Alternative 3 : Leap-frog development

As shown above, CALABARZON GRDP is projected to ₱618,300 million in 2010, growing on an average at 8.8% per annum. The total employment is projected to 5,830,000 in 2010, an average increase of 4.8% per annum.

4.2.2 Spatial development framework

(1) Basic elements of spatial framework

Spatial development of any region is affected primarily by existing transport infrastructure, settlement patterns and land capability. These prime factors are described in this subsection. Other factors affecting spatial development includes water availability, other infrastructure facilities and endowments of other resources as well as deliberate planning and locational policies. These factors are also reflected in the macro-zoning and the project formulation reported in Chapter 6.

(2) Land capability

Land classification

Several key factors affecting land capability for various uses have been analyzed. They include physiography, soil, slope, goelogy, present land use, erosion potential and flood susceptibility. The land capability map in the scale 1 to 250,000, provided by DA, has also been referred to in determining the demarcation by land class.

Land capability classification has been adopted from DA, but only broad classification has been made for planning purposes. The classification is as follows:

A : Very good land; can be cultivated safely; requires only simple but good farm management practices.

B : Good land; can be cultivated safely; requires easily applied conservation practices.

C : Moderately good land; must be cultivated with caution; requires careful management and intensive conservation practices.

D : Fairly good land; must be cultivated with extra caution; requires very careful management and complex conservation practices for safe cultivation; best suited to pasture or forest.

M : Steep, very severely to excessively eroded, or shallow for cultivation; suited to pasture or forest with careful management.

Land capability

According to the classification presented above, the land capability map has been prepared (Figure 4.1). Based on physiography, geology, soil and other factors, 54 units have been identified in CALABARZON. Land capability by each of these 54 units is summarized in Table 4.1.

(3) Transportation network

The regional spatial structure of CALABARZON is influenced by Metro Manila's presence. Major roads originate from Metro Manila, connecting Metro Manila to other outer regions and integrating various parts of the CALABARZON region. Major roads constitute an important element in the regional spatial structure (Figures 4.2 and 4.3).

Inter-regional roads

- Manila South Road connecting Metro Manila to San Pablo, Lucena and eastern centers.
- South Super Highway from Metro Manila to Calamba
- Road from Sto. Tomas to Batangas, where inter-island shipping is available to southern islands provinces, by ships or ferry boats
- Ortigas Avenue and a lakeshore road from Metro Manila to Famy and farther to Real and Infanta in Quezon.

Roads integrating the Region

- Road from Metro Manila to Bacoor, Rosario, Naic and Ternate.
- Road from Metro Manila running through Imus, Dasmarinas, Silang, and Tagaytay connecting to Nasugbu, Tuy, Calaca, Taal, Bauan, and Batangas.

- Road running along the southern lakeshore of Laguna Lake to Famy.

These major roads are connecting most of major urban centers (or city/municipal capitals) with Metro Manila as well as with each other. Other minor roads are connecting rural areas to major urban centers.

(4) Settlement system

Urban hierarchy

It is an important issue in the CALABARZON regional development to encourage urban centers to develop further to serve local people in various ways. Depending on the size, location, existing infrastructure, available services, and potential in its hinterland, expected functions of urban centers are different.

Based on the "two regional systems" presented in subsection 3.2.2, a hierarchy of urban centers with different functions is proposed. Each of the two regional systems should have one regional urban center, which is a large, multi-functional center with agglomerated urban economies. At the second level, several major urban centers are defined also as multi-functional ones. At the third level, there are service urban centers, and further rural centers exist in rural hinterlands.

In the Greater Capital Region, Metro Manila exists with dominant urban functions higher than those of expected regional urban centers. It provides the highest level services such as national administration, advanced education, financial center and center of information exchanges. At the same time, it is the regional center for the Greater Capital Region.

The hierarchical functions of the centers are summarized below.

Proposed Hierarchical Functions of Urban/Rural Centers

National Capital Center	Highly specialized service functions including not only national administrative functions but also high-order functions of finances, information, higher education, research and development, and headquarters of companies.
Regional Urban Center	Large multi-functional urban center with relatively high-order functions serving the whole region, including regional administration, regional financial center, higher education center, regional medical service center, regional commercial center, and manufacturing industrial center.
Major Urban Center	Medium-sized multi-functional urban center with sub-regional business service functions, sub-regional commercial center functions, sub-regional educational functions, housing areas, and manufacturing industrial areas.
Service Urban Center	Urban center serving rural hinterlands with distribution functions of agricultural inputs, commercial functions dealing with agricultural produce, agricultural supporting facilities, agro-processing center functions, and social services.
Rural Center	Rural center with basic urban services such as a town hall, schools, and markets for neighboring rural communities.

Functional division of urban centers

Major changes expected to take place to strengthen the urban hierarchical structure in CALABARZON are the following:

- Upgrading of a major urban center in the Southern Tagalog Region to its regional urban center,
- Upgrading of Metro Manila's functions specializing in higher-order services, and
- Upgrading of selective service urban centers to major urban centers.

The proposed hierarchy of urban centers in CALABARZON is summarized below and illustrated in Figure 4.4.

Proposed Hierarchy of Urban Centers in CALABAR

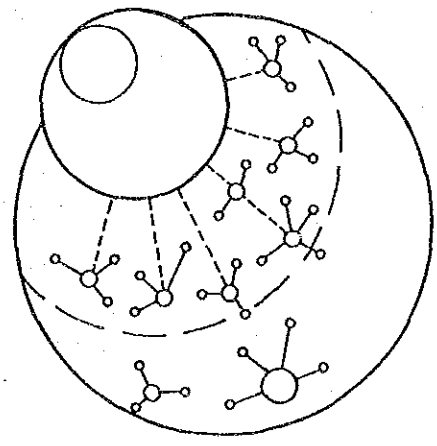
Level of Urban Centers	Center
National Capital Center	Metro Manila
Greater Manila Region	
Regional Urban Center	Metro Manila
Major Urban Centers	Binan, Calamba, Santa Cruz, Trece Martires, Cavite Lowland, Tanay/Morong,Siniloan
Service Urban Centers	Los Banos, Nagcarlan, Tanauan, Silang, Tagaytay
Southern Tagalog Region	
Regional Urban Center	Batangas
Major Urban Centers	Lucena, San Pablo, Lipa, Nasugbu
Service Urban Centers	San Juan, Taal/Lemery, Balayan, Rosario, Lucban

(5) Spatial implications of development alternatives

The development alternatives presented in Section 4.1 are looked at in the light of spatial framework prescribing to some extent relationship of CALABARZON development with Metro Manila (spill over) and relationships among settlements and between settlements and rural areas within CALABARZON.

Alternative 1: Agro-based development

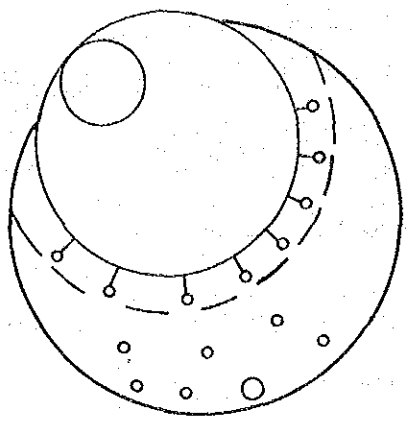
Spatial development pattern will be more dispersed under this alternative, as it emphasizes the rural economy based on indigenous resources. Degree of suburbanization will be relatively low with small spill over from Metro Manila as public sector resources will be devoted more to rural areas rather than to infrastructure in the suburbanization areas. As a result, the growth will be relatively slow as indicated by the socio-economic framework (Section 4.2). The relationships between rural service centers and their respective hinterlands will be strengthened.



Spatial development pattern indicated by this alternative may be schematically represented above.

Alternative 2 : High industrialization

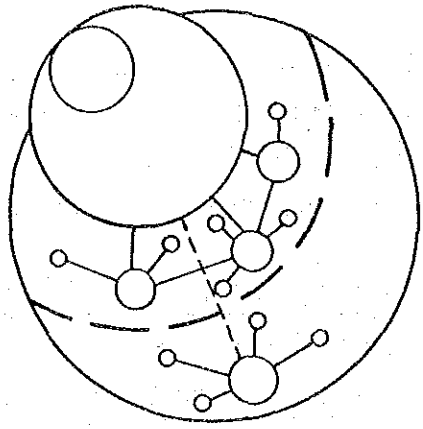
Spatial development pattern will be highly centralized under this alternative, linked strongly with Metro Manila. Degree of suburbanization will be high with large spill over from Metro Manila. Public sector resources will have to be devoted largely to meeting needs for infrastructure and utilities in the suburbanization areas. As a result, other rural areas may be comparatively neglected.



Spatial development pattern indicated by this alternative may be schematically represented above.

Alternative 3 : Leap-frog development

Under this alternative, industrial development will be directed to selected urban centers not in the immediate vicinity of Metro Manila. Thus the development will leap-frog to areas around these centers. This will call for more deliberate efforts by public sector in the provision of infrastructure and utilities as well as in development planning and locational policies. Degree of suburbanization will be intermediate between Alternative 1 and Alternative 2 with moderate spill over from Metro Manila.



Spatial development pattern indicated by this alternative may be schematically represented above.

4.2.3 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 below.

Evaluation of Three Development Alternatives

	Alternative 1 Agro-based development	Alternative 2 High development	Alternative 3 Leap-frog development
(1) Definition	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 suburbanization around Metro Manila	Decentralized
(4) Growth rates	Low	High	Medium
(5) Social and environmental 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 costs	Smallest investment costs	Increasingly high costs for infrastructure, utilities and social services	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

Alternative 1 will involve the smallest investment costs. Negative environmental effects will be minimal, if proper farming and forestation practices are adopted in rural areas. Attainment of equity may be relatively high, but growth rates will be low.

Alternative 2 represents what was originally conceived under the Project CALABARZON. It may be the most economically efficient option upto the mid-term future from the private investors' point of view. However, the public sector resource costs will become increasingly high to keep providing improved infrastructure and utilities to meet the private sector needs. Also, social costs would be the highest under this alternative in the forms of the urban poor, insufficient social services, imbalance between urban and rural economies and others. This alternative would apply the highest pressure on water use and water quality in Laguna de Bay.

Costs involved in Alternative 3 will be intermediate with respect to public investments for infrastructure and utilities, social costs and negative environmental effects. This alternative calls for more deliberate efforts in the public sector to lead the development in more desirable locations. They include selective and strategic improvement in the provision of infrastructure and utilities according to careful development planning and locational policies. Also, strengthening of project planning and implementing capabilities at local level is a prerequisite.

Alternative 1 for agro-based development and Alternative 2 for high industrialization are two extremes, presented to clarity 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 practicable alternative on the balance between agriculture and industry and between rural and urban areas.

4.3 Development Phasing

CALABARZON regional development has to be planned in phases, as the expansion of resource base and financial capacity and related institutional development will take place over time. The planning period is broadly divided into three phases: Phase 1 upto 1995, Phase 2 for 1996-2000, and Phase 3 for 2001 to 2010. Expected performance of the Region in each phase is described below for Alternative 3.

(1) Phase 1 (upto 1995) : trend growth

Socio-economy

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

On-going national efforts in agriculture will be extended to CALABARZON, including the rehabilitation of coconut plantations with replanting/inter-cropping and the livestock improvement programs. Preparation for introducing new crops, better seed varieties, new livestock breeds and fish species will be accelerated. This includes applied research and extension, and establishment/expansion of production capacity for seed, seedlings and fingerlings. Demonstration schemes for new crops/varieties, new breeds, and fish species should be established. CARP implementation will be a prerequisite to encouraging intensive land use for high value-added products. Improvements in input delivery and marketing infrastructure will also take place associated with the new development described above.

The trend growth of industry in the Southern Tagalog Region during this phase will be supported primarily by steady growth of consumer goods industry, including processed food, beverages, apparel and footwear. In the Greater Capital Region, expansion of Metro Manila based industries will continue such as consumer durables and food processing. Investment into export processing-assembly type industries will steadily increase in the existing EPZ and other industrial areas. Some of the latter will start bringing in foreign suppliers of parts and intermediates. At the same time upstream local industries would be supported to develop sub-contracting and input delivery linkages with large firms.

New investment will be required for further expansion of industrial output as the excess production capacity appears to have been already largely utilized. The availability and cost of project financing will be an important factor of industrial expansion.

Infrastrusture

The emphasis in this phase for 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 Batangas port, a few highway projects and the EPZ expansion. Limited infrastructure projects will also be newly initiated as indicated below.

In energy, urgent measures should be taken for power generation expansion as well as consolidation of existing generation, transmission and distribution systems. An rural energy program may be initiated, and applied research on new and renewable energy be systematically expanded. In telecommunication, an improved system may be installed along the prospective second north-south highway to serve planned industrial areas in Cavite and also for rapidly growing urban centers. Basic telephone services will be extended to all the municipalities. Water supply for selected urban centers should be expanded, and initial implementation of the Marikina watershed management will take place as well.

This phase should also see extensive planning and studies for major infrastructure projects which have been selected by the Master Plan for priority implementation. They include irrigation and integrated rural development, the Taal lake multi-purpose water resources development, and major power sources development.

Land use plans for selected municipalities should be newly prepared or updated on a priority basis. Those municipalities that are on prime agricultural land or otherwise strategically important for CALABARZON development should be covered.

Central and local government programs for housing, infrastructure and social services will be reviewed to give priority to those that will support priority agricultural and industrial development areas. At least in some selected urban areas, detailed development programs involving both the private and public sector, should be prepared to provide housing, urban physical infrastructure and social services in an integrated manner.

A key issue to be addressed in the short term is the planning and financial capability of local administrations. Local governments can not lead urban development if they are not capable of providing infrastructure in advance of urban growth and otherwise affecting the use of urban land.

Spatial development

Integration of the Greater Capital Region will proceed with the extension / improvement of primary and secondary arteries. Suburbanization 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. Otherwise the substantial spatial development will be confined to Batangas City and Lucena City.

(2) Phase 2 (1996-2000) : trend acceleration and renewed growth

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. The demonstration schemes initiated in Phase 1 will be fully implemented through extension and farmer support by transferring their prime responsibilities to the government extension services, and development of grass root organizations including cooperatives.

Major projects for irrigation and integrated rural development studied in Phase 1 will be implemented. Planning and studies for additional projects will be undertaken.

In industry, active investments by domestic firms will be made in the full range of existing industries as the domestic demand 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.

In addition to consumer goods industry, other industries will start to develop rapidly, such as fabricated metal products, plastic products, chemicals and other engineering industries as well as new agro-processing industries. The former will support automotive and consumer durables industries and also find opportunities to supply parts and components to large multinational corporations in ASEAN. Processing plants for marine and aquaculture products will also be established. Many of them are SME's transformed into efficient production units and serve as linkage industries.

Spill over from Metro Manila will become increasingly more the relocation of industries originally established in Metro Manila. Industry composition in Metro Manila and its

vicinity should change in favour of those industries capitalizing on their locational advantages rather than just common labour 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, labour intensive and agro-/resource based processing industries will further develop in the Batangas Bay area. Some of the latter will utilize raw materials transported from resource islands. A petro-chemical complex in Batangas will develop backward linkages.

This is a critical phase for technology upgrading. This will be effected by increasing number of joint venture arrangements with foreign firms and multi-nationals linked with local research and training institutions.

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 such as the Taal lake multi-purpose development and the Marikina watershed development and management. They will encourage the decentralization by enhancing the comparative position of the Southern Tagalog Region, or otherwise help to integrate part of the Region into the Greater Capital Region. The provision of infrastructure and utilities in selected second-tier towns will be strategically improved.

In energy, major power generation projects will be implemented within the Luzon grid, and a new and renewable energy project will be initiated. Development of telecommunication system during this phase include its extension to serve major tourism sites as well as to all the intermediate size urban centers.

Spatial development

Intensive land use and much increased agricultural production in rural areas of the Greater Capital Region will be supported by the assurance of good access to urban services and markets for their products as well as betterment of living conditions in villages. 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

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. Agricultural value-added will be dominated by industrial crops, horticulture and livestock including dairy cattle by the end of the phase.

The composition of industry will continue to change from dominance by the 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.

More people having strong entrepreneurship and technology seed will spin out of large enterprises or otherwise retire from them and enter into venture business. They will become a driving force for further industrialization in CALABARZON with upgraded production and R & D activities.

Infrastructive

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.

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.

(4) CALABARZON paradigm

The Project CALABARZON should serve for a model case of regional development in the Philippines. Different areas in the CALABARZON region will be transformed for the

benefit of the local people: from urban squatter areas to quality housing sites having good access to high-grade social services and urban amenities, from crippled urban centers with partial functions to fully equiped multi-functianal urban centers, and from poverty stricken rural areas to rich rural environment containing several hubs of industries surrounded by productive agricultural land and forest areas.

