infrastructure projects will be implemented in this phase which will alter the patterns of spatial development in CALABARZON. They may be related to upgrading of port facilities, artery network, and major water resource development. They will encourage the decentralization by enhancing the comparative position of the Southern Tagalog Region, or help to integrate part of the Region in to the Greater Capital Region.

3) Spatial Development

Strengthened urban functions and enhanced rural economy will lead to more active interactions between rural and urban areas. Development axes will be gradually formed in the Southern Tagalog Region centering around Batangas City. Deficiencies in transportation network will be resolved in both the Greater Capital and the Southern Tagalog Regions. except in the Bondoc peninsula and mountainous areas of Quezon.

(3) Phase 3 (2001-2010): Sustained Growth

1) Socio-economy

Agricultural land use will become more intensive with mixed farming and inter-cropping. Hydroponics and other forms of industrial agriculture may be introduced. The composition of industry will continue to change from a dominance of consumer goods industries in favor of intermediate goods and investment goods. This change will also be reflected in the export composition with the assembly type operations becoming less significant as a source of employment and exports.

2) Infrastructure

Major urban centers will be equipped with some higher order service functions such as communication/conference, higher education/technology development and administration. Accordingly, various amenity facilities will be provided for the major urban centers. Infrastructure and some of social services will be increasingly provided by the private sector with the public role confined to regulatory functions.

3) Spatial Development

Development axes in the Southern Tagalog Region will be well established. The main axes will be developed connecting Batangas City/Bauan with Lucena City, which may be further extended to the east and to the west. Network deficiency will be completely resolved including those in the Bondoc peninsula and mountain areas of Quezon.

CHAPTER 4 SEA TRANSPORT NETWORK IN GREATER CAPITAL REGION

4.1 Domestic Sea Transport Network

In port planning, the sea transport network plays an important role. Future sea transport network often has a deterministic impact on objective ports. Thus, it should be carefully predicted, based on a thoroughgoing analysis of the present sea transport network.

In this study, the sea transport network should be analyzed from the following view points.

1) Sea routes of calling vessels at major ports in GCR.
2) International trade routes of container vessels which are making calls at the Southeast Asia.

Table 4-1 shows the domestic shipping route to/from the North Harbor. There are eight(8) shipping companies whose vessels call at the North Harbor. Among them, the Sulpicio Lines has the largest domestic sea transport network which covers almost the whole country. The total number of domestic shipping routes is fifty-five(55). As seen in Table 4-1, the North Harbor is the center for the domestic sea transport network.

Table 4-1 Domestic Shipping Route to/from North Harbor

SHIPPING COMPANY	DOMESTIC SHIPPING ROUTE
ABOITIZ SHIPPING	*Manila-DavaoDadiangas-Davao-Dadiangas-Manila *Manila-Cebu-Manila *Manila-Cagayan-Bugo-Cagayan-Manila *Manila-Pulupandan-Manila *Manila-Polioc-Davao-Manila *Manila-Roxas-Sipalay-Iloilo-Manila *Manila-Iloilo-Polloc-Manila *Manila-Dumaguit-Iloilo-Dumaguit-Manila *Manila-Dumaguit-Capiz-Manila-Romblon-Dumaguit-Manila-Cagayan-Manila *Manila-Ormoc-Baybay-Sugod/Cablian-Surigao-Baybay Ormoc-Manila
CARLOS A. GOTHONG LINES	*Manila-Roxas-Isabel-Cebu-Ozamis-Iligan-Cebu-Isabel-Palompon-Manila *Cebu-Palompon-Roxas-Manila-Roxas-Palompon-Isabel-Cebu *Cebu-Palompon-N. Washington-Palompon-Cebu *Manila-Nasipit-Cebu-Nasipit-Manila
ESCANO LINES	*Manila-Cegu-Cagayan-Iligan-Manila *Manila-Cebu-Surigao-Butuan-Manila *Manila-Cebu-Cagayan-Iligan-Cagayan-Cebu-Manila *Manila-Cebu-Iligan-Cebu-Manila
LORENZO SHIPPING	*Manila-Zamboanga-Dadiangas-Manila *Manila-Davao-Dadiangas-Manila *Manila-Davao-Manila
NEGROS NAVIGATION	*Manila-Bacolod-Manila-Bacolod-Iloilo-Manila *Manila-Romblon-Iloilo-Romblon-Manila-Culasi-Bacolod-Culasi-Manila *Iloilo-Manila-Bacolod-Manila-Iloilo *Manila-Iloilo-Cagayan-Iloilo-Manila-Iloilo-Manila *Manila-Bacolod-Iloilo-Bacolod-Manila
SOLID SHIPPING LINES	*Manila-Davao-Manila
SULPICIO LINES	*Manila-Iloilo-Zamboanga-Dadiangas-Zamboanga-Iloilo-Manila *Manila-Cebu-Manila *Manila-Cebu-Davao-Cebu-Manila *Manila-Dumaguete-Dipolog-Cagayan-Ozamis-Dipolog-Dumaguete-Manila *Manila-Puerto Princesa-Iloilo-Puerto Princesa-Manila *Manila-Puerto Princesa-Iloilo-Puerto Princesa-Manila *Manila-Estancia-Iloilo-Zamboanga-Cotabato-Zamboanga-Iloilo-Estancia-Manila *Manila-Calubian-Palompon-Maasin-Surigao-Maasin-Palompon-Calubian-Manila *Manila-Catbalogan-Tacloban-Catbalogan-Manila-Tacloban-Manila *Manila-Masbate-Calbayog-Catbalogan-Ormoc-Cebu-Ormoc-Catbalogan-Calbayog-Masbate-Manila *Manila-Dumaguete-Ozamis-Manila *Manila-Iloilo-Pulupandan-Manila *Manila-Cebu-Zamboanga-Cotabato-Cebu-Manila *Manila-Cagayan-Manila *Manila-Surigao-Butuan-Surigao-Manila *Manila-Cebu-Dadiangas-Manila
SWEET LINES	*Manila-Cebu-Manila *Manila-Zamboanga-Davao-Zamboanga-Manila
WILLIAM LINES	*Manila-Ozamis-Iligan-Cebu-Iloilo-Manila *Manila-Tacloban-Masbate-Tagbilaran-Cebu-Masbate-Manila *Manila-Pulupandon-Manila *Manila-Iloilo-Cebu-Iloilo-Manila *Manila-Dumaguete-Cagayan-Dumaguete-Manila *Manila-Iloilo-Zamboanga-Davao-Manila *Manila-Zamboanga-Davao-Dadiangas-Manila *Manila-San Jose (Mindoro)- Manila-Tilik (Lubang)-Sablayon-Tilik-Manila *Manila-San Carlos-Ozamis-San Carlos-Manila *Manila-Estancia-Polloc-Estancia-Manila

4.2 International Sea Transport Network

Table 4-2 shows the international container route to/from the South Harbor. There are seventeen(17) shipping companies which are making shipcalls at the South Harbor. The total number of international container routes in terms of feeder service is six(6). Those feeder services are Manila-Hongkong, Manila-Singapore, Manila-Kaohsiung, Manila-Guam, Manila-Micronasia and Manila-Japan. However, COSCO Shipping Company has a direct international container service to Australia, Hongkong and Japan.

Table 4-3 shows the international container route to/from MICT. There are twelve(12) shipping companies which are making shipcalls at MICT. The international container routes related to MICT in 1993 can be classified into six(6) routes as shown in Table 4-3. Those feeder services are Manila-Singapore, Manila-Hongkong, Manila-Kaohsiung, Manila-Tokyo, Manila-Keelung-Kaohsiung, Manila-Keelung-Johore- Manila. On the other hand, there are seven(7) direct international container services at MICT. These are three(3) Southeast Asia routes, the Pacific Ocean route, Australian route, European route, and Russian route.

As described above, Hongkong, Singapore and Kaohsiung are the most important ports in terms of feeder service between Manila and the foreign destination.