Table 4.1 Land Capability in CALABARZON (1/4)

Characteristics Name of Area (Tentative)	Topography	Major Soil	Slope	Geology	Major Land Use	Erosion Potential	Flood Prone Area	Legal Restriction	Land Capability Class
1. Siera Madre Mountain Area	4-500m-up to 1,469m Mountainous area	Mountain Soils	More than 30% steep slope area	Cretaceous-tertiary rocks/ diorite, andesite/basalt	Forest	Severe erosion	None	National park reforestration area	M
2. Rizal Upland Area	300-500m hilly upland area	Inceptisols/ Alfisols	30% + relatively steep	Tertiary/quartenary volcanics	Grass land/partly secondary forest	Severe	None		D
3. Angono Hill	Hilly upland up to 255m	Inceptisols	18-30% partly over 30%	Quartenary volcanics/lava	Shrub	Severe	None		M
4. Talim Island	Hilly upland up to 410m	Entisols	18-30%	Quartenary volcanics	Shrub	Severe	Coastal lowlands is affected by Laguna lake		M
5. Montalban Lowland	Fluvial lowland	Vertisols/ Inceptisols	Less than 8% relatively flat area	Alluvial deposits	Residential, paddy	Slight	Overflow from the river (temporarily)		A
6. Taytay Lowland	Fluvial to lacustrine lowland	Vertisols/ Entisols	0-3% very flat land	Alluvial deposits	Residential area/paddy	None	Flood by Laguna lake		A
7. Tereas-Tanay Lowland	Fluvial to lacustrine lowland	Inceptisols/ Entisols	0-3% very flat land	Alluvial deposits	Paddy	None	Flood by Laguna lake		A
8. Jalajala Lowland	Narrow lacustrine lowland partly fluvial	Inceptisols	Less than 8%	Alluvial and lacustrine deposits	Paddy	None to slight	Flood by Laguna lake		A
9. Bagumbong Lowland	Lacustrine lowland	Entisols	Less than 8%	Alluvial and lacustrine deposits	Paddy	None	Flood by Laguna lake		A
10. Mabitac Lowland	Fluvial lowland/partly lacustrine lowland	Vertisols	0-3%	Alluvial/lacustrine deposits	Paddy/built-up area	None	Partly flooded by Laguna lake		A
11. Laguna Lake West Lowland	Fluvial lowland	Inceptisols/ Vertisols	0-3%	Alluvial deposits	Paddy/built-up area	Slight	Partly flooded by Laguna lake		A
12. Laguna Lake South Lowland	Fluvial lowland	Inceptisols/ Vertisols	0-3% almost flat land	Alluvial deposits	Paddy coconut forest	None to slight	Partly flooded by Laguna lake		A
13. Maguiling-Atimbia Mountain	Mt. Makiling, 1,110m Mt. Atimbia, 654m	Alfisols	More than 30%	Quartenary volcanic deposits	Forest	Severe	None		M
14. Liliw Upland	Foot slope	Volcanic Loamy Soils	8-18% Partly more than 18%	Volcanic Pyroclastics Alluvial deposits	Coconut Rice paddy	Moderate	None	None	C
15. Mt. Banahow	Mountain ranging from 1,410-2,151m	Alfisols	More than 30%	Quartenary volcanic deposits	Forest shrub grass land	Severe	None	National park reforestation	M

Table 4.1 Land Capability in CALABARZON (2/4)

Characteristics Name of Area (Tentative)	Topography	Major Soil	Slope	Geology	Major Land Use	Erosion Potential	Flood Prone Area	Legal Restriction	Land Capability Class
16. Sariya-Tayabas	Foot slope	Volcanic Loamy Soils	8-18%	Volcanic pyroclastics	Coconut Rice paddy	Moderate	None	None	C
17. Sto. Nino Mountain	Mountain up to 963m	Alfisols	More than 30%	Quartenary volcanic deposits	Forest foot slope area/coconut	Severe	None		M
18. Cavite Lowland	Alluvial to coastal lowland	Inceptisols/ Vertisols	0-3% partly 3-8%	Alluvial deposits/partly tuff	Paddy/built-up area	None to slight	Coastal area has slight flood potential		A
19. Cavite Plateau	Undulating taffaceous plateau partly dissected	Inceptisols	3-8%	Tuffaceous rock/pyroclastics	Sugarcane free crops/grass land	Slight	None		C
20. Tagaytay Upland	Upland/partly dissected deeply	Inceptisols	8-18% partly over 18-30%	Pyroclastics/tuff breccia	Tree crops/coconut	Moderate to severe	None		C
21. Lipa Plateau	Upland are but gently sloping/partly dissected	Inceptisols	3-8% partly flat	Quartenary pyroclastics	Coconut/sugarcane upland crops	Moderate/ partly severe	None		C
22. San Juan Lowland	Mainly alluvial lowland	Inceptisols/ Vertisols	0-3% flat land	Quartenary pyroclastics alluvial deposits	Paddy coconut upland crops	Slight	River over flow		B
23. Sampiro Hill	Lowlying hill	Inceptisols	8-18%	Tertiary volcanics/meta-andesite/basalt	Shrub	Moderate to severe	None		D
24. Lobo Mountain	Mountain area up to 972m	Alfisols	More than 30%	Tertiary volcanics/ andesite/basalt/pyorite	Forest/shrub grass land	Severe	None	Reforestation area	M
25. Taal Lake Slopes	Slope area around Taal lake basin	Alfisols/ Inceptisols	Mainly over 30%	Quartenary volcanic/ pyroclastics/breccis	Coconut/shrub/ grass land	Severe/partly moderate	None	Partly national park/reforestation	M
26. Taal Lake Lowland	Alluvial lowland along Taal lake	Inceptisols	0-3%	Alluvial deposits	Paddy	None	None		B
27. Batulao-Palaypalay Mountain	Volcanic mountains up to 810m	Alfisols	More than 30%	Tertiary volcanic lava/ pyroclastics/andesite/basalt	Forest/shrub/ grass land	Severe	None	National park reforestation	M
28. Nasugbu Lowland	Coastal lowland	Vertisols/ Entisols	0-3%	Alluvial deposits	Paddy	None	River overflow temporarily		A
29. Calantas Plateau	Gently sloping plateau partly dissected deeply	Inceptisols	8-18% mainly	Quartenary volcanics/ pyroclastics/tuff	Sugarcane/coconut	Moderate	None		C
30. Balibago Upland	Hilly upland up to 249m	Alfisols/ Inceptisols	18-30% partly over 39%	Tertiary rocks/ limestone/sandstone	Shrub/grass land	Severe	None		M

Table 4.1 Land Capability in CALABARZON (3/4)

Characteristics Name of Area (Tentative)	Topography	Major Soil	Slope	Geology	Major Land Use	Erosion Potential	Flood Prone Area	Legal Restriction	Land Capability Class
31. Balayan Coastal Lowland	Coastal lowland	Entisols/ Vertisols	0-3%	Alluvial/coastal deposits	Sugarcane	None			A
32. Calumpan Hill	Hilly upland up to 501m	Alfisols	More than 30%	Tertiary rocks/limestone/ andesite/sandstone	Shrub	Severe			M
33. Batangas Coastal Lowland	Coastal lowland	Entisols/ Vertisols	0-3%	Alluvial coastal deposits	Paddy/sugarcane	None			A
34. Narrow Coastal Lowland	Narrow coastal lowland	Entisols	0-3%	Alluvial coastal deposits	Coconut	None			B
35. San Pablo-Candelaria Lowland	Lowlying Foot slope-alluvial fan	Volcanic, Loam Alluvial Sand and Gravel	3-8%	Volcanic deposits Alluvial deposits	Coconut Rice paddy	Slight	None	None	B
36. Tiaong-San Jaan-Lucena Lowland	Alluvial lowland-coastal	Alluivial Soils	0-3%	Alluvial clay, sand/gravel	Coconut Rice paddy	None	River overflow in coastal lowland	None	A
37. Infanta Lowland	Alluvial delta	Alluivial Soils	0-3%	Alluvial Deposits	Rice paddy Coconut mangrove	None	River overflow due to bad drainage	None	A
38. Peninsula Hilly Upland	Hilly upland from 100m-300m +	Sandy-Loamy Soils	18-30%	Tertiary sedimentary rocks	Coconut Grass land	Moderate-severe	None		D
39. Peninsula Mountains	Mountain from 100m-500m +	Mountain Soils	More than 30%	Tertiary sedimentary rocks	Forest, coconut Grass land	Severe	None	Reforestation	M
40. Cadig-Bayabas Mountain	Mountain up to 728m	Mountain Soils	More than 30%	Tertiary sedimentary rocks	Forest Grass land	Severe	None		M
41. Minor Coastal Lowland in Peninsula	Alluvial clay, loam and sandy	Alluvial Clay, Loam and Sandy	0-3%	Alluvium	Coconut, paddy Mangrove	None	River overflow	Preservation of mangrove forest	A
42. Lopez Lowland	Alluvial-coastal lowland	Alluvial Clay, Loam and Sandy	0-3%	Alluvium	Coconut, paddy Mangrove	None	River overflow	Preservation of mangrove forest	A
43. Pitogo Lowland	Alluvial-coastal lowland	Alluvial Clay, Loam and Sandy	0-3%	Alluvium	Coconut, paddy Mangrove	None	River overflow	Preservation of mangrove forest	A
44. Macaleon Lowland	Alluvial-coastal lowland	Alluvial Clay, Loam and Sandy	0-3%	Alluvium	Coconut Paddy	None	River overflow		A

Table 4.1 Land Capability in CALABARZON (4/4)

Characteristics Name of Area (Tentative)	Topography	Major Soil	Slope	Geology	Major Land Use	Erosion Potential	Flood Prone Area	Legal Restriction	Land Capability Class
45. Pagsanjan River Lowland	Alluvial lowland	Alluvial Clay, Loam and Sandy	0-3%	Alluvium	Coconut corm	None to slight	River overflow		A
46. Minor inland Alluvial Lowland	Alluvial lowland	Alluvial Clay, Loam and Sandy	3-8%	Alluvium	Paddy	Slight	River overflow		B
47. Minor Alluvial Lowland in Bondac Peninusla	Alluvial lowland	Alluvial Clay, Loam and Sandy	3-8%	Alluvium	Paddy Corn	Slight	River overflow		B
48. Polillo Island	Island	-	Hilly upland 18-30% Lowland 3-8%	Tertiary sedimentary rocks	Forest, coconut Paddy	None to slight	Flooding in coastal lowland	Preservation of mangrove forest	• Up land area : D-M • Coastal lowland : A
49. Patnanongan Island	Island	-	0-3% partly 3-8%	Tertiary sedimentary coral limestone	Coconut forest	*None to slight*	*None*	Preservation of mangrove forest	• Up land area: D • Coastal lowland : A
50. Jomalig Island	Caral island	-	3-8%	Coral limestone	Coconut	None	None		• Up land area: D • Coastal lowland : A
51. Alabat Island	Island	-	*Hilly area:* 30% + Coastal area: 0-3%	Tertiary sedimentary rocks	Coconut forest	None to slight	None		• Hilly area: D • Lowland area : A
52. Cabalete Island	Island	-	3-18%	Tertiary sedimentary rocks	Coconut	None	None		• Hilly area: D • Lowland area : A
53. Maricaban Island	Island	-							D-M?
54. Verde Island	Island	-							D-M?

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Legend	Figure 4.1

- A — VERY GOOD LAND
- B — GOOD
- C — MODERATE
- D — FAIR
- N — NOT SUITABLE
- NO DATA
- (10) — INDEX TO REGIONAL DIVISION

0 10 20
KILOMETERS

N

LUCENA CITY

Figure 4.1 Land Capability Map	Department of Trade and Industry
	Japan International Cooperation Agency

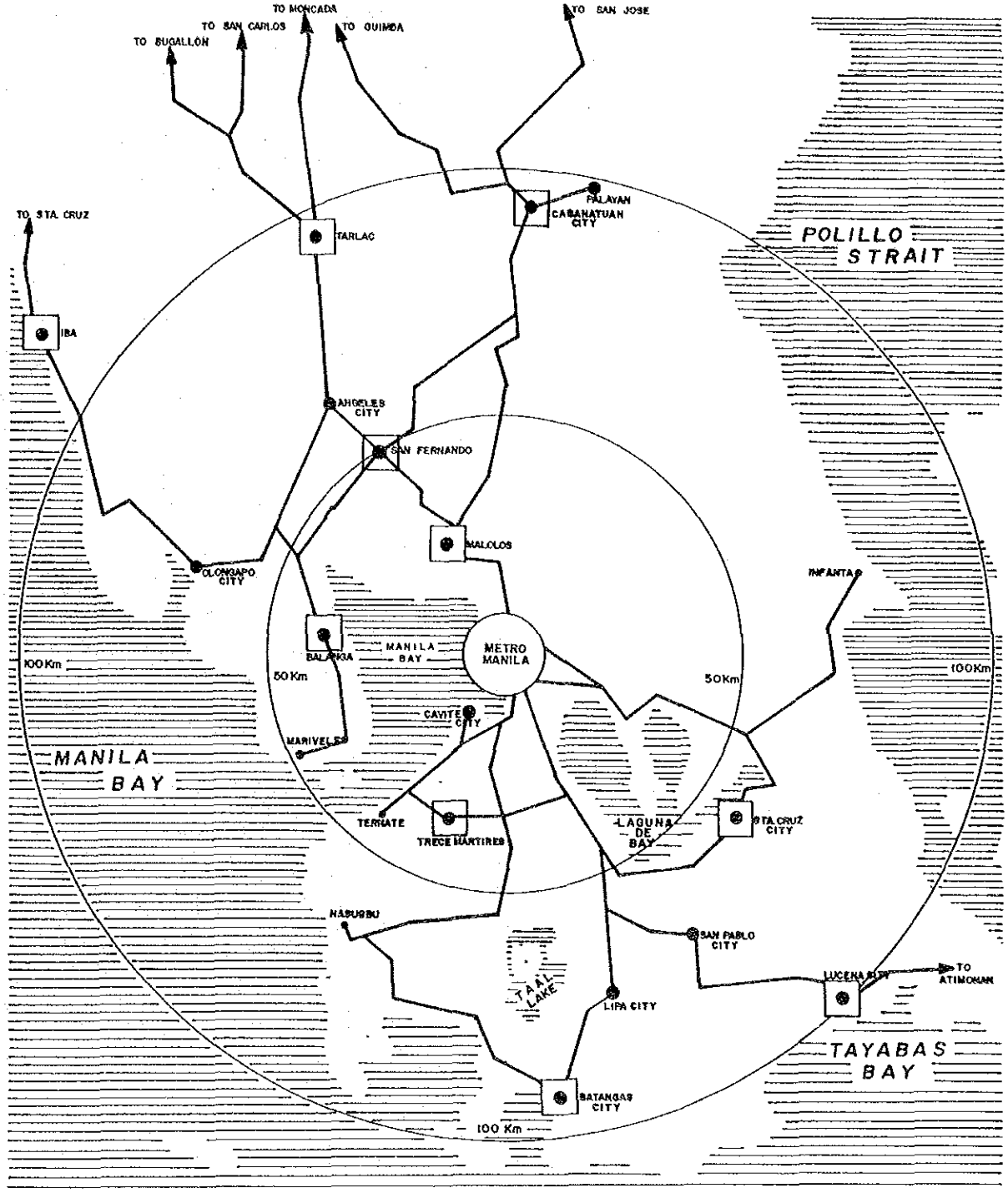

FIGURE 4.2
Macro – Spatial Framework in 100 km Radius Centering on Metro Manila

LEGEND :

- Provincial Capital
- City Center
- Other Urban Center

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Legend	Figure 4.3

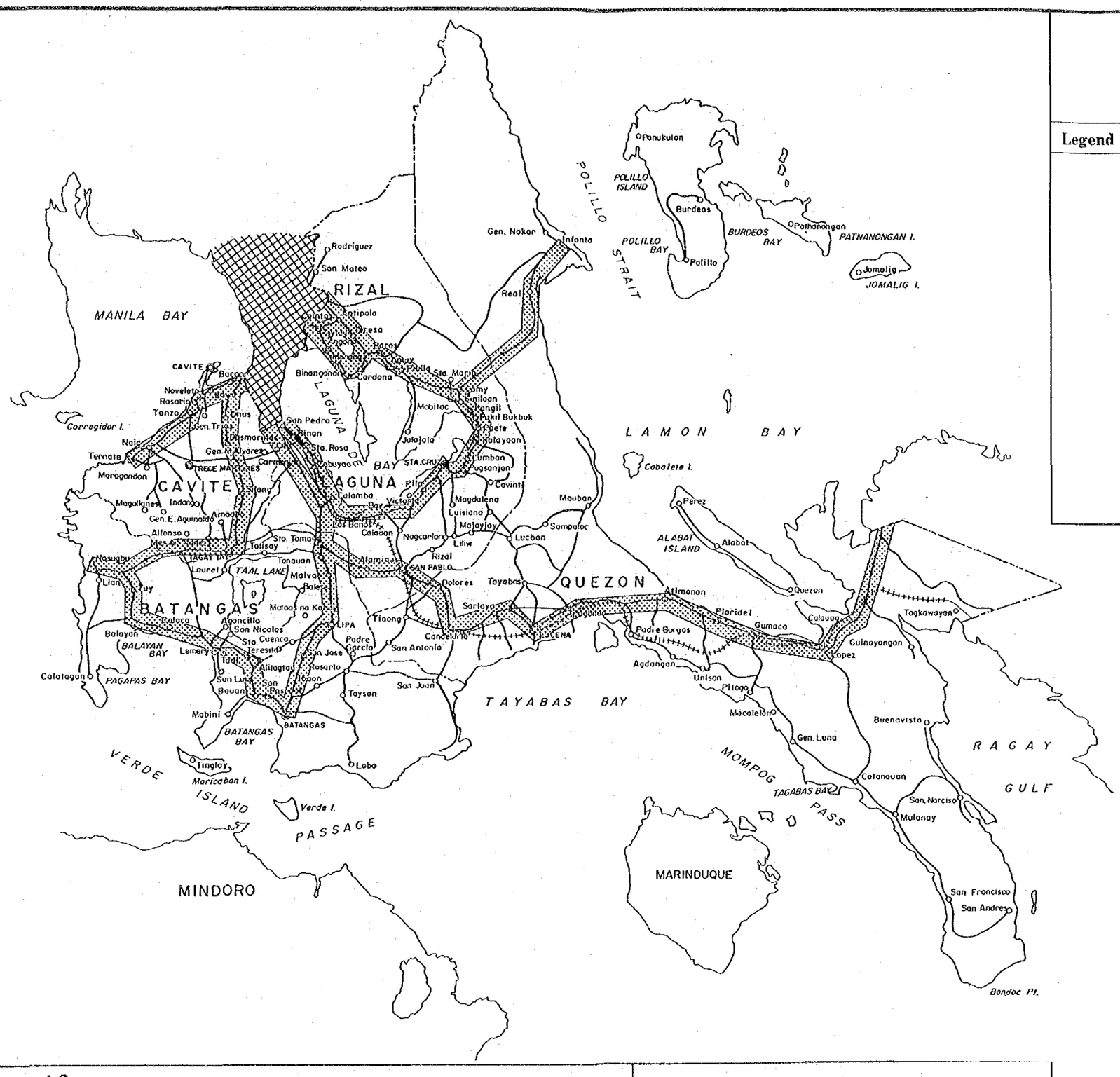

Figure 4.3

Major Axes of the CALABARZON Region

Department of Trade and Industry
Japan International Cooperation Agency

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Legend | **Figure 4.4**

- Regional Urban Center
- Major Urban Center
- Service Urban Center
- Rural Center

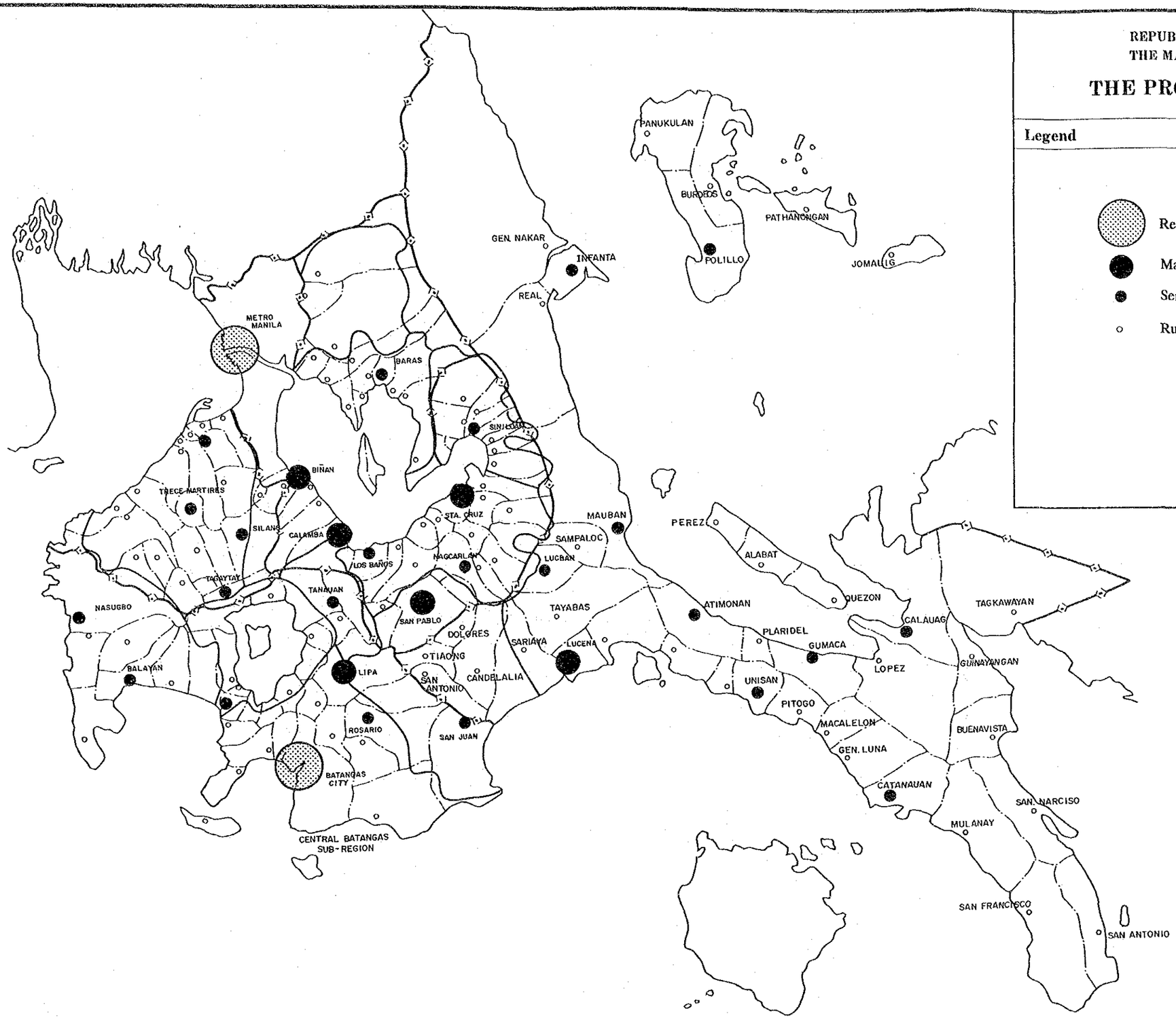

Figure 4.4
Proposed hierarchy of Urban Center in CALABARZON

Department of Trade and Industry

Japan International Cooperation Agency

CHAPTER 5

Chapter 5. CONDITIONS FOR DEVELOPMENT

5.1 Water Resources

5.1.1 Basin system and hydro-meteorological conditions in CALABARZON

Of the five water resource planning units within Region IV, Laguna Lake basins, Taal Lake basins and Quezon basins constitute the CALABARZON region (Figure 5.1). Laguna Lake basins have a total area of 5,080 km^2 and cover the entire provinces of Laguna and Rizal and a small portion of Batangas and Cavite. Taal Lake basins have a total area of 3,940 km^2 covering almost the entire provinces of Cavite and Batangas. Quezon basins have a total area of 10,160 km^2, corresponding largely to the province of Quezon but including also parts of Batangas and Laguna.

(1) Meteorology

There are 32 rainfall stations operating within CALABARZON, 20 in Laguna Lake, eight in Taal Lake and four in Quezon basins, all managed by the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA). Estimated annual rainfall over the basins vary from 1,900 mm to 2,500 mm with the highest precipitation observed in the Sierra Madre range (Figure 5.2). Based on the isohyet map prepared by the National Water Resource Board (NWRB), the mean annual rainfall has been estimated to be 2,148 mm in Laguna Lake, 2,026 mm in Taal Lake and 2,260 mm in Quezon basins. Detailed meteorological data are contained in Appendix D.

(2) Surface runoffs

Laguna Lake basins

The Pasig river flowing from east to west through central Manila is 17 km long from the confluence with the Marikina and Napindan channel to Manila Bay. A principal tributary is the San Juan river. During periods of high tide in the bay and low water level in the lake in the dry season, the Pasig river reverses its flow direction. During high tide conditions and high flow of the San Juan river, a backwater effect slows down the flow of Pasig river and causes overbanking. The Marikina river flows are carried predominantly to Manila Bay, and during periods of high river discharge, a significant portion of the discharge flows into the Laguna lake via Mangahan floodway.

Laguna de Bay is a shallow lake with average depth of about 3 m immediately inland from the Metro Manila area. About forty short streams enter the lake. The major tributaries to the lake, Santa Cruz, Pagsanjan and Romero rivers, drain the southern and eastern slopes of the watershed. Laguna de Bay functions as a natural retarding basin for discharges from the surrounding tributaries. The only outlet is the Pasig river via Napindan channel.

Twenty-two stream gauging stations are established in the Laguna Lake basins, of which only nine have discharge data, while the rest have records of only gauge height (Figure 5.1). Principal features of the rivers in the basin are provided in Appendix D.

According to a runoff map prepared by NWRB (Figure 5.3), the mean annual runoff depth of the basin is estimated at 1,435 mm. The runoff ratio to the total rainfall volume in the basins is calculated to be 67%.

Taal Lake basins

There are eight stream gauging stations within the Taal Lake basins (Figure 5.1). All stations, except the Molino river in Batangas , have about twenty years of available data. However, only data up to 1979 are discharge data and the data from 1980 to the present are recorded in terms of gauge height. Principal features of rivers are given in Appendix D.

According to NWRB, the mean annual runoff depth of the basins is 1,246 mm. The runoff ratio to the total rainfall volume in the basins is calculated to be 61%.

Quezon basins

Only ten stream gauging stations are presently operated in the basins, located mostly in the central portion of the Quezon province (Figure 5.1). Data for these stations are given in Appendix D.

Based on the mean annual runoff map, the mean annual runoff depth of the basins is estimated to be 1,445 mm, making the average runoff ratio 64%.

(3) Hydrogeology

Hydrogeologic conditions of the CALABARZON region are described below to indicate the aquifer distribution. The Region is divided into three groundwater categories with respect to aquifer depth. Shallow well area is where wells with depth not greater than 20m are recommended and the static water levels are generally within 6m below ground water surface (mbgs). Deep well area is where wells with depth greater than 20m are

recommended and the static water levels usually exceed 6 mbgs. Difficult area is where groundwater depth varies considerably and about 25% of such area may yield non-productive boreholes. Aquifer distribution in the Region is illustrated in Figure 5.4.

5.1.2 Existing water use and facilities

(1) Existing water use

Domestic water

Three levels of water services are defined by the Government for domestic water supply. Level I consists of a point source usually a protected spring or well without distribution system, often provided in areas where houses are few and scattered thinly. It essentially covers 100 persons. Level II is a communal faucet system intended for rural areas where houses are clustered enough to justify a simple distribution system with public standpipe. It delivers water to an average of 100 households per system. Level III water supply service refers to a piped system with individual house connection, generally suited for dense urban areas.

The result of estimation indicates that the average per capita water use in the Region is estimated 45 litre per day (detail in Appendix D). This may be compared with the average per capita water use in Metro Manila of 135 litre per day.

The domestic water in CALABARZON depends mostly on groundwater. Water supply systems depending on sources other than wells and springs account for some 20% of the total in terms of quantity of water supplied for Rizal, Laguna and Batangas and less for Cavite and Quezon.

Industrial water

NWRB estimated the industrial water use in 1975 and 1980 based on the estimate of industrial output. The results are given below by basins.

Industrial Water Use in CALABARZON

	1975	1980
Laguna Lake basins (mcm/year)		
Manufacturing	13.7	21.3
Mining	0.02	0.03
Construction	0.50	0.79
Electricity	0.30	0.48
Total	14.5	22.6
Taal Lake basins (1,000m^3/year)		
Manufacturing	583	1,370
Mining	1	-
Construction	12	-
Electricity	3	-
Total	599	-
Quezon basins (1,000m^3/year)		
Manufacturing	211	421
Mining	2	3
Construction	8	3
Electricity	3	5
Total	225	440

The water use by manufacturing is further classified into three groups: primary, intermediate and capital goods industry. In Laguna lake basins, the shares of primary, intermediate and capital goods industry are 33%, 36% and 31%, respectively. In Taal lake basins, the share of intermediate industry is 92%.

Irrigation water

Existing water use for irrigation is estimated on the basis of data on the irrigated land area obtained from NIA and the pattern of water requirement. The latter is 1.5 l/sec/ha for 90 days in January-March, 1.0 l/sec/ha for 132 days in June-October, and 41 days in November - December.

Average annual water use for the period 1985 through 1989 is summarized below by province.

Irrigation Water Use

Province	Irrigation water (Mm^3/year)		
	NIS	CIS	Total
Rizal	-	50	50
Laguna	199	116	315
Cavite	175	7	182
Batangas	19	40	59
Quezon	49	106	155
Total	442	319	761

NIS : National irrigation system
CIS : Communal irrigation system

Almost all irrigation water is supplied from river water with a small diversion dam or intake gate. There exist some communal irrigation systems to which insufficient water or no water is supplied during the dry season because of small storage capacity of dam or no water regulation facility.

(2) Existing facilities

Dams and reservoirs

According to the inventory of water impounding projects conducted by NWRB, five dams exists in the provinces of Batangas and Cavite. Locations of existing dams are shown in Figure 5.5.

List of Water Impounding Reservoirs

Site	River	Province	Catchment Area (km^2)	Dam high (m)	Purpose
Novaliches	La Mesa	Rizal	26	30	M & I
Wawa	Marikina	Rizal	280	11	M & I
Caliraya	Caliraya	Laguna	92	106	P, etc.
Nagcarlan	Balugbog	Laguna	-	-	P
Majayjay	Botocan	Laguna	5		P

M & I : Municipal and industrial water supply
P : Power

Water supply facilities

According to the 1987 data of DPWH, LWUA, and MWSS, the approximate number of existing water supply facilities in the CALABARZON region is as shown below.

Inventory of Water Supply Facilities

Province	Level I	II	III
Rizal	1,680	38	36
Laguna	3,430	30	57
Cavite	5,140	90	35
Batangas	2,720	227	33
Quezon *	5,506	-	10
Metro Manila	1,700	-	1
Total	20,176	385	172

* As of December 1990

Flood control structure

Flood protection measures have been implemented to alleviate the flood problems of the basins. These measures involve the construction of revetments, spur dike, drainage,

mains and river walls, and dredging. Existing condition of flood protection measures by province is shown below.

Inventory of Flood Protection Measures

Province	Dike/ Levees (km)	Revet- ment (km)	Dredging (km)	Spur Dikes (m)	River Walls (km)	Drainage Main (m)
Rizal	0.0	3.63	11.7	0.0	0.22	0.0
Laguna	0.0	2.54	0.0	79.0	0.0	196
Cavite	0.1	0.65	0.0	0.0	0.0	0.0
Batangas	2.2	0.34	0.9	10.0	0.0	0.0
Quezon	0.6	0.53	-	-	0.23	-
Total	2.3	7.69	12.6	89.0	0.45	196

Source: Southern Tagalog, Frame Work Plan 1983 by NWRC

Major flood control structures for the Metro Manila area are the Mangahan floodway and the Napindan hydraulic control structure. The general features are as follows.

The Mangahan floodway is a diversion channel which limits the flood discharge of the Pasig river to the bank. It will carry the remaining portion of the flood discharge from the Marikina river to Laguna Lake for temporary storage to prevent overbank flow into the Manila area. The Napindan hydraulic control structure is a gated spillway dam situated across the Napindan river. This was constructed to prevent back flow of the Pasig river to the lake and at the same time provide a means of storing water for water supply and irrigation purposes.

5.1.3 Planned and on-going projects

(1) Water impounding reservoir projects

Six reservoirs in the Laguna Lake basins, two reservoirs in the Taal Lake basins and nine reservoirs in the Quezon basins are either proposed or identified (Figure 5.5).

Proposed/Potential Water Impounding Reservoirs

Site	River	Province	Catchment area (km^2)	Dam height (m)	Purpose
Wawa	Marikina	Rizal	280.0	135	P,FC,M&I, etc.
Pililla	Unnamed Cr.	Rizal	1.0	-	I, FC,etc.
Morong	Unnamed Cr.	Rizal	1.8	-	I, FC,etc.
Mt. Banbang	Lanatin	Rizal	70.0	-	P,FC,M&I, etc.
Montalban 1	Mango	Rizal	18.4	60	P,FC,M&I, etc.
Montalban 2	Puray	Rizal	33.0	50	P,FC,M&I, etc.
Rosario	Malakin-ilog	Batangas	235.0	40	P,FC,M&I, etc.
San Juan	-	Batangas	0.3	-	I, FC,etc.
Lower Agos	Agos	Quezon	873.0	130	P
Pagbilan	Gumaca	Quezon	-	9	P
Daraitan	Caliwa	Quezon	340.0	106	P,M&I, etc.
Kanan	Kanan	Quezon	357.0	-	P,M&I, etc.
Picsan	Guinhalinan	Quezon	54.8	50	I, P, M&I
Camohaguin	Camohaguin	Quezon	10.0	-	I, FC, etc.
Mauban	Balay-balay	Quezon	65.0	-	P,FC, etc.
Gen. Luna	Hingoso	Quezon	30.0	40	P,FC,M&I
Santa Rosa	Adoa	Quezon	42.4	30	I, FC, etc.

M & I: Municipal & industrial water supply
P: Power I: Irrigation FC: Flood control

The Wawa dam project (Marikina multi-purpose project) is a major project involving the construction of a dam, spillway, diversion tunnels, water treatment plant and a hydroelectric plant. It is specifically intended for alleviating the recurring potable water and power deficiencies for Metro Manila during dry periods and controlling the flood flows along the Marikina river during the rainy season in conjunction with the Mangahan floodway.

In addition, a transbasin water project from the Kaliwa river basin is planned. The Kaliwa river originates from the boundary area between Rizal and Quezon. The project involves the construction of a dam and transbasin tunnel to connect the Kaliwa reservoir (Laiban dam) to the Marikina reservoir for the purpose of augmentation the safe yield in the Marikina reservoir for water supply. The estimated reservoir yield of the Laiban dam is 22.1m^3/s.

(2) Water supply projects

Major water supply projects are planned or implemented by Metropolitan Waterworks and Sewerage System (MWSS). Local water supply projects are undertaken by Local Water Utility Administration (LWUA). They are given respectively in Appendix D.