Table 4-2 International Container Shipping Routes at South Harbor

SHIPPING LINES	CALLS	INTERNATIONAL CONTAINER SHIPPING ROUTES
Wide Shine/Mercury	4	Manila-Hongkong (Feeder)
KYOWA/Sky Int'l.	2	Manila-Guam (Feeder)
Wallem Phils.	1	Manila-Hongkong (Feeder)
Wan Hai/ESA	6	Manila-Hongkong (Feeder)
COSCO/Wallem	12	Manila-Australia-Hongkong-Japan
Fullson/MOF	9	Manila-Hongkong (Feeder)
Heung-A/Wallem	4	Manila-Busan (Feeder)
APL	4	Manila-Kaohsiung (Feeder)
NYK/Fil-Japan	5	Manila-Japan (Feeder)
Zim/OFSI	3	Manila-Hongkong (Feeder)
Vigour/Anchor	5	Manila-Singapore (Feeder)
Fleet Trans/Jardine	6	Manila-Hongkong (Feeder)
ESL	8	Manila-Japan (Feeder)
WESTWIND/BALIWAG	3	Manila-Japan (Feeder)
PIL/TMS	3	Manila-Singapore (Feeder)
FML/SORIAMONT	2	Manila-Micronasia (Feeder)
Sky International	1	Manila-Guam (Feeder)
TOTAL	78	

Table 4-3 Major International Shipping Routes at MICT

Nedlloyd	Manila-Singapore (Weekly Feeder), Manila-Hongkong (Weekly Feeder)
Sealand	Manila-Kaohsiung (Weekly Feeder)
Maersk Line	Manila-Gen. Santos-Cebu-Manila-Kaohsiung-Hongkong-Manila (Weekly)
National Sipping Corporation	Manila-Hongkong-Keelung-Busan-US (San Fransisco, LA)-Manila (Monthly Direct)
Jardine Shipping Agencies	Manila-Hongkong (Weekly Feeder)
Fil-Japan Shipping Corporation	Manila-Kaohsiung (Weekly Feeder), Manila-Tokyo (Weekly Feeder)
Soriamont	Manila-Hongkong-Keelung-Kaohsiung-Busan-Japan-New Zealand-Manila (Direct Service) Manila-Hongkong-Guam-Saipan-Manila (Direct Service)
K-Line	Manila-Singapore-Japan-Keelung-Manila-Singapore-Johol-Manila
Mitsui OSK Lines	Manila-Kaohsiung (Weekly Feeder)
Don Tim Shipping Corporation	Manila-Kaohsiung (Weekly Feeder) Manila-Keelung-Kaohsiung-Manila (Weekly Feeder) Manila-Cebu-Kaohsiung-Keelung-Manila (Weekly Feeder) Manila-Kaohsiung-Johol-Manila (Weekly Feeder)
Filso Shipping Company	Manila-Australia (Direct Service) Manila Europe (Direct Service) Manila-Hongkong-Japan-Bostonik (Russia)-Manila (Direct Service)
Evergreen	Cebu-Manila-Kaohsiung (Feeder Service)

CHAPTER 5 OUTLINE OF PORTS IN GREATER CAPITAL REGION

5.1 Port Location and major Functions

5.1.1 Outline of Port Functions

Figure 5-1 shows the location of ports within GCR.

(1) Port of Manila

The Port of Manila consists of three (3) ports, namely MICT, South Harbor and North Harbor, and is the biggest port in the Philippines. This port is located at Northeast of Manila Bay, Southeast of Luzon Island. Its total port area is about 165 hectares.

The MICT is located just north of the mouth of the Pasig River. The North Harbor is located along the shores of Tondo District in Manila, northeast of the MICT. The South and North Harbors are now undergoing rehabilitations for renewing piers, apron roads using ADB loans.

1) MICT (see Figure 5-2)

The MICT has a usable quay length of 900 meters with a minimum water depth alongside of about 12 meters. It currently has four (4) berths.

This terminal has a container yard of 29 hectares, three (3) container freight station, cargo handling equipment with four (4) gantry cranes and other supporting facilities. Two (2) container freight stations are now being utilized for import cargo un-vanning. These container freight station have a capacity of handling 114 container vans at one time.

2) South Harbor (see Figure 5-3)

South Harbor has five (5) finger piers (Nos. 3, 5, 9, 13 & 15) divided into 23 berths (except three (3) berths not being utilized) with a total length of 3,669 meters. The average depth of the berth is about 10 meters.

These piers are protected by the west breakwater with 2,300 meters in length and the offshore south breakwater with 880 meters in length.

The navigation Channel of South harbor is about 200m wide between the south and

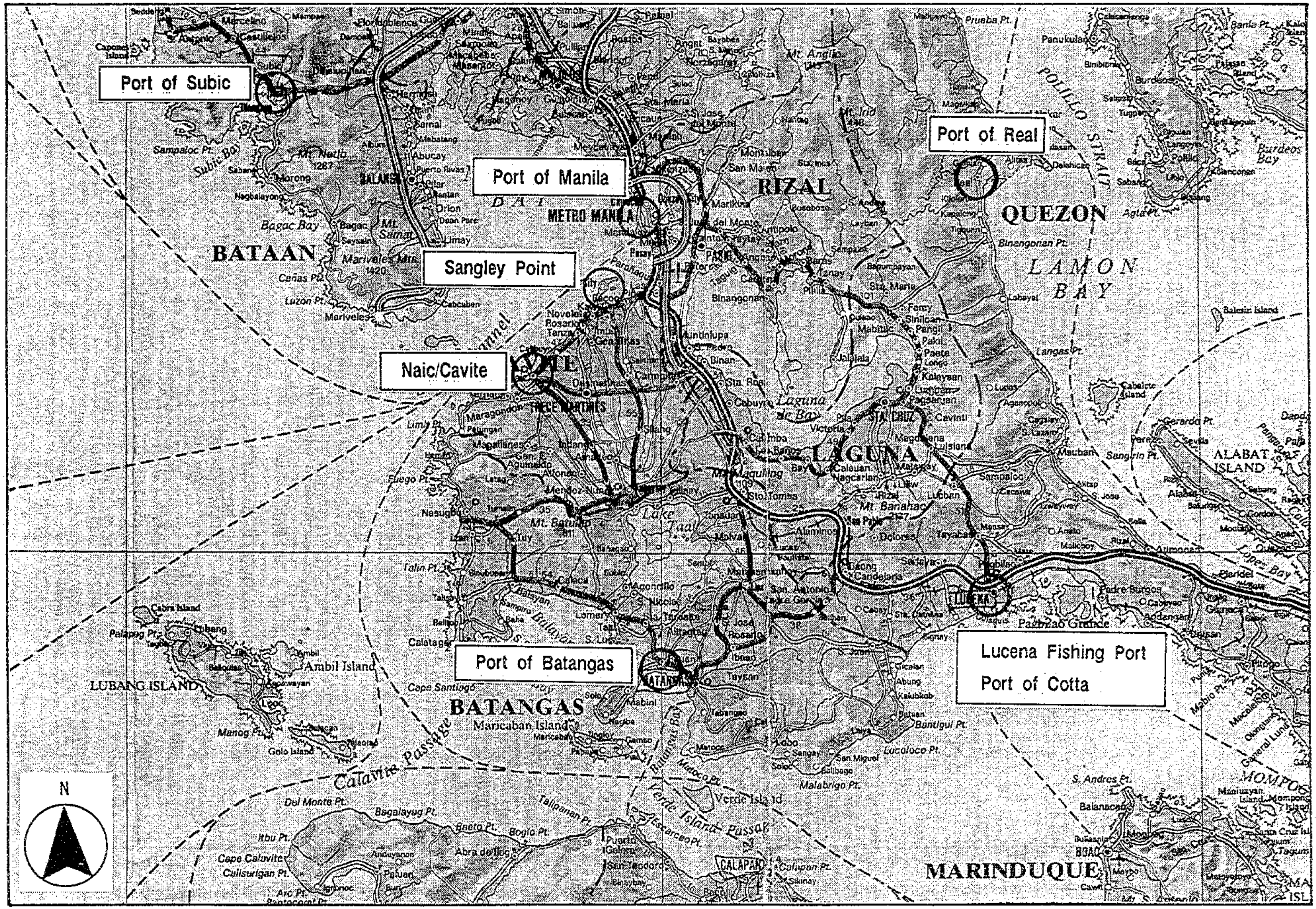


Figure 5-1 Port Location

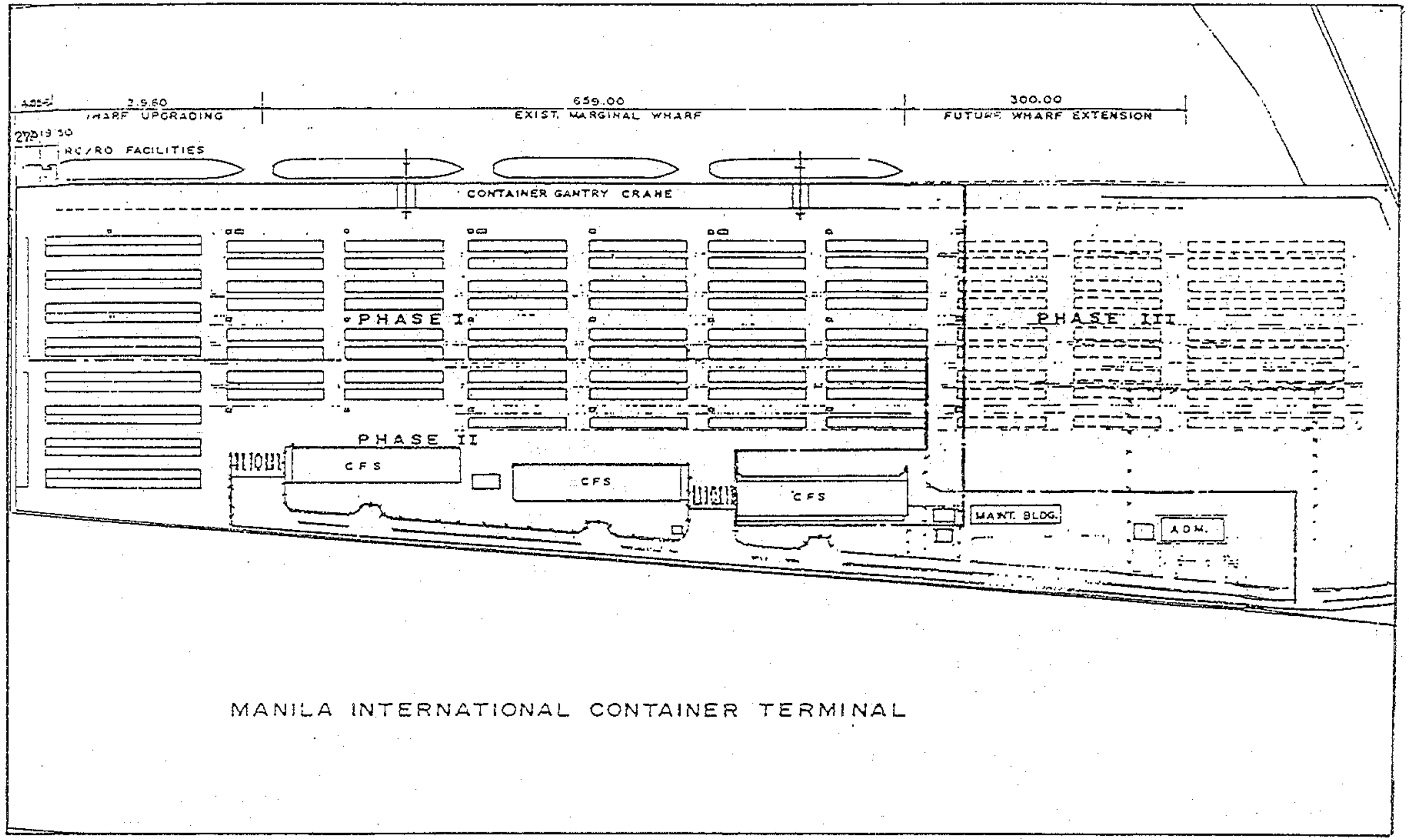


Figure 5-2 Manila International Container Terminal

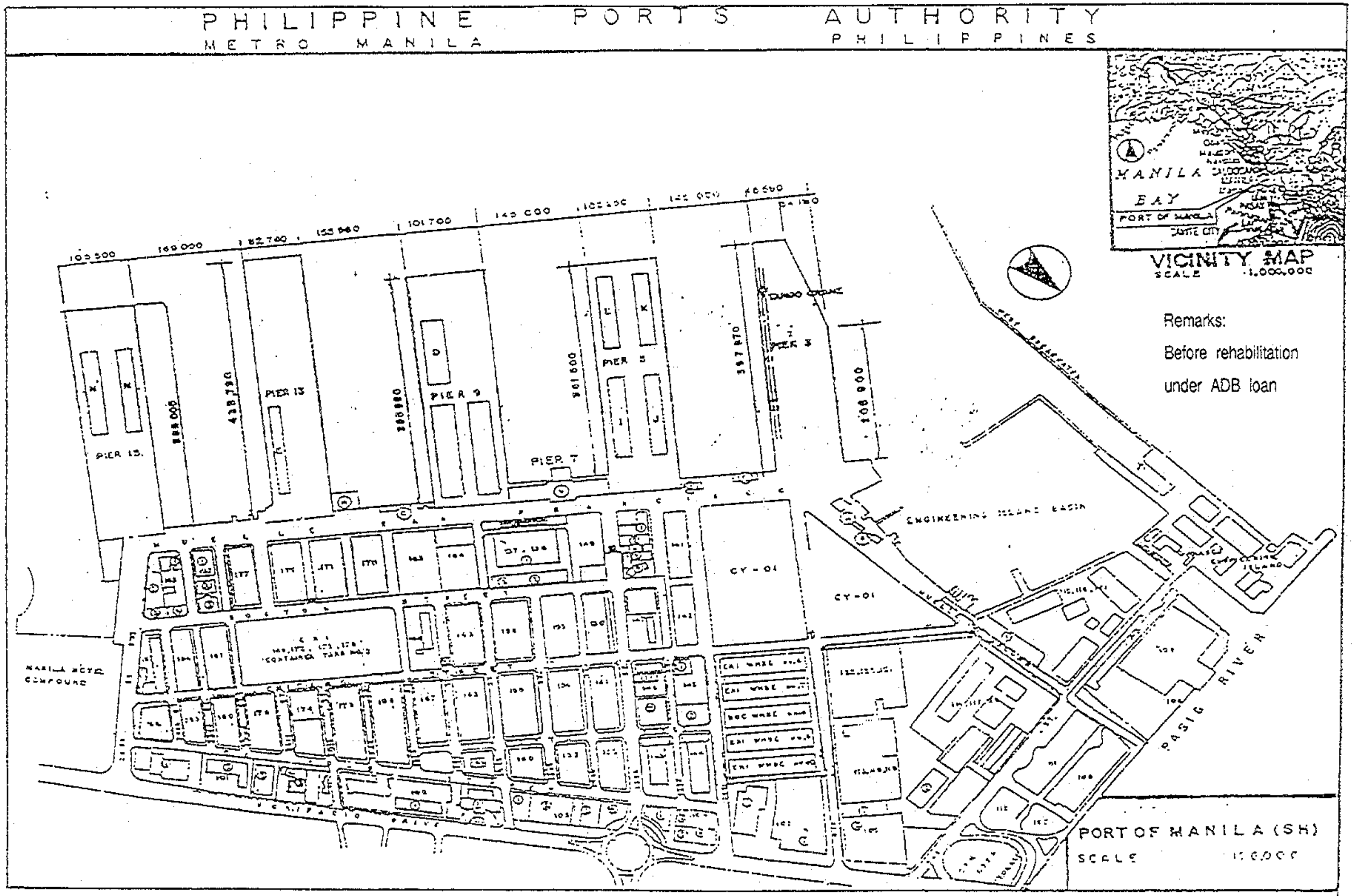


Figure 5-3 South Harbor, Port of Manila

west breakwater. The depth of the channel is approximately 10.5m below MLLW (mean lower low water).

Pier No.3 has two (2) container berths, serviced by two (2) gantry cranes (30.5t) which operation covers 375m of the pier. Pier No.5 has two gantry cranes. These pier are used for handling the foreign container cargo and the general cargo by ship's crane. Other piers, No.9 and 15, are mainly used for handling the foreign general cargo by ship's crane.

Except for Pier No.3, each pier a has transit cargo shed with lowered passageways.

A fixed Ro-Ro ramp of 50 ton capacity is located at the foot of Pier No.13. Pier No.15 is also used for passenger accommodation.

3) North Harbor (see Figure 5-4)

North Harbor is the most important domestic port in the Philippines. This port has eight (8) piers, Nos. 2, 4, 6, 8, 10, 12, 14 and 16, divided into fifty-three (53) berths with a total length of 4,023m of berthing space. The depth of berth is about 5.0m to 6.0m.

This harbor is protected by the north breakwater with a length of 1,900 meters. The depth of the channel is approximately 8.0 meters. All piers are used for general cargo and containerized cargo. Piers No.4, 12 and 14 are especially used for handling containerized cargo by ship's crane.