(3) *Flood control and drainage project*

Parañaque spillway

This is a proposed artificial channel about 9 km long. This will cut the narrow neck of land between Laguna lake and Manila Bay as an additional outlet for excess water in Laguna lake.

Pasig river walls

This project will confine excess flood flows within the channel of the rivers. There is actually a proposal to raise the existing walls to transport higher flood flows in the Pasig river.

5.1.4 Water resources potential and prospects

(1) Surface water potential

Preliminary evaluation of surface water potential has been carried out on the basis of the mean annual rainfall and runoff maps and observed annual rainfall and stream discharge (Figures 5.2 and 5.3). Runoff ratios at existing stream gauging stations are calculated using annual basin rainfall and observed discharge data. The runoff ratio by each river is presented in Table 5.1. Annual runoff depth in some sub-basins, where stream gauging station is not installed, is estimated using the above runoff ratio and annual basin rainfall. Estimated annual runoff depth and runoff volume are provided in Table 5.2 for the Laguna Lke and the Taal Lake basins.

Laguna Lake basins

The Marikina river basin is the largest sub-basin of the Laguna Lake basins. The runoff ratio is among the highest and the specific discharge is relatively high. Thus the annual runoff is estimated to be over 1,000 million m^3, equivalent to the runoff depth of over 1,700 mm.

The Balanac and Sta. Cruz river basins are located in the highest rainfall intensity area in the Laguna Lake basins and the runoff ratio is relatively high. The annual runoff depth is about 1,500 mm. The San Antonio river basin has relatively high runoff coefficient and annual runoff volume. The runoff depth is between 1,400 and 1,500 mm.

Other basins have either small catchment area or low runoff ratios, and thus are considered of low potential. The annual runoff depth varies from less than 1,300 mm in the southern

part of Laguna de Bay up to 1,600 mm in the high rainfall area in the northern and the eastern part of the lake.

Taal Lake basins

The Taal Lake basins have generally smaller runoff depth than the Laguna Lake basins ranging between 1,000 and 1,400 mm. The Maragondon river basin has relatively high runoff ratio and runoff depth in the range of 1,300-1,400 mm. The Kumpang river basin has the largest area and total annual runoff volume of some 800 million m^3, although its runoff depth is relatively small at 1,200 mm.

Other river basins having relatively high potential are the Rosario, Bolbok and Bayan river basins in the eastern part of Batangas and the Lian and Molino river basins in the western part of Batangas. The Pansipit river draining the Taal lake basin has low runoff ratio estimated at 0.35 and small runoff depth below 1,000 mm, but its discharge is stable throughout a year due to regulating effects of the Taal lake. The northern part of Cavite is drained by many small rivers having low runoff ratios. Surface water potential in this area is generally low with small runoff depth.

Quezon basins

The Quezon basins have generally larger runoff depth than the Laguna Lake basins, ranging between 1,300 and over 1,800 mm. The Agos river basin in the northern most part has the largest catchment area and large runoff depth over 1,500 mm. Rivers draining the central part also have large runoff depth but their catchment areas are small. Rivers in other parts of the Quezon basins are mostly short, have small catchment area, and their runoff depth is generally in the range of 1,400 - 1,500 mm.

(2) Groundwater potential

Laguna Lake basins

Distribution condition of three categories of groundwater area in the basin is shown in Figure 5.4. On the basis of the available data on existing wells in the basin, a summary groundwater potential is given below (detail in Appendix D).

Groundwater Data for Laguna Basins

	Rizal	Laguna
Total land area (km²)	1,350	1,760
Number of wells (nos.)	187	398
shallow wells	57	48
deep wells	130	350
Well depth (m)	8 - 153	18 - 156
SWL (mbgs)	2.9 - 1.37	0.3 - 120.4
Specific capacity (lps/m)	0.21 - 1.37	0.40 - 5.29
Ave. actual capacity (lps)	0.59 - 4.25	0.53 - 1.95
Safe yield level (mcm/year)	230	440

Source: Rapid Assessment of Water Supply Source in 1982

High yielding areas are principally found in the flat land such as the area along the shore of Laguna de Bay and western part of Mt. Cristobal in the province of Laguna. In the province of Rizal, the area is very limited and low yielding area prevails on the most part of the province.

Taal Lake basins

A summary of groundwater potential is provided below (detail in Appendix D).

Groundwater Data for Taal Basins

	Cavite	Batangas
Total land area (km²)	1,290	2,390
Number of wells (nos.)	410	1,140
shallow wells	10	101
deep wells	400	1,039
Well depth (m)	13 - 234	4 - 260
SWL (mbgs)	1.3 - 42.4	7.1 - 65.9
Specific capacity (lps/m)	0.19 - 1.98	0.21 - 1.35
Ave. actual capacity (lps)	-	0.32 - 3.47
Safe yield level (mcm/year)	265	470

Source: Rapid Assessment of Water Supply Source in 1982

Major high yielding areas are found in the flat land extending from Trece Martires to the coastal area along Manila Bay, from Batangas City to the southern shoreland of Taal lake, the coastal area along Balayan Bay and from Rosario to San Juan in the eastern end of the province of Batangas.

Groundwater potential in the Quezon basins is summarized below.

Groundwater Data for Quezon Basins

Total land area (km²)	10,106		
Number of wells (nos.)	584		
shallow wells	-		
deep wells	-		
Well depth (m)	7	-	50
SWL (mbgs)	0.6	-	17.2
Specific capacity (lps/m)	0.11	-	2.07
Ave. actual capacity (lps)	-		
Safe yield level (mcm/year)	-		

High yielding areas are found in the central part of the Quezon basins. The average specific capacity is high in the western central part such as in Candelaria, Mauban, Sariaya and Tiaong, but wells in these areas tend to be deep. The average specific capacity is high also in lowlands of Infanta, Real, Agdangan and istands of Alabat and Patnanungan.

5.1.5 Strategy and measures for water resources development

Water resources potential evaluated for both surface water and groundwater is summarized in Figure 5.6. Water resources in CALABARZON are relatively rich but their distribution varies highly both seasonally and spatially. CALABARZON is characterized also by vulnerable water and related land environment. Therefore, water resources development and management are critically important for the CALABARZON regional development. Strategy and measures are described below for water supply, watershed management and multi-purpose water resources development. Priority projects and institutional measures are also presented.

(1) Water supply

Sources of water for different uses in CALABARZON will not basically change in the future. For domestic drinking water, local sources such as springs and streams should be utilized as much as possible except in the suburbanization area of Metro Manila. For irrigation water, various sources should be combined to meet the requirements in particular localities, such as local rivers, small water impoundments, springs, groundwater and lake water. Industrial water will continue to depend primarily on groundwater except in the MWSS area.

The following strategy for municipal water supply, due to NWRB, seems reasonable in CALABARZON.

1) The level of water supply (Level I, II, or III) shall be determined based on technical and financial considerations, needs of a particular water district (WD) and rural waterworks and sanitation association (RWSA), and their willingness and ability to share costs and responsibilities of construction and maintenance of waterworks.

2) New water supply projects shall be selected by the criteria of (1) community commitment, (2) inadequacy of existing water supply, (3) prevalence of water-related diseases, (4) development status and potential of the community, and (5) capital costs per capita.

3) Technology suitable for local needs, conditions and resources shall be selected.

4) The planning for new water supply systems in suburban areas shall be coordinated with the existing system of the urban areas.

5) A large scale new water supply system with individual house connections shall not be planned in principle, but instead upgrading or expansion of existing systems shall be planned.

(2) Watershed management

In view of generally vulnerable water and related land environment, concepts of watershed management should be applied widely to water resources development and management in CALABARZON. Objectives of watershed management are (1) to minimize the erosion of productive top soil, (2) to minimize the discharge of organic and non-organic wastes into the ambient environment, and (3) to enhance the water retaining and productive capacities of the land.

General measures for watershed management include not only structural measures to store flood water for subsequent use or to arrest sand but also the following.

1) Improvement of farming practices such as deep ploughing, terracing on slopes, buffer strip cropping and mulching as well as controlled application of irrigation water, fertilizer and pesticides,

2) Allocation of sufficient cultivation area to perennial crops and other crops of better land surface coverage and soil enriching characteristics,

3) On-farm tree planting,

4) Pasture management,

5) Promotion of controlled grazing, and

6) Afforestation.

Applicability of these measures differs depending on particular areas such as the Marikina watershed, the Laguna basin, upland areas in Cavite and Batangas, and mountainous areas in Quezon. Important factors affecting the applicability are rainfall patterns (both spatial and temporal), land use, vegetation cover, soil characteristics and topography (slope gradient and slope length). Appropriate measures should be selected for each area, taking account of these factors.

(3) Multi-purpose water resources development

Opportunities to develop water resources in substantial scale are quite limited in CALABARZON. Development of surface water generally involves large capital costs and long lead time. In order to utilize limited opportunities to the maximum, multi-purpose development should be pursued as long as relevant. Watershed management should be an important consideration in such development, but effective development of water resources in limited areas would contribute to this objective as well.

Industrialization in CALABARZON will depend more on groundwater development. As more industries locate in larger areas, availability of groundwater will become a critical factor for successful industrialization. Over-extraction of groundwater will cause serious problems such as exhaustion of the source, deterioration of water quality and land subsidence. As reliable and comprehensive data are lacking on groundwater resources in CALABARZON, a comprehensive groundwater survey should be undertaken in the nearest future.

(4) Priority projects

Under the strategy described above and in line with the CALABARZON Master Plan, the following projects are vital for the overall development of the Region:

1) Taal Lake multi-purpose water resources development project,
2) Marikina watershed development and management project, and
3) CALABARZON groundwater potential study.

Project profiles of these projects are contained in Appendix K.

(5) Institutional measures

Coordination of water-related activities

Wide application of concepts of watershed management and multi-purpose development will call for improvement or reinforcement of the coordination system for water resources development. In addition to the agencies already mentioned, other agencies will be more actively involved such as DPWH, DOH, DILG, DENR, DA, DAR and DTI. Present division of responsibilities among these agencies is given in Appendix D.

NWRB is the body responsible for coordinating and integrating all activities related to water resources development and management. Its prime objective is to achieve a scientific and orderly development and management of all water resources. To realize this objective, the status and membership of NWRB may be reviewed. Policy initiative can be achieved by NWRB through the direction of main thrusts of its operational program given to water-related implementing agencies for program formulation, project evaluatin and coordination. To thresh out specific problems, NWRB should effectively utilize task forces or technical committees to consult with related agencies. This "botton-up" mechanism will be more important to address to specific problems in specific localities.

Basic data collection

NWRB has initiated the establishment of a national water resources data system for the purpose of systematically improving collection, storage and dissemination of water resources data. The data cover meteoro-hydrology, groundwater, existing conditions of water resources development, inventory of water-related facilities and their use and production record. These data are useful not only for planning water resources development but also for monitoring the effects of such development. Clarification of specific uses will help in developing a more efficient system. The envisioned Laguna

basins environmental monitoring system should link to this system effectively to allow easy access.

Manpower development

MWSS, LWUA and DPWH have their own training programs, and courses and seminars on systems management, administration, technical aspects and other subjects are provided to project personnel and beneficiaries. RWSA gives orientation about RWSA's roles, importance of rural sanitation and responsibilities of people in related communities. These programs should be extended further to make people more conscious about their responsibilities as well as to provide basic technical information.

Water use regulation

Water use regulation is effected by NWRB through administrative concession or water permit system. These functions of NWRB involve generally:

1) approval, modification or denial of water permit applications for diverting and using surface water or groundwater,

2) resolution of conflicts in water use, and

3) prescription of rules and regulations governing water use, conservation and protection.

These water right functions are the most established activity of NWRB. For groundwater development, a monitoring system for production volume and regulations to control total extraction should be established to avoid problems due to over-exploitation.

5.2 Transportation

5.2.1 Present transport conditions

(1) Transportation system

The Region's transport network comprises strong arteries to/from Metro Manila and secondary links that connect some major urban activity centers with each other and with the arteries (Figure 5.7). At present, there are four major transport corridors in the Region, namely:

1) Metro Manila-Calamba-San Pablo City-Lucena City; served by South Super Highway and national road, PNR Main Line South, and Lucena port;

2) Metro Manila-Calamba-Lipa City-Batangas City-Calapan (Mindoro); served by South Super Highway and national road, Batangas and Bauan ports;

3) Metro Manila-Cavite City; served by national road; and

4) Metro Manila-Antipolo; served by national road.

The main secondary links include the following:

Calamba - Sta. Cruz
Nasugbu - Tagaytay City - Sto. Tomas
Carmona-Trece Martires - Cavite City,
Sta. Cruz - Famy - Real - Infanta; and
Marikina - San Mateo - Montalban

The main trunk road near Metro Manila is the 45 km toll road (South Super Highway) which carries about 50,000 vehicles a day at the Manila end. At the Calamba exit, traffic is still as high as 15,000 vehicles a day. The expressway service (North Diversion Road, toll road) is also available toward the north, connecting Metro Manila with Pampanga and being extended further to Tarlac. The proposed radial trunk roads also include R-1 (Metro Manila-Cavite), R-10 (Metro Manila-Bulacan), Marikina - Infanta (Metro Manila - Rizal - Quezon) and so on. All the existing and planned trunk roads center in Metro Manila, while the secondary network is not necessarily effectively configurated.

The PNR Main Line South with single or double track runs from Manila through the Region via Calamba and San Pablo in Laguna, and Tiaong and Tagkawayan in Quezon to Bicol. Carmona is connected with a branch line. Although the PNR serves the area, it carries little freight, most of which is moved by road. Rail passenger levels from Calamba to Manila are of the order of 5,000 a day, decreasing to 2,000 a day on the Calamba - Lucena stretch.

There are only two ports of significance in the Region, Batangas and Bauan. Their domestic traffic is fairly light - 187,000 tons and 630,000 passengers at Batangas and 120,000 tons at Bauan, compared with over 6 million tons and over 2 million passengers at Manila in 1980. Ferry and small craft service is served by either Batangas or Bauan to the neighboring island of Mindoro.

(2) Transport demand

Passenger traffic

The results of the JUMSUT II Study (JICA/DOTC 1984) give an indication of the person traffic demand level and distribution for CALABARZON, shown in Figure 5.8. The characteristics are as follows.

- Metro Manila generates extremely large volume of traffic with high density.
- The immediate adjoining areas of Metro Manila in Bulacan, Rizal, Cavite, and Laguna provinces heavily interact with Metro Manila.
- Cavite and Laguna have relatively high percentages of inter-regional traffic, 66% of the total traffic, while Rizal and Bulacan areas have approximately 55% and 45%, respectively.
- The above adjoining areas do not have any significant inter-provincial traffic movements between the other areas, with the exception of Metro Manila.

These person trip demands are largely met by public transportation. The modal shares of public transportation for major OD movements are 74% within Metro Manila, 80% for Metro Manila-Bulacan, 78% for Metro Manila-Laguna/Cavite, 91%, 86% and 87% respectively within Bulacan, Rizal and Laguna/Cavite.

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 road movements in Luzon. Limited surveys conducted in NTPP in the early 1980s (OD survey at Sto. Tomas) give an indication of commodity flow pattern in Southern Luzon as shown below.

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
Timber/Firewood	1.0	1.8
Mineral 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: NTPP Part III, August 1982

(3) Roads and road transport

Road network

The road network in the CALABARZON region consists of about 11,600 km in 1989: 2,120 km national, 2,200 km provincial, 1,010 km city/municipal, and 6,300 km barangay roads. The national roads comprise in general the trunk system and access roads to national airport, seaports, etc. Provincial roads connect municipalities/cities with each other and with the trunk system, public wharfs and other terminals. Municipal/city roads are either roads or streets within the poblacion of a municipality/city or its sitios. Barangay roads are in essence farm-to-market roads.

National roads and barangay roads are constructed and maintained by the Department of Public Works and Highways (DPWH), while the provincial government and the municipality/city are responsible for provincial roads and municipality/city roads, respectively.

Road length by class and administrative unit in the CALABARZON region is summarized in Table 5.3. National roads in the Region are classified by surface type in Table 5.4.

The national roads are mostly paved in Cavite, Laguna, Batangas and Rizal (85% of the total length in 1988) but in Quezon only 34% is paved. Barangay roads are hardly paved with only about 3% of the total length paved with concrete or asphalt in Regions IV and V. Situations are similar in the CALABARZON region.

The characteristics of road availability in the CALABARZON region are as follows (detail in Appendix E).

- Overall availability of roads in CALABARZON is considerably better, except in Quezon, than that in other regions, with the exception of NCR, not only in terms of road length but also in the percentage of paved roads and roads of fair condition.

- Cavite has higher road density than other provinces in CALABARZON. Rizal and Laguna have relatively poor road density. Quezon by far has the lowest road density. Batangas has higher road density than these three provinces, but road conditions are relatively poor.

- Of the total road length, barangay roads share about 45% in Cavite and Laguna, while about 60% in Batangas, Rizal and Quezon.

Road traffic

The characteristics of road traffic volume in the CALABARZON region are as follows (Figure 5.9; detail in Appendix E).

- Heavy traffics are observed on the roads radiating from Metro Manila in four directions - east into the province of Rizal, southeast along the South Super Highway/Manila South road, south to Bacoor and Imus, and southwest along the coast of Cavite.

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

- Other relatively heavy traffics are observed only on a few road sections away from Metro Manila.

Road freight transport industry

In 1985, there were approximately 94,000 trucks registered in the Country. The number of trucks licensed for hire (TH) was about 10,000 or only 9% of the total, the remaining being private trucks. About one-third of the total fleet were registered in Metro Manila. In addition to the licensed TH-operators, there are a large number of illegal ("colorum") for-hire operators.