Covered and open storage areas are approximately 14 hectares. These area include container yard, 9 hectares approximately.

In the north side of the North Harbor, Marine Slipway Wharf, with a length of 230m, and Vitas Wharf are located.

(2) Port of Batangas (see Figure 5-5)

The Port of Batangas has 3 piers divided into 13 berths having a total of 618 meters. The depth of the berths are approximately 3.5m to 11.0m meters.

Since the port is located in the calm Batangas Bay, there are no breakwaters. The depth of sea water in front of the Port is more than 11 meters naturally.

The major facility of this port is domestic Ferry Terminal. There are five (5) Ro-Ro ramps. The open storage area is approximately 920 sq. meters.

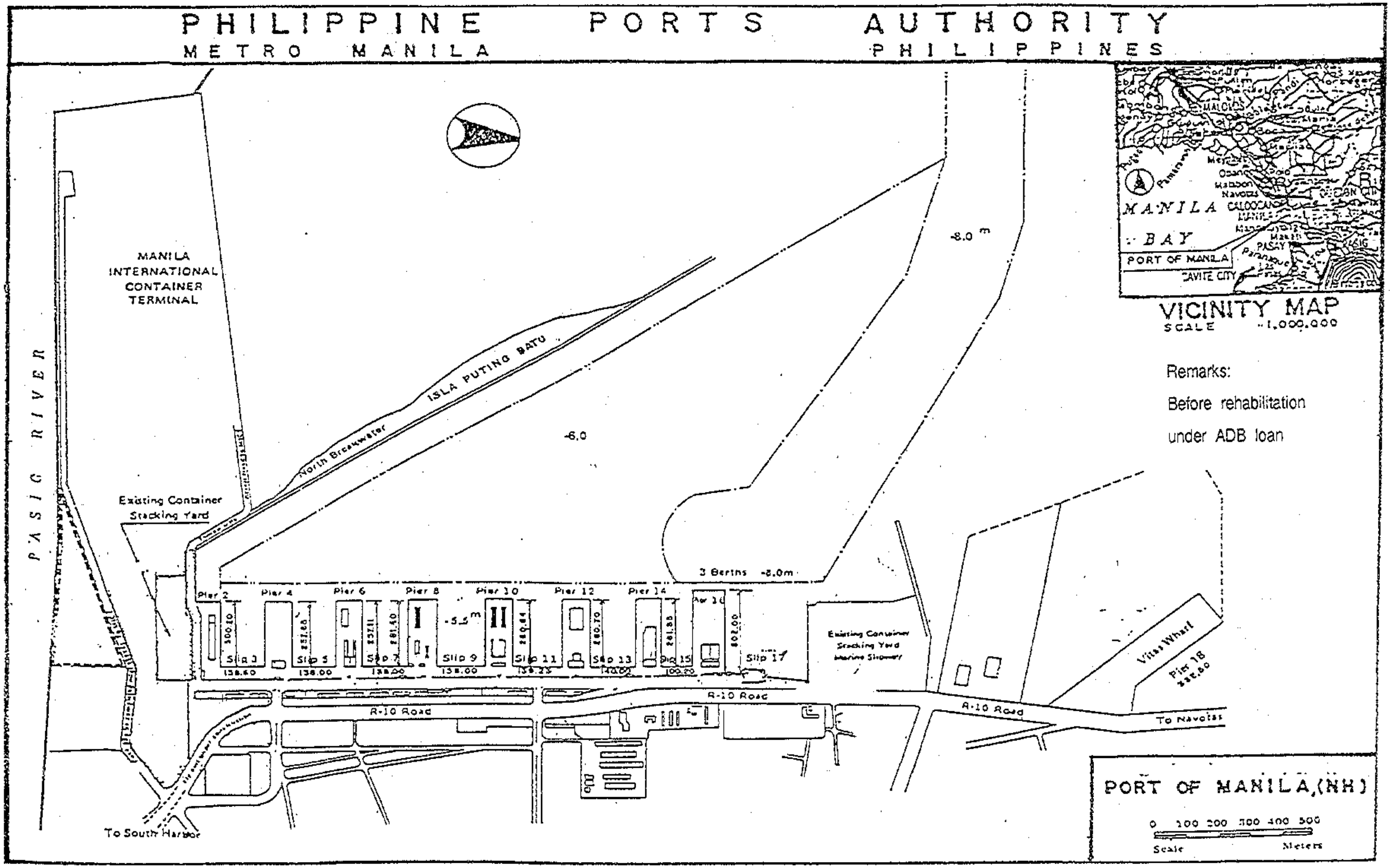


Figure 5-4 North Harbor, Port of Manila

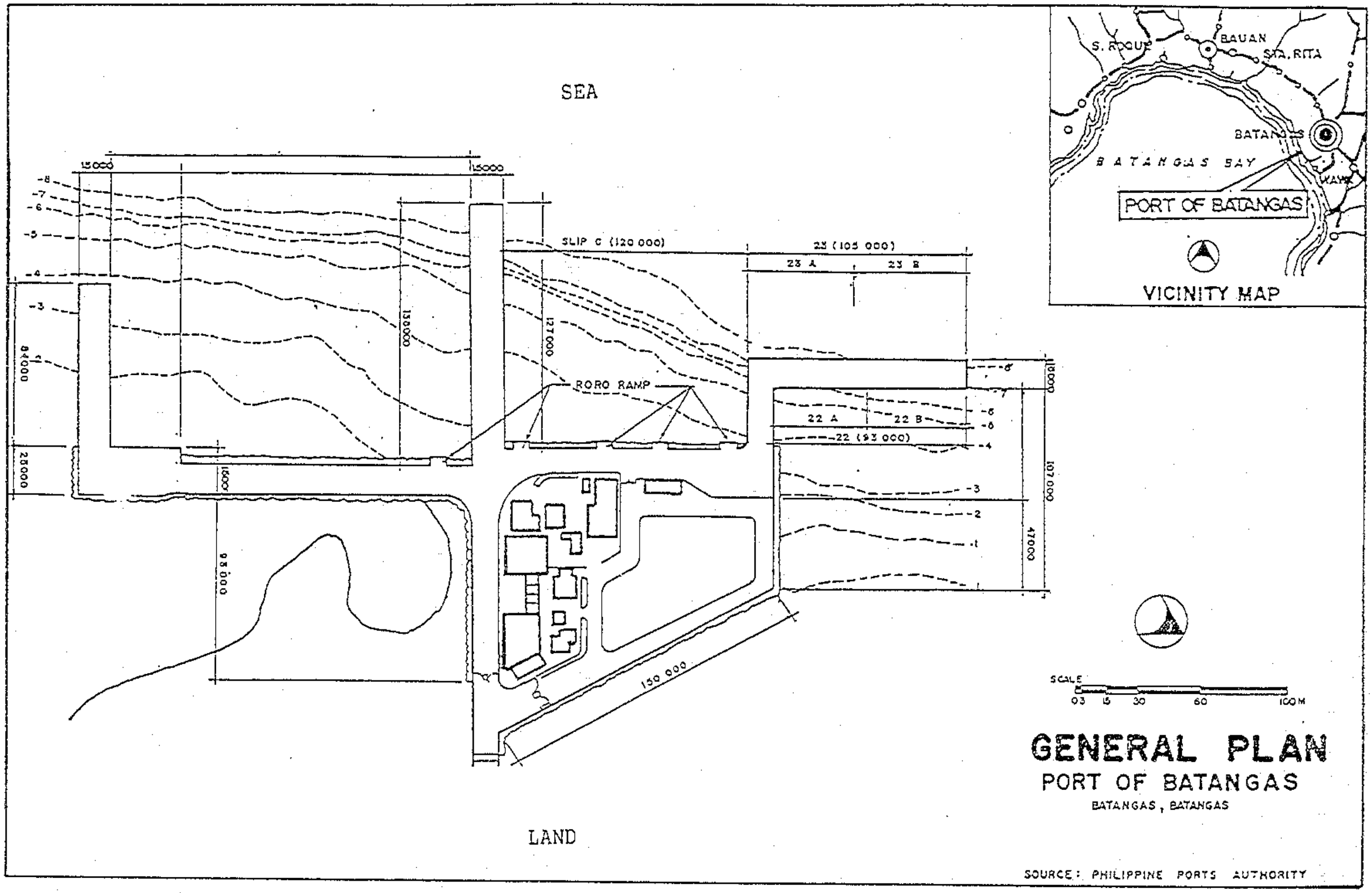


Figure 5-5 Port of Batangas

(3) Port of Subic (see Figure 5-6, 7 and 5-8)

The existing port facilities of the Subic Port mainly comprise nine areas, Alava Wharf, Rivera Wharf, Marine (Osir Basin) Area, Marine Terminal (Naval Supply Depot: NSD) Area, Boton Wharf, Leyte Wharf, Nabasan Wharf, Camayan Wharf and Grande Island Wharf. The port area was turned over to the Government of the Philippines is December 1992 including all the port facilities within Subic Bay.