Most trucking firms are small family-owned outfits where trucking is often only a part of the family business. Licensed truckers engaged in medium and long distance haulage appear to be mostly medium-sized firms where transport is the main or only activity. Each trucking firm is usually operated completely on their own; there are few examples of active cooperation in marketing and operations.

The trucking industry has difficulty in raising capital to finance investment due to high interest rates for short term loans, collateral requirements, and generally small-scale operations. Training for technical and management skills is limited to learning through job experiences and in-house training activities of large private truck fleet owners and bus companies.

Bus transport industry

Registered public utility buses, including tourist buses, numbered over 20,000 in 1978, but they decreased steadily until 1980 and then sharply thereafter to reach 11,000-12,000 levels.

In Southern Luzon, there are many bus routes radiating from Metro Manila and also a network of local routes linking many towns. There exist two large operators having a fleet of around 370 and 200 units serving the CALABARZON region. There are also a large number of medium-sized operators in the Region with 40 to 100 units each. They operate on a variety of routes in competition with each other and with the large operators.

Among the main routes in the Region are Manila-Batangas, Manila-Lucena, and Manila-Sta. Cruz. On each of these routes, there are at least two or three of the medium-sized companies competing with a large operator as well as quite a few smaller operators.

In general, traffic on these routes is fairly heavy. Majority of passengers are commuters travelling daily to Manila, and thus traffic demand is sharply peaked and heavily uni-directional at certain times of the day.

Service schedules for most routes connected to Manila are frequent, and departure times and service intervals adhered to. On the non-Manila bound routes, most services are provided by a large number of relatively small operators of mini-buses and large buses. In general, these services do not run to fixed schedules but depart when acceptable passenger loads (usually 50% of the seating capacity) have been reached.

For some local routes, operators have formed informal groups which share terminal facilities and coordinate competition of services. Their main competition comes from "colorum" jeepneys which are reported to be very common in the Region.

(4) Railways

Railway network and services

The PNR in the CALABARZON region refers specifically to the following sections:

- Main Line South between San Pedro and Tagkawayan through Calamba, San Pablo and Tiaong: single track, operational,
- Branch Line from San Pedro to Carmona: 5.1 km, single track, operational, and
- Branch Line from Calamba to Batangas: 57 km, not operational, right-of-way retained.

Commuter services are available using Main Line South and Main Line North for seven routes which are classified into two:

a) Routes having Manila (Tutuban) Station as its terminals, namely:

Manila - Carmona	:	40.3 km
Manila - Alabang	:	28.1 km
Manila - San Fernando,P	:	61.6 km
Manila - Meycauayan	:	15.0 km

b) Routes running through North and South Line without passing Tutuban Station, namely:

Carmona - Caloocan	:	46.1 km
Alabang - Caloocan	:	28.1 km
Malolos - Alabang	:	65.2 km

Current service frequencies are low except for Manila - Carmona route. Particularly along Main Line North, service frequencies are negligible compared to buses/jeepneys.

PNR traffic demand

Since the completion of the Maharlika highway to the south of Manila in 1975, PNR passenger patronage has diverted drastically to bus services. Cumulative effects of years of neglect on the PNR track conditions has also played a part in recent years by reducing train speeds to increase the advantage of bus transport.

PNR long distance service carried 749,000 passengers or 146 million passenger-km a year in 1985. The average daily ridership of Main Line South has increased to 3,300 passengers (boarding and alighting) for the first half of 1987. The average number of passengers per day at major stations on Main Line South in the CALABARZON region during the first half of 1986 were 47 at Biñan, 56 at Calamba, 40 at San Pablo, 79 at Lucena and 815 at Manila.

According to the field survey conducted by PNR in 1981, the total number of commuters was 16,000 passengers/day. Of this total, almost 90% were concentrated on the South Line. Traffic is heaviest between San Lazaro and Sucat, particularly Buendia and España.

Freight traffic demand

The contribution of freight traffic to PNR's total operating revenue was 14% in 1985, with express traffic accounting for another 12%. The Main Line South accounted for by far the greater part of freight movement. The total tonnage carried has been consistently decreasing from 1.2 million tons in 1960/61 to only 54,000 tons in 1985. Express traffic totalled 19,400 tons in 1985, a sharp decrease from the peak 102,100 tons in 1973/74.

During the first half of 1986, freight traffic increased by 56% in terms of freight tons or 46% in terms of ton-km, compared with the same period of 1985. Express traffic also increased by 38% and 39% respectively. The share of Main Line South in freight traffic is 99.7% in terms of freight tons or almost 100% in terms of ton-km during the first half of 1986. It is 95% or 97.8%, respectively in express traffic.

(5) Ports and shipping

Port system

The Philippine Ports Authority (PPA) has five Port District Offices (PDO) in the whole Country and there are 19 Port Management Offices (PMO) under the PDOs. There are 19

base ports, 57 sub-ports, some five hundred other public ports and some three hundred private ports under the supervision of the PMOs in the Philippines.

In Luzon Island, there are two PDOs, namely Manila and Luzon. In the CALABARZON region, there is a Port Management Office (PMO) Batangas under the PDO of Luzon. Besides, there are two PMOs, South Harbor and North Harbor under the control of PDO of Manila and a Field Office of Manila International Container Terminal (MICT).

According to the Annual Report 1988 published by PPA, the combined volume of trade reached 88.4 million metric tons in 1988. Domestic cargo comprised 57% of the aggregate, and foreign cargo, 43%. Containerized foreign and domestic cargo continued to rise to reach 13.94 million metric tons or 15.6% of total cargo and total containers handled reached 1.07 million TEUs. Of the annual cargo throughput, 47% were handled by the public ports and 53% by the private ports.

The passenger traffic recorded 23.34 million in 1988, an additional 5.37 million passengers over the previous year or an increase of 30%.

The port system in Region IV is composed of 82 public ports and 46 private ports. Of all the public ports, 15 are classified as national and the rest as municipal ports. The port of Batangas is a base port, and there are 55 public ports and 26 private ports under the supervision of PMO Batangas.

Along the long coastline of Quezon, there are 27 existing ports. Under the base port of Siasin, there are one national port, 23 municipal ports and two private ports. More important ports and routes for regional shipping are ports of Hondagua (national), San Andres, Infanta-Polillo, Gumaca-Alabat, Atimonan-Alabat and Cotta (Lucena City).

Batangas port

The port of Batangas, located in Santa Clara, has four wharves owned by PPA. Piers I and II are used for accommodating Ro-Ro vessels and ferry boats plying between the Batangas port and the ports of Calapan, Puerto Galera and Abra de Ilog located in the northern periphery of Mindoro Island. At Pier III, it is currently difficult to maintain the required depth due to the siltation. This pier is mainly utilized for handling silica sand, gypsum and pyrite by barges. The marginal wharf connected with Pier II is utilized for accommodating large size vessels which carry broken bulk cargoes such as lumber, logs, and general cargoes. The eastern side of the marginal wharf provides a berthing place for small vessels like tug boats.

According to the Profile of Philippine Ports 1989, published by PPA, a total of 12.4 million metric tons of cargo are loaded and unloaded in 1988 at the ports controlled by PMO Batangas including private ports. Of these, a total of 703 thousand tons of cargo are handled at the Batangas base port.

Of the total domestic cargo, over 85% is handled by Ro-Ro service. The total number of passengers was 1,032,736 in 1988. Major cargoes handled at the Batangas port are rice, calamansi, copra, logs/lumber, minerals and other general cargoes coming in, and bottled cargoes, cement and other general cargoes going out. No foreign export cargo is recorded in recent years, while foreign import cargoes consist of fertilizer, sugar and other general cargoes.

Interisland shipping

Main passenger transport routes with more than 50,000 passenger per direction in 1986 are 17 to/from Cebu, 7 to/from Manila, 7 to/from Zamboanga and 17 to/from other areas. There are 3 main routes to/from Batangas: to/from Calapan with 316,000 passengers, Calapan with 207,000 passengers, and Puerto Galera with 57,000 passengers.

Main routes with more than 100,000 tons per direction in 1986 are concentrated in Manila and Cebu. Batangas also has 4 main routes: to/from Calapan with 98,000 tons, Calapan with 103,000 tons, Davao with 149,000 tons, and Cebu with 141,000 tons.

(6) Air transport

National system

Civil aeronautics in the Philippines is regulated by the Civil Aeronautics Board (CAB) and the Bureau of Air Transportation (BAT). CAB deals with economic aspects of air transportation including routes and fare, while BAT with operational and technical aspects including safety.

The present airports consist of 83 national airports, 120 private airports/landing strips, military airports and heliports. The national airports comprise five international airports (Manila, Cebu, Davao, Zamboanga and Laoag), trunkline airports, secondary airports and feeder airports. The international airports are used for the operation of aircrafts engaged in international air commerce, trunkline airports serve the principal commercial centers of the Country, secondary airports serve towns and cities with less regular air traffic densities and feeder airports serve towns and rural communities with limited air traffic potential.

Air traffic

There is no airport in the CALABARZON region and Manila (Ninoy Aquino International Airport or NAIA) is practically the only airport which provides air links between the Region and the rest of the Country as well as the world. Most of the major destinations in the Country are directly connected with NAIA and the some extent with Cebu and Davao, while the other regional centres are not linked each other directly.

NAIA is in the premier position in the air passenger movements, handling 4.4 million passengers in 1980. The second is Mactan in Cebu which handles less than a fourth of NAIA. NAIA is located within Metro Manila that provides easy access to/from the airport. Capacity of airside will not be reached in the near future, while, the terminal and curbside already show congestions during peak hours. Relatively large number of visitors and well wishers and inefficient traffic control often amplify the chaotic situation. Traffic conditions in Metro Manila roads are getting worse to make the access time long and unsure.

5.2.2 Existing transport problems

(1) Transport network

The CALABARZON region has strong arteries consisting of the South Super Highway, main highways and the railway, but they are all oriented to Metro Manila. While this artery system serves well the present transport requirements and fit well with the envisioned near-future transport demand in the Region, it may work against decentralization of economic activities and more balanced development of the Region. The major challenge is how to strengthen a few selected sections of overall transport network not directly connected to Metro Manila, while taking advantage of good access to Metro Manila assured by the existing artery system.

(2) Roads

Road capacity

The road network in the Region is well developed and network deficiency is minimal as far as main and secondary roads are concerned. Transport capacity, however, is already inadequate in some sections. The South Super Highway is already heavily utilized, and the old Manila South road is congested at a few sections such as between Las Piñas and Alabang being an access link to the South Super Highway and the section from Alabang to Calamba. Other congested roads include the road between Las Piñas and Dasmariñas and the coastal road between Las Piñas and Rosario.

Some of other national and provincial roads have poor surface conditions. The present road to Infanta from Famy in Laguna is in a bad to very bad condition along most of its length. The section from Cavinti to Lucban of the Laguna (Pagsanjan) - Quezon (Lucena) road has the pavement in a bad state. The national and provincial roads in Laguna are mostly paved, but asphalt roads are mostly in bad condition. The national and provincial roads in Batangas are only 55% paved with asphalt and 5% with concrete. The asphalt pavements are generally old and in need of patching, sealing and overlays.

Rural roads

Rural areas in the Region are generally fairly well covered by rural road network in terms of road density, except in Quezon. Road density in Quezon is much lower than the national average. Conditions of many rural roads are poor to make travel time longer, transport industry costly and marketing of agro-products difficult. Delivery of social services is also affected. The situation is more serious in Quezon as a whole, in the mountainous areas of Laguna and in the rolling terrains of Batangas.

Road transport industry

The road transport industry in the Region is well developed and serves the transport demand reasonably well in terms of service availability, quality and price under the prevailing operating conditions. The industry, however, suffers mostly from its weak financial base. Most operators are small and incapable of sufficient investments and adequate maintenance and repair. Also systematic training for technical and management skills is largely lacking. The small operators suffer more from poor conditions of rural roads and limited access to credit facilities. The truck ban in Metro Manila affects not only operation within the metropolis but almost all long distance trucking in Luzon.

(3) Others

Railway system

The PNR system at present suffers from a number of problems. They are both technical and management problems interacting with one another. Failure to observe fixed schedule or to inform delays or cancellation due partly to poor communication system is one such example. Observed problems include the following:

(a) Weak track facilities such as alignment, missing and rotton sleepers, insufficient ballast volume, eroded embankment, damaged rail etc.;

(b) Inefficient communication system due to improper induction of power transmission line, damaged open wire transmission line, lack of spare parts for the equipment, etc;

(c) Obsolete signalling system; Existing equipment have by and large exceeded their economic lives and have become technically obsolete;

(d) Inadequate level crossing system; No automatic warning system is operated, only its deteriorated parts remain. Ineffective traffic controls at the crossing require train drivers unnecessary slow down. Unsmooth pavement at the crossings also force road vehicles to slow down;

(e) Poor passenger facilities at and for access to the stations; Stations are poorly provided with necessary facilities such as proper access roads, signboards, fences, waiting facilities, toilets, lighting, public transport connection; and

(f) Squatters; The PNR operation is also seriously affected by squatters residing in and along the PNR right-of-way.

Port facilities

The CALABARZON region does not have major port facilities, which may become a serious constraint to export-oriented industrialization. Sharing of Manila port would increase the pressure on this already heavily utilized port. Conversion of Sangley Point in Cavite into a container terminal is conditional on the improvement of the access roads and transportation to/from Metro Manila. The existing port of Batangas is still a local port (a little more than a ferry terminal), although it has a superb natural setting.

Air transport

The lack of airport may be a constraint to the CALABARZON development in the long run. Possibility of a future CALABARZON airport needs to be examined as complementary to NAIA.

5.2.3 Objectives and strategy for CALABARZON transport development

(1) Objectives

Transportation development in CALABARZON will have to satisfy two distinct but mutually inter-related objectives:

1) to contribute to the establishment of more efficient transportation system for the Greater Capital Region centering around Metro Manila, and

2) to support and promote the CALABARZON regional development.

For the attainment of the first objectives, the following will be particularly important:

- inter-linkages between the urban transport system of Metro Manila and the CALABARZON regional transport system especially with respect to roads/highways and the railway,and

- port development within CALABARZON to share responsibilities with the Manila ports with proper functional division.

In order to attain the second objective, transport projects should in general be designed to serve increasing agricultural production and marketing, encourage small and medium industries, support land reform and increase income levels. Indirect effects are as important as direct ones. In fact, the transportation sector in general is a significant contributor to the broad service sector in terms of value-added and employment. The service sector in turn claims the larger share, as the economy develops to reach the higher level.

(2) Strategy for transport development

The following will be the basic strategy for transport development at the national level, having relevance also for CALABARZON:

1) to strengthen the inter-modal coordination in transport planning for efficient allocation of development resources, and

2) to effect further decentralization in transport project planning, implementation and management and further privatization/liberalization of transport industry.

At present, project planning starts with individual subsectoral agencies. Project development is based mostly on past trends and current economic situations without much regard to the impact of other transport development. The recent shift in policy emphasis toward decentralization and liberalization is a commendable one (Appendix E).

Along this line, a system should be established based on barangay as functional unit to maintain and rehabilitate rural roads by utilizing self-help efforts. The system should be supported by the provision of basic facilities and equipment as well as technical training. Such a system may be introduced first in the CALABARZON region as a model case.

More specific to CALABARZON, the following strategy should be adopted in line with the objectives presented above.

i) to maintain the road network as the prime mode of transportation in CALABARZON for both intra- and inter-regional traffics, and

ii) to establish better inter-modal linkages, especially between roads/highways and ports, by upgrading port functions as well as strengthening arteries.

Under the first strategy, the following measures will be more important in the short - to mid-term:

- rehabilitation and maintenance of primary and secondary roads,
- expansion of transport capacity in already heavily utilized road sections, and
- improvement of rural access to high potential areas.

In the mid- to long-term, the emphasis will shift to the establishment of a stronger artery network and secondary roads connected to it, and the dissolution of network deficiencies.

The second strategy will help to make CALABARZON the important segment of a larger network for inter-regional and international flow of commodities. This function will start with the increased rate of CALABARZON in inter-island trade within Region IV but may quickly expand to cover other regions and countries by capturing commodity flow to be diverted from the Manila ports, provided that related facilities are improved in CALABARZON.

5.3 Telecommunications

5.3.1 Present telecommunication services and related institutions

(1) Overview

Telecommunication services in the Philippines are provided by a state owned enterprise TELOF, some 61 telephone companies, seven domestic record carriers, four international record carriers and two satellite systems. The Philippine Long Distance Telephone Company (PLDT) owns the nationwide backbone network for long distance calls and about 94% of the total main telephones. TELOF provides complementary backbone network in Regions I and II.

The Government policy in telecommunications is to maximize the role of the private sector for efficient service delivery and rapid growth of the sector, with the Government acting as a facilitator not a competitor (National Telecommunications Development Plan (1991-2010). The Government encourages moderate competition to activate the market environment and conduce to service improvement.

(2) Telephone services

Local and national telephone services

Local and national telephone services in the Philippines are provided by 61 telephone operating companies and TELOF. In CALABARZON, telephone services are available in 66 out of 142 municipalities. Unserved municipalities are summarized below by province.

Province	Total number of municipalities	Number of unserved municipalities
Cavite	23	11
Laguna	30	12
Batangas	34	20
Rizal	14	2
Quezon	41	31

Source: Rural Telephone Service Plan 1989, DOTC

PLDT also operates a mobile telephone system. It serves areas along the highway from Baguio via Metro Manila to Batangas with some 7,500 mobile terminals in operation.