There are 68 berths with a total berth length of approximately 4,600 meters.

The Marine Terminal, which has the widest area in Subic Port, has two piers, Sattler Pier and Covered Pier, which can accommodate four large vessels at the same time; berth depth ranges from -12.6 ~ -12.8 meters and berth length is 900 meters.

Only Sattler Pier has gantry crane railings. The Covered Pier has a warehouse of 8,360 sq. meters.

(4) Other Ports in Greater Capital Region

1) Sangley Point (see Figure 5-9)

Because Sangley Point is now under the Naval Reservation Control, the Study Team cannot undertake field survey and inventory study of existing port facilities.

The port area supposedly handles three (3) ships at a time. The berthing areas are mostly occupied by Landing Ships and Patrol Crafts of the Philippine Navy.

There is a private shipyard within the Naval Base: the Fernandez Shipyards (commonly known as the EL VARADERO de Manila). The base does not have any warehouse and cargo-handling equipment.

2) Lucena Fishing Port (see Figure 5-10, and 5-11)

Lucena Fishing Port was constructed last year (1992). There area approximately 7.7 hectares of reclaimed land. This fishing port has a 106 meter-multi-purpose pier and a 78.5 meter slipway. The depth is approximately 3.0-4.0 meters along the pier. The front of the reclaimed land is protected with breakwater, 390 meters in length.

Near the northeast of this point, a new commercial port is under construction by PPA.

3) Port of Cotta (see Figure 5-12)

Along the Dumaca river, the Port is on the right side toward the Tayabas Bay. This port has a 90 meter pier with 1.0 meter depth. The port is old but the wharf is always full of small boats.

4) Port of Real (see Figure 5-13)

The port of Real has a pier 42 meters in length along the shore. The port is used by cargo/passenger vessels which accommodate household consumption goods.