International telephone services

PLDT operates an international gateway exchange and provides international telephone services. Two international record carriers will join in the service market in 1991 with their own international gateway exchange. Only three exchanges provide international direct dialing services in CALABARZON, while others provide operator-assisted international telephone services.

Almost all the telephone switching equipment in CALABARZON is of electro-mechanical non-SPC type. Thus, national direct dialing (NDD) and international direct dialing (IDD) services are not available except from Canlubang, Batangas City and Cavite EPZ.

(3) Record services

Domestic record services

Three out of seven domestic record carriers dominate the market: the Radio Communications of the Philippines Inc. (RCPI), the Philippine Telegraph and Telephone Corporation (PT&T) and TELOF. Each of them operates its own trunk network and provides telex and telegraph services.

PT&T operates mostly in urban centers and carries over 90% of the telex traffic. RCPI provides extensive services in rural areas, but also competes in some areas with PT&T and TELOF. TELOF provides telegraph service mostly in isolated rural areas. Other special services primarily catering to business users including data communications, electronic mail, facsimile and radio paging are provided by other private enterprises.

Availability of telegraph services in CALABARZON is summarized below.

Province	Total number of municipalities	Number of served municipalities
Cavite	23	22
Laguna	30	30
Batangas	34	33
Rizal	14	12
Quezon	41	41

International record services

Four international record carriers provide international data and record services and operate their own telex switching exchanges: Capwire, ETPI, GMCR and Philcom. ETPI, GMCR and Philcom are multi-national affiliates on 60/40% eguity share with Filipinos as the major stock holders. Capwire is the only 100% Filipino owned. As they are barred

from providing direct record services, they resort to inter-agency agreements with domestic record carriers.

(4) Carriers' carriers

The Philippine Communications Satellite Corporation (Philcomsat) is the exclusive provider (state-owned corporation) of international satellite services, operates an earth station near Manila and leases circuits on the Indian Ocean and Pacific Ocean satellites of Intelsat. The Domestic Satellite Philippine Corporation (Domsat) is a privately-owned corporation, operates a main earth station near Manila and 10 other earth stations in outlying areas, and offers only domestic satellite services. Domsat leases transponder space on the Indonesia Palapa satellite.

(5) Distribution of services and facilities

Telephone density with respect to the number of telephones and the number of main telephone lines is compared in Table 5.5 by region and by province in CALABARZON. About 75% of the total telephones are in Metro Manila, and some 5% in Region IV ranked second. In terms of main telephone lines per 100 population, Region IV ranks fourth with only 0.56, while this density is 5.73 for Metro Manila and 1.09 for the Country. The density varies within CALABARZON: 0.90 in Laguna, 0.80 in Cavite, 0.61 in Rizal, 0.45 in Quezon and 0.30 in Batangas.

Transmission links interconnecting the existing switching equipment consist of open wires, cables, VHF, UHF and SHF. In addition, mobile telephone network facilities are provided at Dasmariñas, Antipolo and Canlubang as base stations and at Sampaloc as an exchange station.

(6) Major constraints

Telecommunications development in the Philippines has been led mainly by the private sector. This poses two major constraints. First, it is not easy for many private enterprises to procure foreign financial sources with adequately low rates of interest necessary for importing high-technology products. Second, their services are not well integrated for overall efficiency.

About 36 local exchanges of small telephone companies are not yet linked to the PLDT's nation-wide network. They provide telephone services only to their franchise areas. Also,

private operators tend to concentrate in high-revenue areas: i. e. urban centers, making service distribution unequal, discriminating rural areas.

5.3.2 Planned and on-going projects

To expand and improve the existing telecommunication services in CALABARZON, the private companies as well as DOTC/TELOF have been planning and implementing several projects.

(1) DOTC/TELOF projects

National telephone program Tranche I-1

This project aims at improving telecommunication systems in Region III, IV and V by introducing new automatic, fully digitized, store-programmed telephone switching system, telegraph network and digital toll links composed of digital microwave radio links and optic fiber cable links. It will provide 66 local exchanges with a total capacity of 59,150 lines at its completion in 1993. New local telephone exchanges will be installed in Biñan, Laguna and eight municipalities in Batangas with a total of 6,300 lines. Gentex terminals will also be provided at Cavite City in Cavite, Batangas City, Lipa City, Balayan and Lemery in Batangas, and Calamba, Biñan and Sta. Cruz in Laguna, Lucena City and Gumaca in Quezon.

Rural telephone service plan

This plan provides for the basic telephone services to all the unserved municipalities in the Philippines to satisfy the mandates of the Municipal Telephone Act of 1989. The Government has set the following principles for its implementation:

1) Private sector participation is encouraged as much as possible;

2) For areas not covered voluntarily by the private sector, an appropriate operator will be directed to assume responsibility; and

3) Concessional loans/grants can be used through DOTC by the private operators as certified by the National Telecommunications Commission (NTC).

Maritime communications project, Phase II

This project will provide maritime mobile services through the construction of coastal stations at 11 key locations throughout the Country. In CALABARZON, a third class station will be provided at the port of Batangas,and will serve for radio telephone communications with vessels in VHF band having coverage of about 50 km.

(2) PLDT projects

X-5 and X-5 C projects

The X-5 project will expand, improve and modernize PLDT's telephone network throughout the Country. Its implementation period is 1989-92. The X-5C project will extend X-5 through 1991-93. These projects will provide new installation and expansion of local exchanges in CALABARZON as well. The provision of telephone services at Cavite EPZ is implemented under X-5C. The number of telephone lines in CALABARZON will be increased by X-5/X-5C and NTP Tranche I-1 by 2.9 times in three years: i.e. from 35,562 in 1990 to 101,615 in 1993.

Telephone services for industrial estates

PLDT is providing improved telephone services to the existing industrial estates in CALABARZON, financed by PAP. After the project is completed in 1992, telephone calls from these areas can be made on direct dialing basis. Together with the introduction of digital transmission links, service quality will be much improved.

(3) PT&T program

The expansion and improvement program implemented by PT&T for 1988-90 includes digitalization of the existing analog radio network extending telex services to San Pablo City and Calamba in Laguna, and Batangas City and Bauan in Batangas. At present, Los Baños and Lipa City are served by digital radio links, and Cainta by analog radio links. In addition, a digital radio network will cover Biñan, Canlubang, Cabuyao and Sta. Rosa in Laguna, and Dasmariñas, Carmona, Imus, Rosario and Cavite City in Cavite. Through the networks, telex, telegraph, facsimile, data communication and voice services will be provided to these municipalities. The target areas of the services coincide with the existing industrial estates in CALABARZON.

(4) International telecommunication services

Several projects are being implemented to improve international telecommunication services. They include:

1) Capwire improvement program, 1989-92,
2) Capwire regional/domestic satellite service proposal,
3) ETPI international gateway proposal,
4) Philcom international gateway proposal, and
5) Philippine global communication improvement program, 1989-91.

The Philippine global communication improvement program is to install transmission facilities to provide industrial estates with international services of telex, facsimile, telephone, leased channel, packet switching and electronic mail. This is done by means of point-to-point circuits between each industrial area and the Philcom's headquarters. The industrial estates to be served are (1) Cavite EPZ, (2) People's Technology Complex in Carmona, (3) Canlubang IE, (4) Science Park Industrial Complex, (5) Carmelray Industrial Complex in Canlubang, (6) Gateway IE in Carmona, and First Cavite IE in Dasmariñas. Construction, started in 1990, is expected to complete by 1993.

5.3.3 Strategy and measures

(1) Strategy for telecommunications development

The private sector enterprises and the Government are implementing many projects as outlined above for telecommunications development. In CALABARZON, they cover collectively both rural areas and most important urban centers, and full range of services for most of the existing industrial areas. These projects should be further promoted, overcoming the major constraints identified above.

Of the major constraints, the most relevant to CALABARZON is the access to foreign financial sources. The private enterprises' access to foreign loans/grants under official development assistance for those projects should be improved in line with the national policy framed in the National Telecommunications Development Plan (NTDP) 1991-2010.

Overall, telecommunication services for the Project CALABARZON should make the maximum use of accesses to the public telecommunications network being expanded and improved under the NTDP. The accesses should encompass direct dialing services, telex,

non-switched data circuits, public switched data network, and others by use of the public switched telephone network such as facsimile, mobile communication, paging and electronic mail.

In the long term future, integrated services digital network (ISDN) will make it possible to provide all the advanced telecommunication services. For a next couple of decades, telecommunication services for CALABARZON will be provided through respectively dedicated networks for telephones, data, telex and others.

(2) Measures for telecommunications

Phase 1 (upto 1995)

Since the on-going projects cover most areas and services for CALABARZON, telecommunications development during Phase 1 should concentrate on additional industrial areas not effectively covered by any on-going efforts. An urgent project has been formulated under the title of the Dasmariñas-Silang telecommunication system upgrading project. The profile of this project is contained in Attachment. During this period, a demand survey should be conducted to identify rapidly growing urban centers where the needs for improved telecommunication services seem to be the highest.

Phase 2 (1996-2000)

Expansion of facilities and service quality improvement will have to take place most rapidly during this phase. The rapidly growing urban centers identified during Phase 1 will be the main focus. The telephone density of 1.2 in the year 2000 is aimed at by the NTDP for Region IV. The density expected in CALABARZON in the same year is around 3.2 much higher than this, in accordance with high growth of regional economy envisioned.

Phase 3 (2001-2010)

The target growth rates of telephone density are lower for this period than the previous period. Still, the telecommunication sector will face rapid expansion of facilities and services areas, and may be entering a preliminary stage of the ISDN services. The nation-wide switched data network will be possessed by 50% of municipalities in CALABARZON. The ISDN services may be extended from Metro Manila to CALABARZON, depending on the results of trial exchanges in Metro Manila and Cebu. According to the projected regional economy, the telephone density of 4.7 is expected by 2010 (detail in Appendix F).

5.4 Energy

5.4.1 Present energy supply and demand situations

(1) Energy consumption and supply capacity

Total energy use

The total energy consumption in the Philippines reached 119 million barrels of fuel oil equivalent (MMBFOE) in 1989. Indigenous energy production amounted to 43.0 MMBFOE in 1989, accounting for 36.1% of the total energy consumption. Of the total indigenous energy, hydropower accounted for 9.5%, geothermal 7.7%, oil 1.4%, coal 3.5% and non-conventional energy 14.0%.

Power supply system

The national power supply system is divided into three areas: 1) "Luzon area" covering Regions I to V including islands of Palawan, oriental and occidental Mindoro, Tablas, Busuanga, Marinduque, Masbate and Catanduanes, 2) "Visayas area" covering Regions IV to VIII including islands of Bantayan, Camotes, Siquijor, western, eastern and northern Samar, and 3) "Mindanao area" covering Regions IX to XII including islands of Basilan, Sulu, Tawi-tawi and Siargo. There is no interconnection between islands, and most electrical facilities are concentrated in the Luzon area, especially in Region IV.

All the transmission facilities, with the exception of 381 circuit-km of 115 kV owned by MERALCO, are operated by NPC. Distribution lines and distribution transformers as well as the related switchgears in the Metro Manila, most of the CALABAR region and Quezon/Bulacan provinces are operated and maintained by MERALCO. The other areas are served by NPC and Co-ops.

Power production and consumption

The total installed capacity for power generation in the Country (NPC grid) was 6,015 MW as of the end of 1989, consisting of 43% oil-based thermal, 35.4% hydro, 14.9% geothermal and 6.7% coal-fined thermal plants. Of the total, 4,321 MW or 72% is located in the Luzon island. The total energy production from these plants was 24,100 GWh in 1989 within the NPC grid, consisting of 41.6% oil-based, 27.1% hydro, 21.1% geothermal and 10.2% coal-fired. The average annual growth of the power consumption was 8% in the country during 1986-89.

The total consumption of electric energy in the Country was 22,200 GWh in 1989, an increase by 5% over the previous year. This low growth is due to the recent power crisis. Energy consumption by sector in 1988 was 35.5% industrial, 20.7% residential, 16.2% commercial, 5.4% other, 4.4% for station use and 17.8% losses.

(2) Energy situation in the Region

Reliable energy statistics on overall energy use are non-existent, except for electricity.

Power supply capacity

Generating capacity by plant type in CALABARZON and Metro Manila is compared with that of the Philippines and the Luzon grid. Of the total generating capacity in the Luzon grid, 64% is in CALABARZON and Metro Manila.

Comparison of NPC Power Generating Capacity

(MW as of end 1989)

	Hydro	Thermal			Total
		Geo-thermal	Coal	Oil	
Philippines	2,131	891	405	2,586	6,013
Luzon grid	1,226	660	300	2,135	4,321
Metro Manila and CALABARZON	349	330	300	740	1,719

Source: NPC

Actual production in the Luzon grid in 1989 was composed of 50% oil-fired, 24% geothermal, 14% hydro and 11% coal-fired.

The primary substation in the CALABARZON region is 230 kV Biñan substation, which is now connected with the Calaca I coal-fired thermal plant and the Mak-Ban geothermal power plant as well as the Sucat oil-fired thermal plant. The power from the Biñan substation is delivered through the secondary substations as follows (Figure 5.10): (i) from the Balibago substation to the industrial area in Laguna; (ii) from the Dasmariñas substation to the whole area of Cavite province except Cavite City; and (iii) from the Pamelona substation to Cavite City, the northwestern part of Laguna province and southern part of Metro Manila.

Power consumption

The Luzon grid is the dominant market of electricity, consuming over 75% of the national consumption. Some 93% of the total consumption in the Luzon grid or 70% of the

national consumption is accounted for by consumers in Metro Manila and the CALABARZON region.

The industrial sector has been the leading consumer, followed by the residential and commercial sectors. Power consumption by sector is given below for Metro Manila and CALABARZON, including supply by MERALCO, NPC and cooperatives.

(GWh, % share in parenthesis)

	1978	1980	1983	1986	1988
Industrial	3,942 (44.6)	4,496 (44.8)	4,475 (41.3)	3,548 (36.5)	4,811 (39.2)
Residential	1,815 (20.6)	2,276 (22.7)	2,950 (27.2)	2,904 (29.9)	3,430 (27.9)
Commercial	2,349 (26.6)	2,651 (26.4)	3,012 (27.9)	2,692 (27.7)	3,377 (27.5)
Others	725 (8.2)	606 (6.0)	386 (3.6)	572 (5.9)	661 (5.4)
Total	8,831 (100.0)	10,029 (100.0)	10,832 (100.0)	9,716 (100.0)	12,279 (100.0)

Source:

Peak load in Metro Manila and the CALABARZON region reached 2,516MW in 1988, accounting for 86% of the Luzon grid or 64% of the national peak load at 3,909MW.

Electric energy consumption per capita is compared between Metro Manila and CALABARZON and other regions as well as the Philippines.

(kWh per capita)

	1987	1988	1989
Philippines	337	360	370
Luzon	478	499	509
Visayas	116	126	133
Mindanao	238	257	266
Metro-Manila & CALABARZON	830	919	-

Electrification

The CALABARZON provinces have high electrification ratios as compared with the national average of 60% in 1988: 95.6% in Rizal, 91.3% in Laguna, 85.4% in Cavite, 79.0% in Batangas and 63.9% in Quezon. The target for complete electrification in the MERALCO's supply areas is set at the year 1997.

5.4.2 Potential and existing programs for energy development

(1) Hydropower

The hydropower potential in the Luzon island has been estimated at 10,200 MW, of which 8,500 MW is considered technically developable with annual energy of 24 billion kWh. By the end of 1989, 2,130MW or 28% of the potential had been developed.

Major potentials in the Luzon island are located in the Abulog and the Cagayan river basins in the north and the Abra river basin in Pampanga province. Potentials in the CALABARZON region have been largely exploited except those in the Marikina and the Kaliwa river basins in Rizal, the Agos river basin in Quezon and mini-hydro potentials.

(2) Coal and oil

Coal

The total proven coal reserve is estimated at 1.6 billion metric tons (MT) in 1987. More than 70% of the reserve is located in Semivava island and Cagayan Valley.

Domestic coal production reached 1.29 million MT in 1988, an increase by 11.1% from the previous year. This increase is attributed to the increase by 38.4% and 25.7% in requirements respectively from the cement industry and for power generation.

According to the Medium-term Philippine Development Plan 1987-92, the domestic production of coal is expected to increase at 25% per annum. As a result, contribution of domestic coal to the total energy supply will increase from 7.9% in 1988 to 11.1% in 1992.

Oil

Oil production in the Philippines started in 1979 in the Nido field, and several wells became operational subsequently. All the producing wells yielded the total of 2.2 million barrels of crude oil in 1988. This represents 6.8% increase from the previous year and corresponds to 3.4% of the imported oil in the same year.

Domestic oil production is expected to increase by 1992 to 6.4 times that in 1988. Such an increase will keep the volume of imported oil at the same level of 66.8 MMBFOE as in 1988.

(3) Geothermal

Estimated total goethermal potential is equivalent to 1,380,000 GWh or 191 GW. Of this, 894MW have been developed by 1988 for power generation with four plants at Tiwi in Albay, Makiling-Banahaw in Laguna, Tongonan in Leyte and Palimpinon in Southern Negros.

Bulk of power generated comes from Tiwi and Mak-Ban having respectively 330 MW installed capacity. These Luzon fields are operated by the Philippine Geothermal Inc., while others are operated by the Philippine National Oil Company. NPC programs to develop its geothermal power generating plants in the Luzon island with total capacity of 840 MW during 1992-95.

(4) Non-conventional energy

The present program of non-conventional energy development focuses on the four systems: biomass, solar, wind and micro-hydro. Since the inception of the program, a total of more than 3,300 non-con energy systems have been installed, although some of them are not working due to lack of technical expertise and sufficient parts.

Biomass

Of the total contribution (15.3 MMBFOE in 1987) of non-con energy to energy consumption in the Philippines, over 95% comes from biomass, consisting of bagass (23% in 1987) and agri-wastes (73%). In most cases, they are used directly as fuels for industrial furnaces and boilers. The CALABARZON region is relatively rich in these sources of energy, including bagasse, coconut husk/shell and woodwaste of coco-lumber.

Solar energy

Various small-scale applications of PV technology are being tested at present, such as a three-way radio communication link, irrigation pumps, several independent home lighting systems, a refrigeration system, a PV battery charging station and a heating system.

In 1989, a small decentralized PV power station was installed to provide electricity to a community of about 30 households in Sitio Bayaan, Barangay San Agapio. Distribution system was undertaken by the Batangas II Co-op, and house-wiring undertaken by the Batelec, NEA, GTZ and OEA personnel.

Windmill energy

The OEA sponsored solar and windmill mapping project has identified potential areas for feasible windmill sites. Demonstration units were installed in Ilocos Norte and San Alfonso, Cavite. Main potential application of windmills is water pumping.

5.4.3 Constraints to energy development

(1) Current issues in power sector

Supply shortage

The Country has been facing a critical power supply shortage, particularly in the Luzon grid, attributable to inadequate generation capacity and a string of unfortunate events transpired since late 1989. In early October 1989, a tripping of the Mak-Ban 230 kV line resulted in cascaded tripping of other lines, cutting power supply throughout the MERALCO franchise area. The damage inflicted by typhoons on the Sucat-II power plant and transmission lines of the Magat hydropower plant also caused serious power failure.

The situation in Luzon was followed by breakdowns of two other major oil-fired power plants, Malaya 1 and 2 plant (650MW). These coincided with the scheduled shutdown of oil-fired power plant Sucat 1 and 4 for regular maintenance and rehabilitation, and with the low water level at Angat and Pantabangan reservoirs.

In addition of rehabilitation of the broken facilities, the Government is taking an urgent step to relieve the power shortage by importation of short lead time gas turbine units. Also the Government is promoting participation of the private sector to increase generating capacity through either BOT or BOO (build-own-operate) schemes.

System losses

Energy losses in the primary transmission system in the Luzon grid were 7.8% of the total grid generation in 1988. In addition, MERALCO's average losses were recorded as 16.7% in 1988. Average losses of Co-ops systems reached 27% in 1988. Non-technical loss, primarily due to pilferage of electricity, is also high. MERALCO's investigation revealed that 8.4% out of 16.7% system losses in 1988 was caused by pilferage.

High tariff

The average tariffs of MERALCO and NEA are 4th and 5th highest in 24 utilities in the statistics of the Asia and Pacific region. At present, the NPC Board is responsible for setting its tariffs, although tariff increases are invariably subject to the Government

concurrence. The NEA establishes the tariffs of rural electric cooperatives. The pricing policy reforms are now implemented in the Country to restructure NPC rates using the long-run marginal cost approach and to continuously reduce Meralco subsidy on generation and distribution cost.

The Energy Regulatory Board is responsible for approving the tariffs of MERALCO and other private utilities. However, there is no single authority responsible for the review and approval of tariffs, although the Government has adopted in principal, a proposal for a single tariff regulatory body.

System reliability

Complaints about electricity delivery received from consumers in Metro Manila and the CALABARZON region include large drops in supply voltage, large fluctuation of system frequency, and frequent interruptions of power supply.

Private cooperatives or similar associations including foreign entities plan to participate in electricity generation for supply to limited estates. This movement is in principle accepted by the Government in Executive Order No. 25.

(2) Future power balance

NPC development program

The latest electric load forecast has been prepared by NPC upto the year 2010 for each of the Luzon, Visayas and Mindanao grids. Regular development programs of power sources have been prepared to meet the generally growing power demand. The program for the Luzon main grid is summarized below.

	1989		1999		2005	
	MW	%	MW	%	MW	%
Geothermal	660	14.9	1,980	22.7	1,980	15.2
Hydro	1,224	27.6	1,814	20.8	2,204	16.9
Oil-fired	1,985	44.7	1,925	22.1	1,925	14.8
Coal-fired	360	8.1	2,080	23.8	5,938	46.0
Gas turbine	210	4.7	927	10.6	926	7.1
Total	4,439	100.0	8,726	100.0	13,015	100.0

Geothermal power plants will be developed subsequent to the urgent introduction of gas turbines. Development of hydro power and coal-fired thermal plants will follow from the end of this century. Dependence on thermal plants based on imported oil will be gradually reduced.

Power balance

Referring to the load forecast and the development program, power balance has been worked out, in consideration of dependable output, allowance for periodical maintenance and forced outage (Figure 5.11). Power supply will be sufficient upto the year 1997 in the Luzon grid. The three power grids are planned to be interconnected in 1995-96. The power shortage may occur in the inter-connected national grid after 1997, if the higher reliability level is to be sought than the reliability level before 1997.

(3) Constraints to power development

Coal supply

Future development of power generating capacity depends heavily on coal-fired thermal plants. The total installation of coal thermal is planned to increase from 405 MW in 1990 to 5,938MW in 2005. Accordingly, coal requirement will increase from 1.15 million MT in 1990 to 15.4 million MT in 2005. In realizing the development program, three major issues will have to be resolved.

First, a significant portion of future coal requirement will have to be satisfied by increasing imports, as the domestic production cannot expand, keeping up with the demand growth. However, the domestic coal production should be increased as much as possible to save the Country's foreign exchange.

Second, the domestic coal should be made more price competitive by reducing the production costs and exploring coal reserves of better quality. At present, the imported coal is cheaper by 39% than the domestic coal on a calory basis.

Third, coal receiving terminals will have to be expanded. The existing terminals are only three as below with the total maximum handling capacity of 1,200 tons per hour.

	Iligan Terminal	Poro Terminal	Batangas Interim Terminal
Location	Iligan city	Poro point, San Fernando La Union	PMC compound Bauan, Batangas
Land Area (m^2)	8,991	9,931	25,000
Maximum handling capacity (tons/hour)	500	500	200

Finance

Finance is the major constraints to the realization of ambitious power development programs. The finance will have to cover not only the NPC regular programs but also additional power plants to be urgently developed to avoid the power shortage after 1997, and allowance for old plants to be retired. The following plants will reach their respective economic life before the year 2010.

Retired	Name of Plant	Capacity (MW)	Year
Hydro	Botocan	17	1998
	Caliraya	32	2000
	Binga	100	2010
Geothermal	Tiwi A	110	2009
	Mac-Ban A	110	2009
	Tiwi B	110	2010
	Mac-Ban B	110	2010
Oil-fired	Manila, unit 1 & 2	200	1996
	Sucat unit 1 & 2	350	2000
	Sucat unit 3 & 4	500	2002
	Bataan unit 1 & 2	225	2007
	Malaya unit 1 & 2	650	2009
Total		2,514	

About 14% of the existing generating capacity may be retired by 2000, and about 60% by 2010. In order to operate the old plants continuously after their lifetime, more careful inspection on, and renovation of facilities are necessary.

Other constraints

Additional constraints are imposed by environmental quality and supply and prices of imported oil. The Philippine National Oil Company (PNOC) has recently devised reinjection pumps for its geothermal plants to recourse the water separated from the steam back to geothermal reservoirs. It has also initiated an environmental monitoring system for the protection of surface water and groundwater, river sediments and soil around geothermal plants. Control of emission from thermal power plants and dust from coal stock-yards are also in order.

New oil-based thermal power plants are programmed only until 1993, and their installed generating capacity will stay at the same level thereafter. Their share in the total installed generating capacity will decrease from 44.7% in 1989 to 15.5% in 2005. Increasing oil bills due to higher prices of imported petroleum should in principle be overcome by macro-economic management.

5.4.4 Energy development strategy

(1) Basic strategy for national energy development

Basic strategy for national energy development is spelled out in line with the existing energy policies and strategy (Appendix G). To promote energy self-reliance at the national level, the exploitation of indigenous energy should be further accelerated. Emphasis will be placed on further exploitation of geothermal resources by joint ventures with the private sector and accelerated development of domestic coal reserves. Consideration of environmental impact will become increasingly more important. With this respect, particular emphasis should be placed on hydropower development. Incremental demand for petroleum should be met largely by boosting domestic production.

(2) CALABARZON energy strategy

In order to support the high industrialization envisioned by the Project CALABARZON Master Plan, continuous and substantial expansion of energy supply base will be of vital importance. At the same time, the enhancement of rural economy, as pursued under the Master Plan, should be supported by diversification and expansion of rural energy. In addition to the extension of existing power supply system, independent systems based on indigenous resources constitute important options, including mini-hydro and other non-conventional energy sources.

Power supply

Within CALABARZON, no significant development of power sources is programmed upto 2000 after Calaca II. As a part of the rapid expansion of coal-fired thermal generating capacity, a coal thermal is planned to be established at San Juan by 2005. In view of the power balance outlined above, the development of this plant may be accelerated. This may also serve for stimulating the development of this important sub-region in the long run.

Development programs for the transmission and distribution system expansion by NPC and MERALCO will cover most of the requirements foreseen in CALABARZON. Programs to be completed by 1993 have been largely funded by several international aid organizations. In fact, the most important strategy here is to secure sufficient finance to allow the completion of the development programs as scheduled.

Non-conventional energy

Strategy for non-conventional energy in CALABARZON is to follow generally the national priority system, but also to emphasize those systems having comparative advantages in the Region with respect to the availability of resources and technology.

In particular, emphasis should be placed on the coconut shell/husk-fired and the bagasse-fired systems for process heat production, steam production and power generation, and the pig-manure-fed system for cooking, process heat and internal combustion. Solar water heaters should be applied not only for households and commercial/service buildings but also for industrial process and pre-heating. In the second priority category, solar dryers should find wider applications in the Region for grains, marine products, fruits and vegetables. In addition, multi-purpose use of geothermal energy for industrial process heat as well as for power generation may deserve serious considerations in some areas in the Region.

Technology for pig-manure system and photovoltaic system are already at the stage of commercialization. Efforts should be directed to local manufacturing of photovoltaic modules, DC motor/centrifugal motor/AC submersible pumps for solar water pumping system, battery control units for solar telecommunications, and industrial-size biogas digesters and compressors for liquefaction of gas. Other priority areas include alcogas from sugarcane, and hybrid system of solar and biomas energy combined with diesel or mini-hydro power plants for rural and remote area electrification and agricultural uses.

Initial emphasis in these areas should be on increase in efficiency, decrease of equipment costs for commercialization, and training of technical personnel. For these purposes, technical as well as financial cooperation of advanced countries should be sought.

5.5 Urban Development and Housing

5.5.1 Urban development

(1) Potential areas of urban development

The structure of urban hierarchy in CALABARZON has been clarified (subsection 4.3.1). It indicates expected roles of urban centers in the context of regional spatial structure, in line with the development scenario. Development potentials, however, vary among different urban centers. Two types of potential areas of urban development are identified in CALABARZON. One is the areas under the direct influence of suburbanization from Metro Manila. The other are the regional urban centers and major urban centers outside the suburbanization areas, especially within the Southern Tagalog regional system.

Suburbanization areas from Metro Manila

At present, within 30 km radius from Manila, suburbanization is proceeding along the existing major roads. The suburbanization takes forms of spontaneous development of individual housing units, housing subdivisions, individual factories and industrial estates along major roads or in inland areas with easy access to major roads.

The pressure of land development for housing and manufacturing facilities will continue to be very high along the major transportation axes. The highest potentials are in the areas with good accessibility to the South Super highway. The second highest potential of suburbanization both for industry and housing is found in Metro Manila's neighboring areas in Rizal, especially along the three existing roads spreading out from Metro Manila. The third highest potential is in the Cavite lowland area, connected to Metro Manila by the Cavite coastal road and its prospective extension. At present, two bottlenecks in traffic to Metro Manila hinder rapid suburbanization. Once the bottlenecks are solved, the suburbanization to the south along the Aguinaldo highway would be accelerated.

Southern Tagalog regional system

While the high pressure of urban development is derived from Metro Manila's growing economies, the urban development pressure in the Southern Tagalog region is at its infant stage and needs to be nurtured by planned actions. The regional urban centers and major urban centers in Southern Tagalog will be transformed in a more fundamental way, although the urban development pressure in these centers is much smaller than that of suburbanization areas.

The Batangas regional urban center has the highest priority in the CALABARZON urban development strategy as an igniter of development in the Southern Tagalog region. However, in order to accumulate economic activities and urban population in this regional urban center, it is necessary to promote concomitantly the development of other major urban centers so that strong urban axes could be formulated.

(2) Urban development strategy

Expected urban development

In order to realize the spatial and economic development in line with the regional development scenario, the formation of multiple urban center pattern should be promoted in both the Greater Capital region and the Southern Tagalog region. At the same time, the suburbanization from Metro Manila will further proceed inevitably in some areas with the pattern similar to the present "ribbon - type" development.

In the Southern Tagalog region, the regional urban center and all major urban centers are to be developed fully to play their assigned roles. However, given the dominance of Metro Manila's agglomeration and external economy, as well as the limited financial resources to be mobilized, it is not realistic to embark on the full development of these urban centers simultaneously. Rather it is recommendable to start with development of a few selected urban centers.

Strategic patterns of urban development

Intensive investments in urban infrastructure and promotion of higher-order urban services should be concentrated initially on multi-center development in the Laguna Lake west shore area. In the suburbanization areas in Rizal and Cavite, planned actions for urban development will be limited to the improvement of major roads connecting to Metro Manila as well as enforcement of land use regulations. As a result, guided ribbon development would be realized. For the Southern Tagalog region, the Batangas regional urban center is the first and prime target. Multi-functional urban center development is to be promoted by providing urban streets to expand urban areas and to acquire plots of land for future business and commercial center districts.

In the Laguna Lake west shore area, the multi-functional urban center development should be promoted and the problems of unorderly land conversion and wastewater discharge to the Laguna Lake should be treated as an essential part of the urban development strategy. For the Southern Tagalog region, the multi-functional urban center development in the

Batangas regional urban center should be initiated with provision of urban streets, other urban infrastructure and possibly an industrial estate.

Subsequently, the corridor development should be promoted in the Laguna Lake west shore area together with upgrading of the commuter rail system. The center development or the corridor development should be encouraged in the Cavite lowland and the Rizal suburbanization areas with the improvement of roads and provision of mass rapid transits. For the Southern Tagalog region, the Batangas regional urban center will be enhanced further by providing a new business district and by upgrading port functions. In order to form urban axes, urban infrastructure provision in Lipa City, San Juan, Lucena, and Lucban is to be initiated.

Institutional measures

In order to effectively promote the development of multi-functional urban centers, a combination of physical and institutional measures are indispensable. Among physical measures are governments' intervention in physically organizing urban areas by the provision of infrastructure, housing estates, industrial estates, and public buildings. Institutional measures include the provision of incentives to the private sector, enforcement of land use regulations, and financial assistance.

The provision of urban infrastructure is essential for expanding urban areas and attracting higher-order urban functions. Following planning decisions for infrastructure projects, a key step is land acquisition. Provision of roads/streets creates development potential for housing, industry, and other service activities. For well-ordered urban development, acquisition of land is important not only for infrastructure but also for related urban functions. The public sector may purchase extra plots of land along planned roads/streets. For urban center development, it is important to purchase land in advance for new business and commercial districts, as well as land for low-cost housing and other urban functions such as skill training centers.

With the extra land acquired in advance as well as improved urban infrastructure, the public sector will have additional power to effectively promote private investments in higher-ordered urban functions, such as commercial centers, condominiums, and office buildings. The public sector can specify the location of these urban functions in accordance with urban plans, and give incentives to the private sector by selling land at prices lower than prevailing market prices.

Main actors involved in urban center development are the Department of Public Works and Highways, which is in charge of infrastructure provision especially for roads and urban streets, and the National Housing Authority, which takes care of land acquisition, construction and promotion for estates of urban functions. Centering around these two agencies, other sector agencies covering water supply, sewerage, power distribution, and telecommunications facilities are to be coordinated for planning and implementation.

In order to take both physical and institutional measures, high abilities are required to manage provision of infrastructure and promotion of private investments. For immediate enhancement of the management ability of the public sector, it is recommendable to establish special management offices for integrated urban development.

5.5.2 Housing

(1) Development issues

Some phenomena in the Region are particularly related to the housing problem. They include in-migration from outer provinces, spillover from Metro Manila, dislocation due to peace and order situation in some parts, damage by calamities (typhoons), and dislocation due to land conversion and project implementation. Main development issues for housing in CALABARZON resulting from these old and new phenomena are insufficiency in absolute number of housing units especially in rapidly urbanizing areas, development of urban squatters and existence of shanties in rural area, and resettlement needs related to CALABARZON implementation.

(2) Strategy

Solution of housing problems generally calls for efforts by both the public and the private sectors. To address multiple housing problems existing and foreseen in CALABARZON as outlined above, the partnership of government agencies and the private sector would be most essential. Therefore, the following should be the basic strategy for housing in the CALABARZON region.