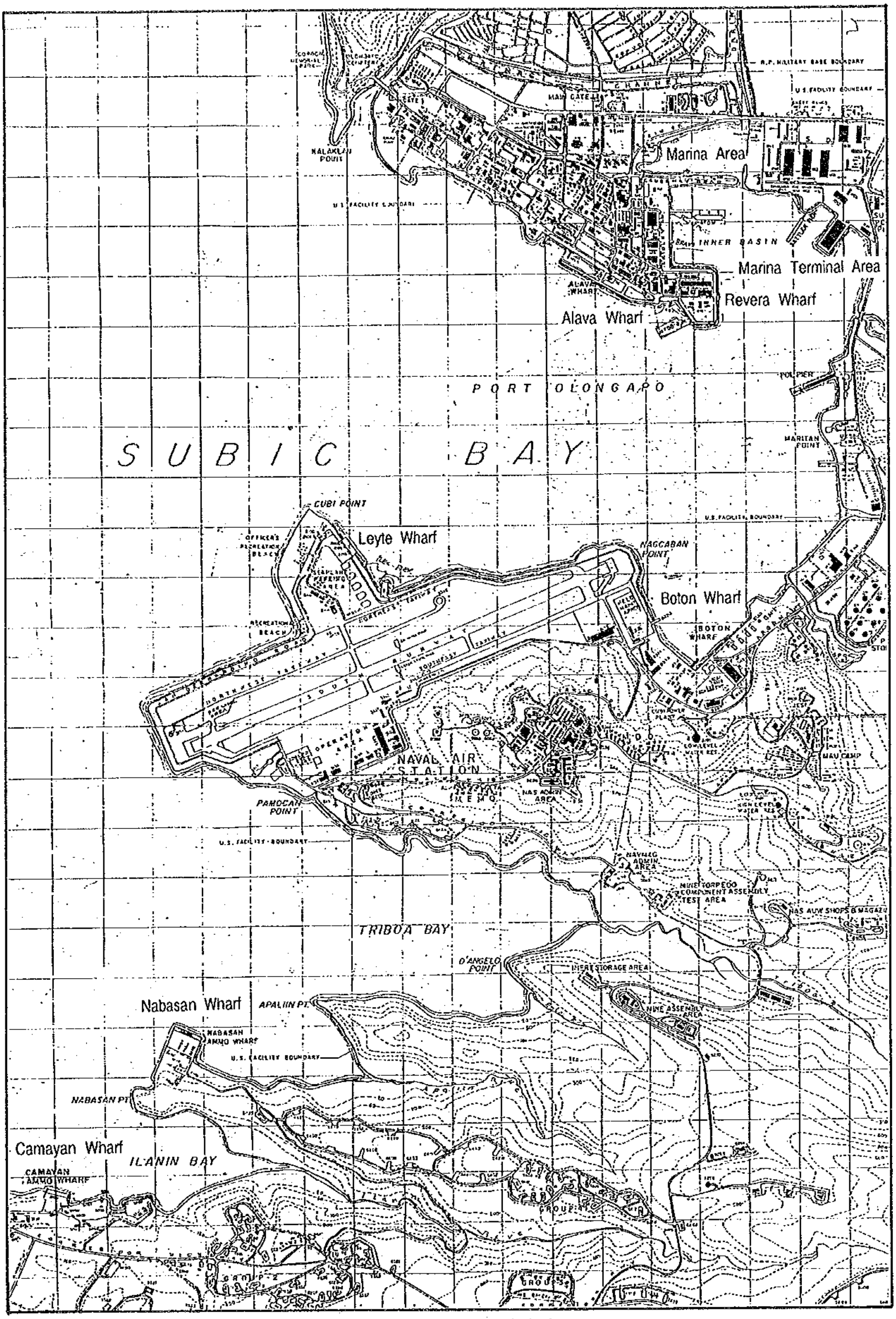


Figure 5-6 Port of Subic

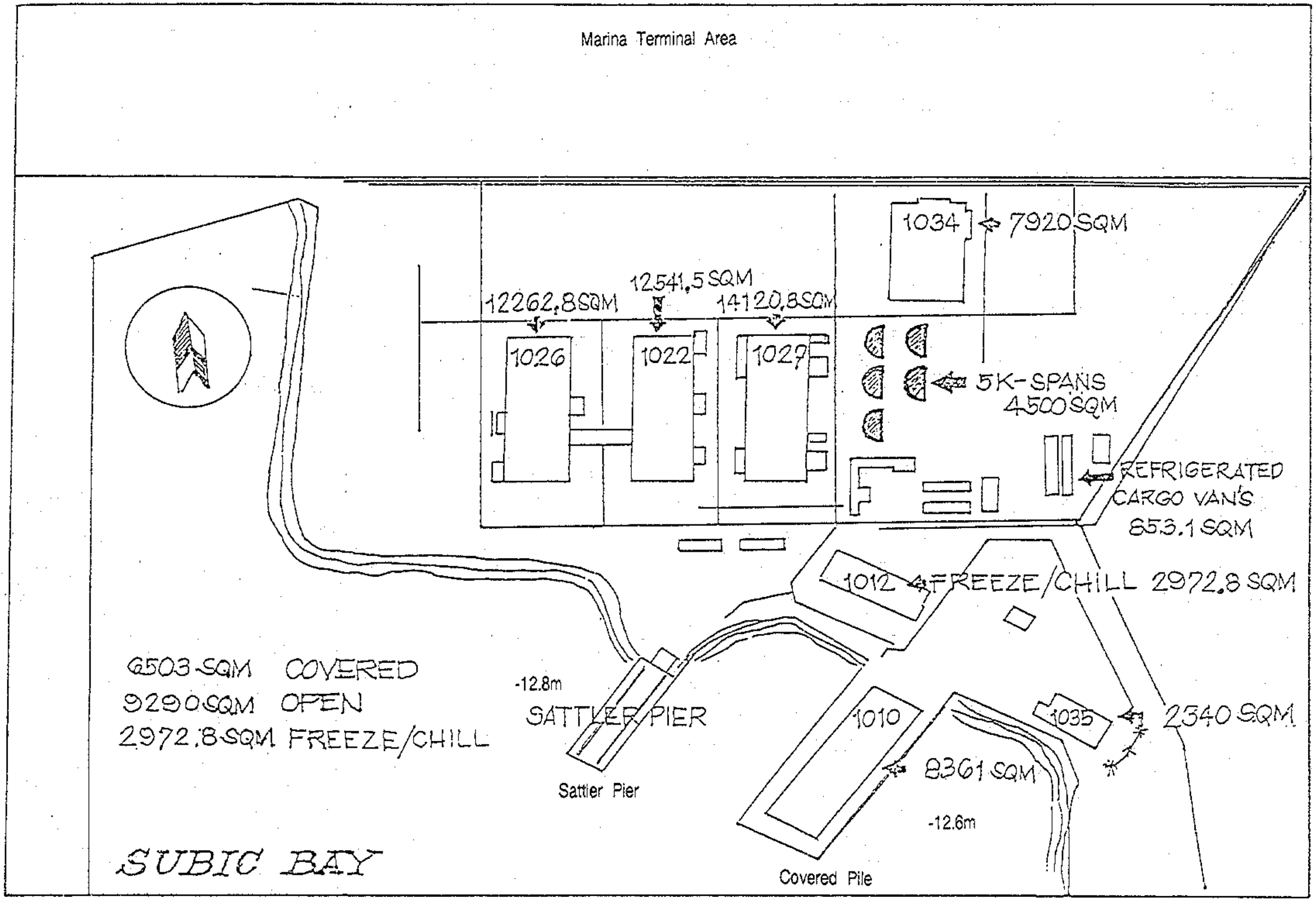


Figure 5-7 Port of Subic (Marine Terminal)

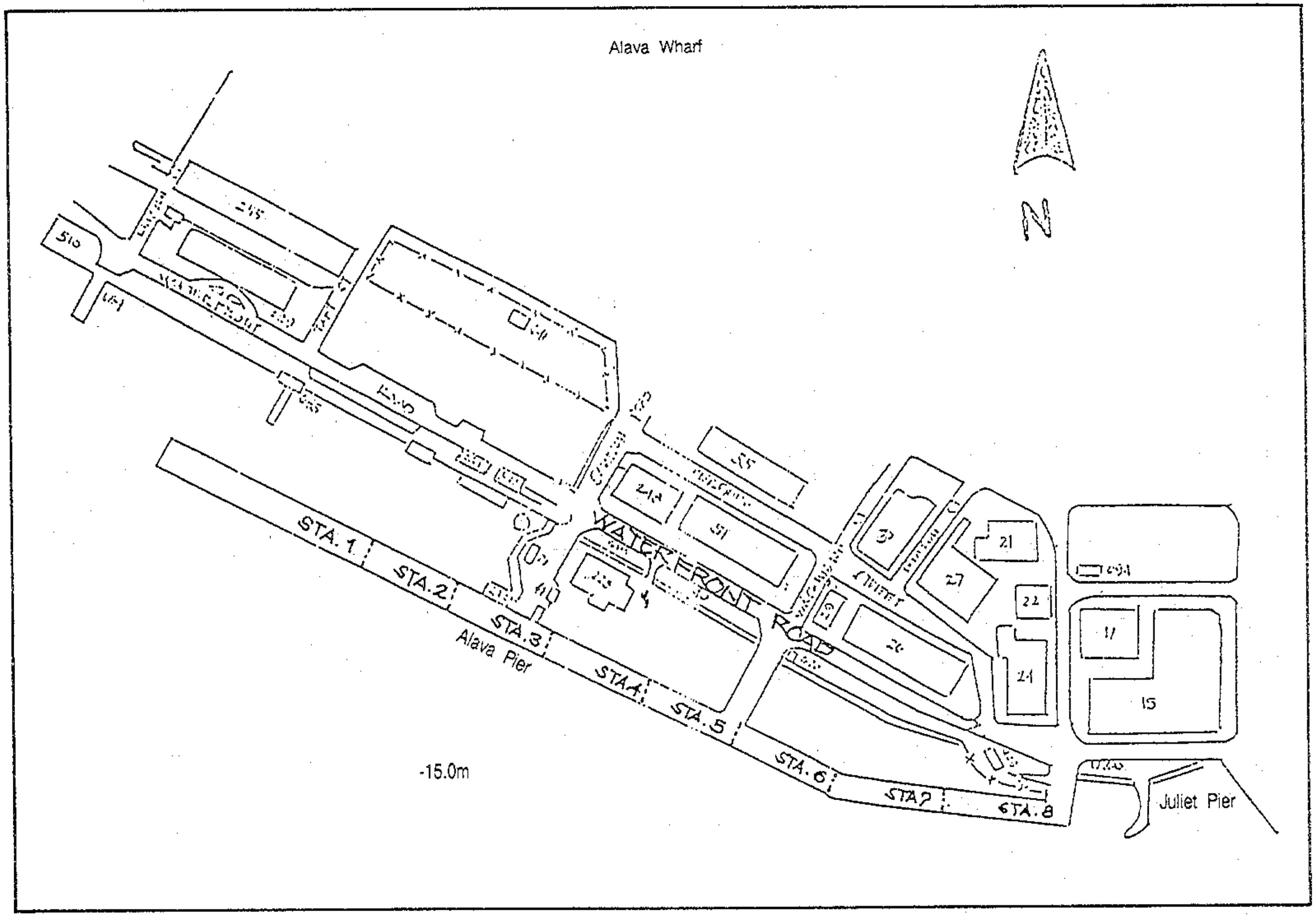


Figure 5-8 Port of Subic (Alava Wharf)

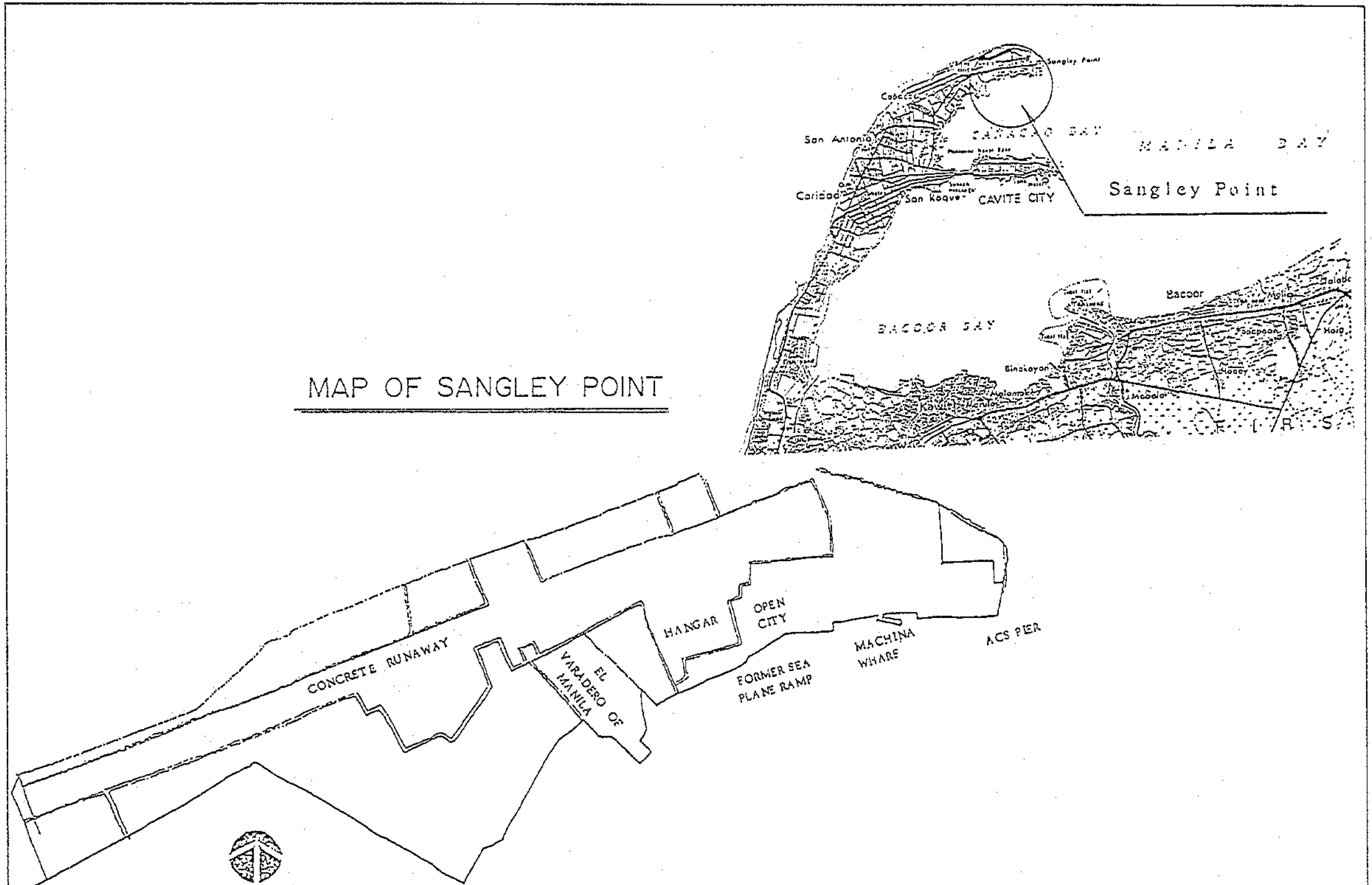


Figure 5-9 Sanglay Point

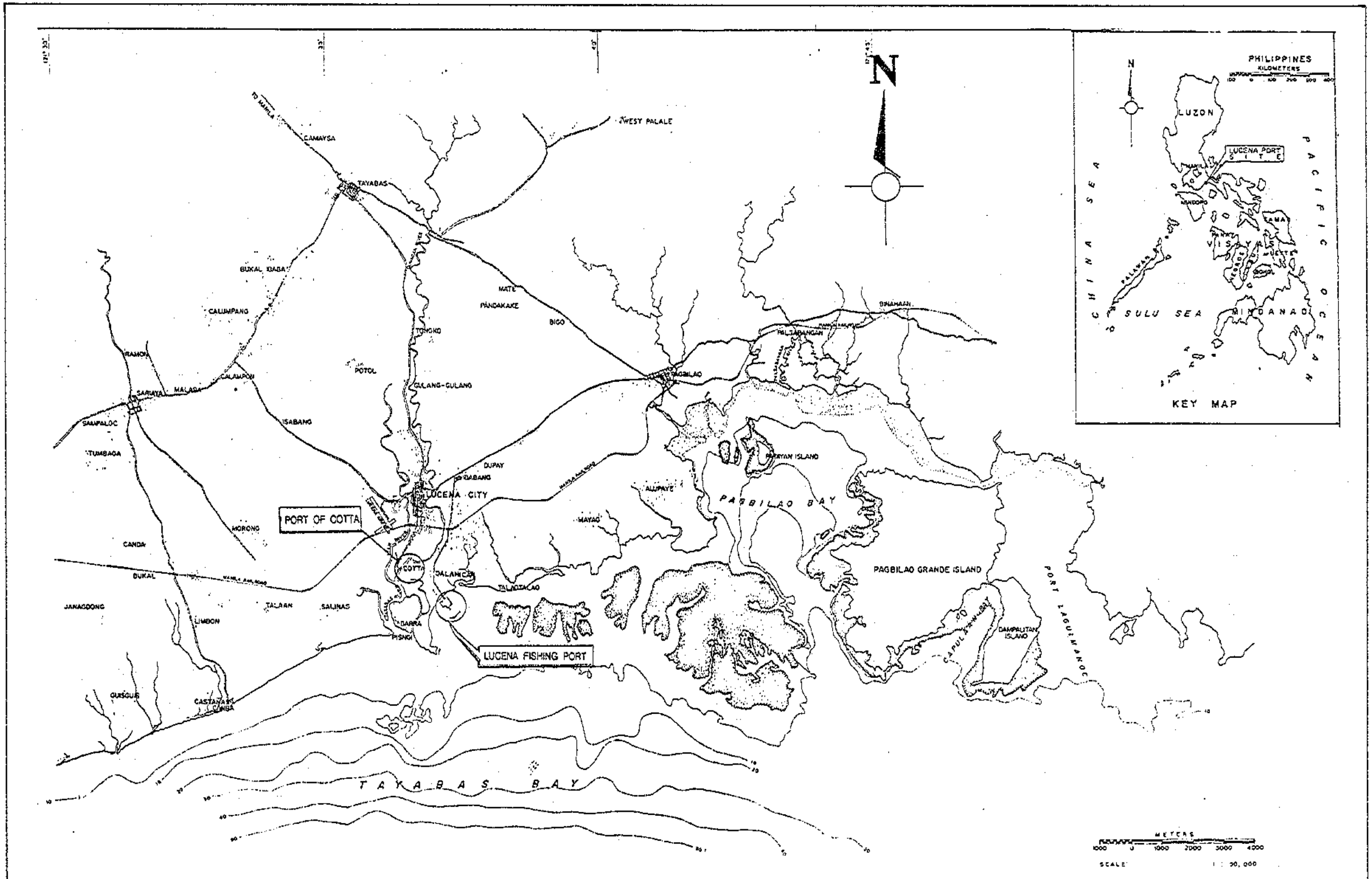


Figure 5-10 Location Map of Lucena and Pagbilao City

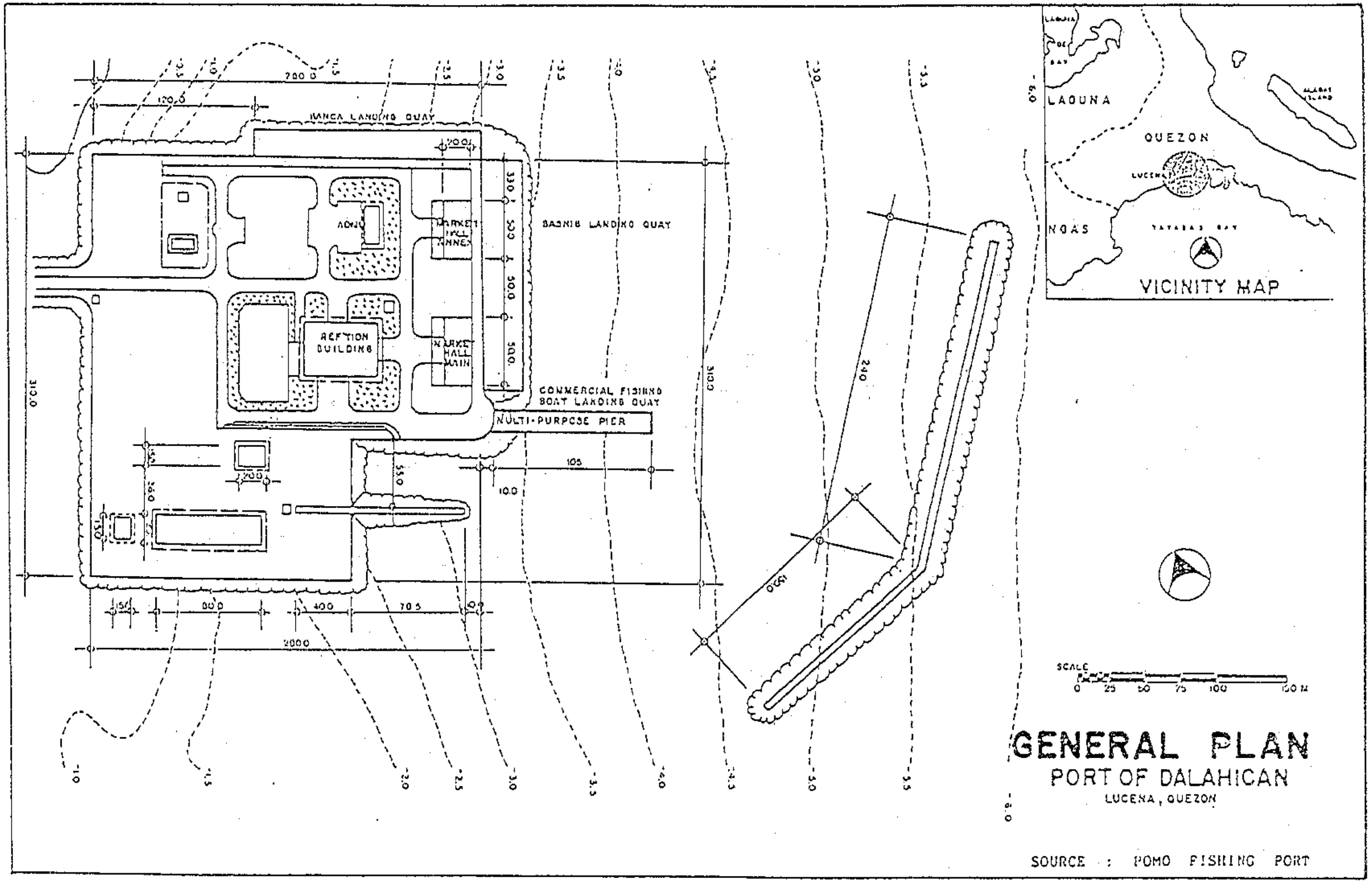


Figure 5-11 Lucena Fishing Port

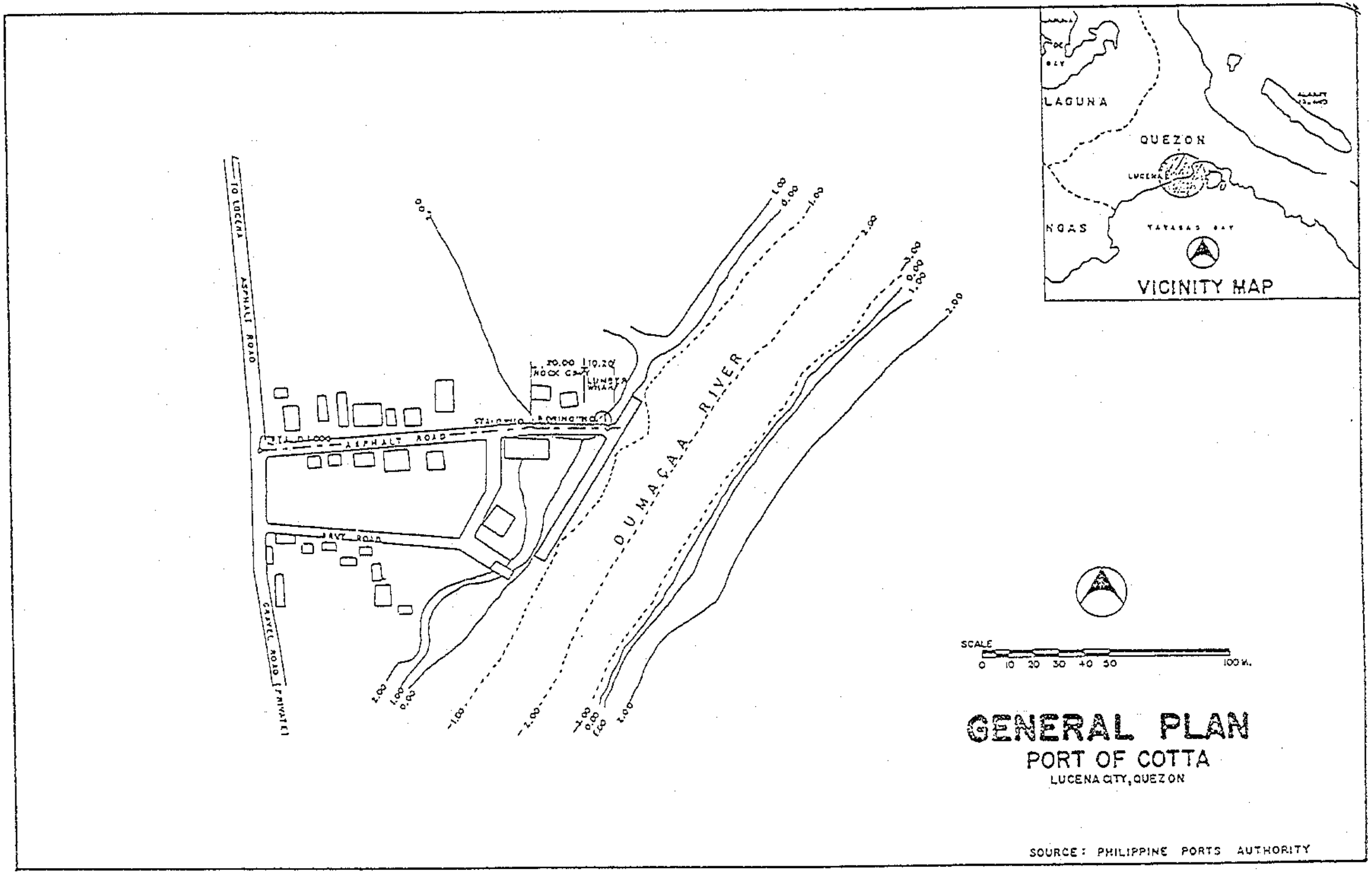


Figure 5-12 Port of Cotta

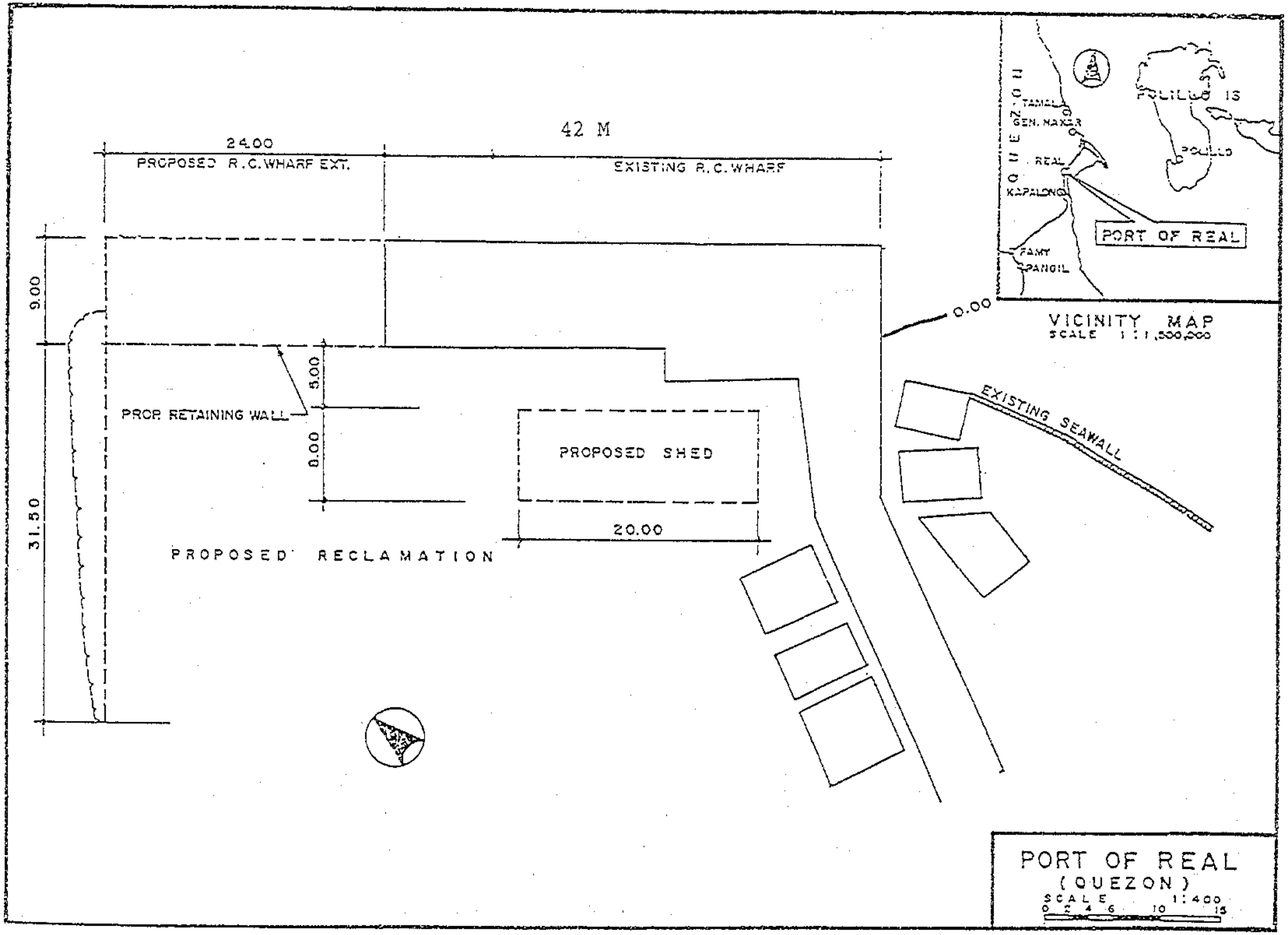


Figure 5-13 Port of Real