1) To establish criteria to provide housing by government agencies for those to be affected by the Project CALABARZON implementation ;

2) To extend existing housing programs by relevant government agencies to address specific housing issues in CALABARZON identified above, covering the less privileged ; and

3) To encourage private sector initiative and participation in the provision of housing affordable by qualified workers.

(3) Measures

Projects/programs

Existing government programs for housing should be extended to enlarge their coverage within CALABARZON. The community morgage program has been implemented to assist existing slum communities to gain land ownership. Target groups in CALABARZON are squatters in rapidly urbanizing areas and settlers in poverty-stricken rural areas. Efforts of NHA, PCUP and DSWD should be coordinated for this program.

The core shelter project of DSWD should be expanded as presently planned. Target groups in CALABARZON should include victims of calamities and those below "food threshold" who will be adversely affected by the implementation of CALABARZON projects such as those in the Batangas port area, the Cavite coastal area and the Laguna lakeshore. As a matter of principle, project beneficiaries should be limited to CALABARZON residents, screening out "professional" squatters.

A few additional projects/programs should be initiated in CALABARZON. First, projects to expand the supply of low-cost housing need to be implemented by both government agencies and the private sector. Low-cost housing should be an important component of the proposed integrated industrial/urban development program. When an industrial estate is planned by the private sector, provision should be made for land that would be developed for low-cost housing by either the public or the private sector.

Housing for "commuters' communities" should be developed in selected towns/areas along major transportation routes which are relatively easily accessible to places of employment. The objective is to provide better residential areas outside industrial cores which have a higher environmental quality.

A program should be initiated to encourage the low-cost production of construction materials such as inter-locking bricks, cement blocks and coco-lumber. Use of local resources should be maximized.

Institutional measures

Proper town planning and strict implementation of land use regulations are prerequisites to successful implementation of some housing projects. Residential areas for future housing development should be designated, and healthy and sound environment protected and enhanced. Regular monitoring should be conducted of public land and unbuildable areas such as creeksides, rights-of-way of railways and power lines to prevent the establishment of new slum communities.

A fundamental solution to the housing problem is to empower people to act by themselves for the betterment of their living environment. For this, community organization will be necessary. This in turn will provide a venue for implementation of various social sector projects. At the same time, an inter-agency body may be necessary to oversee housing and related concerns in CALABARZON. A sub-committee may be created within RDC-SDC to coordinate efforts of government agencies and other entities engaged in housing and community development.

5.6 Environment

5.6.1 Existing conditions of the environment

(1) Existing problems

The most significant environmental problems in CALABARZON are found in Laguna de Bay and its vicinity. They include water quality in the lake, fluctuation of water levels due to temporary storage of flood water in the Marikina river as well as river inflows and rainfalls, resultant flooding of the lakeshore areas, and intrusion of sea water and wastewater through the Pasig river. These problems affect human activities on and around the lake in various ways such as lake fishery, lakeshore irrigation and livelihood of the people.

Other problems pointed out by DENR include the smoke emission and coal dust from the Calaca coal-fired thermal plant and its coal stock yard, the coal dust problem in the PNOC stock yard in Bauan, and the effluents from alcohol plants in the province of Batangas. Also pointed out by others are the air pollution and other problems associated with the geothermal development in Laguna, and the discharge of waste cooling water from the thermal power plants of Calaca and Malaya. The Philippine National Oil Company (PNOC) has initiated an environmental control program, including reinjection of the wastewater separated from the steam back to geothermal reserves and monitoring of surface water, groundwater, river sediments and soil around geothermal development sites. The red tides in Manila Bay pose serious threat to the fishery, although their main cause is presumably wastewater discharges from Metro Manila.

Water quality analysis has been conducted at this time for the Taal lake water as well as the Laguna de Bay water discussed in the next subsection (detail in Appendix J). The Taal lake water has generally good quality for Class C standard (see below) by most indices. An exception was phosphase concentration, measured at 0.14 mg/l at Talisay and 0.104 mg/l at Agoncillo, respectively higher than the standard of 0.05 - 0.10 mg/l. Sulfide concentration was much higher than the standard of 0.05 mg/l for drinking water. These are due to volcanic activities. These elements can be relatively easily removed by conventional water treatment methods.

(2) Existing regulations

Land use regulations

Of the existing land use regulations, designation of National Parks and reforestation areas is important as it relates to the conservation of environment. According to DENR, five National Parks exist in CALABARZON as follows.

1) Taal Volcano Island N.P.
This park covers 2,465 ha of the volcano island within the Taal lake.

2) Rizal-Quezon-Laguna N.P.
This park encompasses the upper catchment area of the Marikina river and the Sierra Madre mountains, covering 46,310 ha in parts of the three provinces. The designation is for a wildlife sanctuary and a game reserve as well as a National Park.

3) Mt. Palay-Palay, Mataas na Gulod N.P.
This is a 5,220 ha park in the Palay-Palay mountains in Cavite.

4) Mt. Banahaw - San Cristobal N.P.
This park extends over the provinces of Laguna and Quezon, covering 11,124 ha, of which 2,745 ha are in Laguna and the rest in Quezon.

5) Quezon N.P.
This is a dipterocarp forest and a historical watershed with an area of 983 ha, established by virtue of Proclamations No.740 dated October 25, 1934 and No.594 dated August 5, 1940.

In addition, there are eight watershed forest reserves in Quezon with a total area of 2,683 ha: Buenavista, Lopez, Mulanay, Polillo, Mulawin Springs, Tibiang-Damagandong, Calauag and Alabat.

Reforestation areas in CALABARZON implemented by DENR are summarized below by province.

Cavite :
1) Mt. Palay-Palay, Mataas na Gulod reforestation project
2) Integrated social forestry; ISF (two locations, 192.6 ha)
3) Contractual reforestation (22.7 ha)

Laguna :
1) Mt. Banahaw - San Cristobal reforestation project (5,300 ha)
2) Caliraya - Lumot reforestation project (10,750 ha around the Caliraya - Lumot reservoir, including area in Quezon)
3) Pakil ISF CARP project (72 ha)

Batangas :
1) Lobo reforestation project (4.932 ha)
2) Laurel ISF CARP project (45.1 ha)
3) Nasugbu reforestation project (677 ha)

Rizal :
1) Antipolo integrated reforestation project (32,650 ha in the catchment areas of the Boso Boso and the Montalban rivers, the upper tributaries of the Marikina river), including contractual projects: San Isidro (156 ha), Green Phil. Foundation (70 ha), and Gregorio Araneta Foundation (120 ha).

Quezon :
1) Six completed reforestation projects with a total area of 13,310 ha: Real, Polillo-Burdeos, Quezon memorial, Alabat, Tagkawayan and Bondoc peninsula, and
2) 18 on-going reforestation projects with a total area of 887 ha.

Effluent regulations

The rules and regulations related to industrial and municipal wastewater effluents are contained in "the Effluent Regulation of 1982." This is based on the Presidential Decree No. 984, otherwise known as "the Pollution Control Decree of 1976" prepared by the National Pollution Control Commission. These regulations were revised in April 1992 by DENR Administrative Orders No.34 and No.35.

Effluent standards are set according to receiving water bodies classified as follows:

Fresh surface water

AA : For source of public water supply. This class is intended primarily for water bodies having watersheds which are uninhabited and otherwise protected and which require only approved disinfection in order to meet the NSDW.

A : For source of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the NSDW.

B : For primary contact recreation

C : For the propagation and growth of fish and other aquatic resources

D : For agriculture, irrigation, livestock watering and industrial cooling and processing.

Marine and estuarine water

NP : National Park or Reserve

SB : For the primary contact recreation

SC : For the propagation and growth of fish and other aquatic resources

Additional standards are set for effluents with high organic contents. They include effluents from manufacturing plants with BOD greater than 300 mg/l and effluents from dessicated coconut factories, tanneries, cassava and starch manufacturing plants, slaughterhouses, meat processing plants and petroleum refineries. In addition to metals and toxic substances, standards are set for color, pH, temperature, phenols, suspended solids, BOD and oil/grease for these effluents. Details are given in Appendix J.

5.6.2 Present conditions of sanitation

(1) Wastewater

No piped domestic sewerage system exists in CALABARZON. Wastewater is mostly discharged directly into the ground, open drains, streams, rivers and occasionally the Laguna lake. Toilet wastewater is discharged into a cesspit or septic tank installed for each house or community. The wastewater from the cesspit or septic tank either infiltrates into the ground or overspilled and discharged as other wastewater.

To clarify the discharge of industrial wastewater in CALABARZON, data collected by LLDA through its monitoring system were compiled. Within the Laguna de Bay basin,

344 wet industries have been identified. They are classified into three types of industries as follows.

Wet industries in the Laguna de Bay basin

Province	Types of wet industries			Total
	Metal	*Chemical*	*Food*	
Metro Manila	44	58	44	146
Cavite	0	4	3	7
Laguna	16	30	64	110
Batangas	0	1	1	2
Rizal	26	17	36	79
Total	86	110	148	344

Of the total, 48 industries have acceptable effluent quality, 107 non-acceptable, and 189 unknown effluent quality. Location of the wet industries is illustrated in Figure 5.12. They concentrate in the northwest and the west of the basin.

(2) Solid wastes

Some areas in CALABARZON are receiving areas for solid wastes generated in Metro Manila. According to the Metro Manila Authority (MMA), a total of 4,500 tons of solid wastes is generated by Metro Manila, but only 3,400 tons are collected. Of the 1,100 tons uncollected garbage, about 600 tons are dumped on streets, storm drains and empty lots.

Solid waste disposal in the Laguna basin was partially clarified by a questionnaire survey. Results show that some solid waste disposal system is provided for 21 out of 25 municipalities in Laguna and Rizal, for which answers to the questionnaire were obtained (detail in Appendix J). Average daily volume of solid wastes generated in Laguna and Rizal is 392 tons/day and 473 tons/day respectively, of which 191 tons/day and 98 tons/day are collected. Overall, about one-third of the solid wastes generated in the basin is collected.

5.6.3 Laguna de Bay environment

(1) Monitoring activities by LLDA

The Laguna Lake Development Authority (LLDA) has been regularly monitoring the water quality of Laguna de Bay since more than 15 years ago through six stations in the West Bay, East Bay, Central Bay and South Bay. Water samples are taken every two weeks.

LLDA monitors also the seven major rivers flowing into the lake by taking water samples once a month at nine points. The monitoring is done by most important chemical and biological parameters: ammonia, nitrate, dissolved oxygen, pH, inorganic phosphorus, temperature, turbidity, total dissolved solids and coliform. Monitoring on heavy metals and pesticides started recently but presently suffers from breakdown of equipment. LLDA also implements a monitoring program for point sources of pollution to determine their compliance to the prescribed effluent standards.

(2) Water quality analysis

Existing water quality data offered by LLDA have been compiled and additional water quality measurement was conducted at this time. These data cover four sampling points on the lake and nine sampling points on six tributaries. Sediment samples were also taken at the four points on the lake and two points on tributaries. Results of the water quality analysis are summarized below (detail in Appendix J).

Overall quality

The lake water quality is acceptable by the Philippine standards for various purposes, measured by most indices except total coliform. High coliform concentration can be solved by chlorination for drinking water, but this involves high operating costs and unpleasant taste. Turbidity and total dissolved solids (TDS) are higher than international standards. High concentration of TDS and turbidity tends to increase the water treatment costs by coagulation and filtration for drinking water.

Seasonal variations of the lake water quality measured by several indices are significant. The water quality problems become serious during dry seasons, while during rainy seasons, pollutants are diluted and washed away.

Concentration of inorganic phosphorus in the lake water exhibits a slightly increasing trend in recent years. This is an indication of slowly progressing eutrophication. High concentration of ammonia, typically of human wastes, has been detected in West Bay.

Heavy metals, such as lead, zinc, manganese and copper, have been detected in sediment in relatively high concentration. However, no reliable standards are available to judge the magnitude and significance of the problem. No serious pesticide problem has been identified.

Turbidity

Inorganic turbidity of the lake water, measured as SiO_2, is increasing rapidly in recent years. This is clearly due to sediments transported from denuded catchment areas. Seasonal variations of turbidity is conspicuous, strongly correlated inversely with rainfall. That is, when the rainfall is higher, the turbidity is lower, and vice versa. This indicate that the turbidity of the lake is caused not much by direct river inflow containing large amount of sediments but rather mainly by stirring up effects of water currents caused by river inflow and winds.

Chloride

Concentration of chloride, one of the most important water quality indices especially for sources of drinking water, decreased sharply since the completion of the Napindan hydraulic control structure in 1983. It has not shown any tendency to increase after the opening of the structure upon the demand by lake fishermen.

The maximum allowable concentration of chloride is set at 200 mg/l for sources of drinking water. The present concentration of chloride in the lake is below this threshold.

Implication to lake fishery

Although the chloride concentration decreased with the completion of the Napindan hydraulic control structure, no apparent relationship can be observed between the chloride concentration and fishery production in the lake. The total fishery production from the lake reached its peak in 1984 and has been declining since then. This is due primarily to decrease in the area of fish pens as a result of dismantling of illegal fishpens. However, the yield per ha of fishpens has not shown any decline since 1985. This indicates that the fishery productivity does not have correlation with the chloride concentration.

Captive fishery reached high production levels in 1984 through 1986. This presumably reflects partly the dismantling of illegal fishpens. However, it started to decline sharply since then. In the meantime, the chloride concentration does not show any trend of increase nor decrease. This suggests that the reduced production is due to some other factors.

5.6.4 Development issues and strategy

(1) Main development issues

Main development issues related to environment are identified. Issues related to Laguna de Bay include declining productivity of the lake, pollution due to urbanization/industrialization, and use of lake water for domestic and irrigation purposes. Other main issues are erosion control of slope land and denuded forest areas and the land covered with volcanic ashes, and the watershed management of the Marikina river basin.

Lake productivity

According to LLDA, fishery productivity in the lake decreased from 4 to 8 tons/ha in peak years to 1 to 2 tons/ha in recent years. The culture period has been prolonged from 4 to 6 months to 10 to 12 months. This decline in productivity is due to a number of factors including the following:

a) fluctuation in lake primary productivity,
b) the depth of lake water that affects the degree of disturbance on the lake bottom sediments due to wind and wave action,
c) the discharge of industrial and domestic effluents,
d) the erosion of upper catchment areas due to deforestation,
e) the illegal fishing practices which trap the eggs and juveniles of fish, and
f) turbidity.

Pollution by urbanization

The urbanization/industrialization along the lakeshore is a main cause of pollution in the lake. Municipal sewage, currently discharged without treatment, is a potential threat to the lake water as well as industrial effluents. Another major problem is the solid waste disposal. At present, not only disposal but also collection of solid wastes is insufficient. Moreover, some municipalities are receiving solid wastes from Metro Manila in their hills. This will eventually lead to the contamination of tributaries and the lake as well as groundwater.

According to a study by WHO-LLDA, the annual load to the lake of nitrogen increased from 3,492 tons in 1973 to 6,200 tons in 1978 and that of phosphorus from 942 tons to 1,600 tons in the same period. The increase in load during 1978-83 is primarily due to the San Pedro river. Another heavily polluted river in terms of nitrogen and phosphorus was the Morong river.

The levels of wastewater treatment and necessary measures for solid waste management need to be worked out vis-a-vis the expected degree of urbanization and the required water quality in the lake.

Use of lake water

The plan to tap lake water for domestic water supply was originally scheduled after the year 2000. However, the offer by NIA for the use of pumps at Putatan and Muntinlupa has made it possible for MWSS to advance the plan. The following plan was discussed in early 1990 by LLDA, NIA and MWSS:

1) Abstraction of water initially at the rate of 300,000 m^3/day starting in 1991 for the Manila South water supply project using the NIA Pumping System located in barangays, Putatan and Muntinlupa, Metro Manila, to benefit some 1.2 million population in four municipalities within the southeast sector of the MWSS Service Area;

2) Direct abstraction of water from the lake for the Rizal province water supply improvement project at the rate of 52,000 m^3/day to benefit particularly the municipalities of Angono and Binangonan with a total population of 107,551 (1980) starting at end of 1991. The system can be expanded to include Antipolo, Cainta, Taytay, and even Taguig; and

3) Expansion in 1994 of the water abstraction to 600,000 m^3/day using MWSS pumps to cover four additional towns as well as the increase in population in the municipalities already served.

As of July 1991, the proposed sharing by MWSS of the NIA pumping system has been suspended. Instead, the Angat project is considered as a more viable option. The use of lake water for irrigation will be expanded by the implementation of the second Laguna de Bay Irrigation Project. This project will irrigate the Cavite friar lands and would require a maximum abstraction of 10.4 m^3/sec, which would reduce the lake water level by 21 cm during the period of November - May.

Should the lake water be used for domestic water supply, the quality would have to be upgraded from the present Class C to Class A. This implies that more stringent effluent standards would have to be imposed on industries and lake fishery would have to be regulated. Other activities along the lakeshore would also be affected such as agro-industry

and reclamation. Barging of oil and other petroleum products across the lake may have to be phased out in favour of land-based transport.

Erosion control and watershed management

Of the Laguna basins, 25% is covered by forests, including most of the Marikina upper catchment reserve. From 1960 to 1977, 54,000 ha were deforested and mostly transformed into unproductive open grasslands, which now comprise 16% of the total basin area.

Areas of severe erosion extend generally on slope lands, which belong to Class M in the land capability map. They are the Sierra Madre mountain area, the Angono hill, the Talim island, Mt. Banahaw, Lobo mountain, Taal lake slopes, Batulao-Palay palay mountains, Balibago upland, and the Calumpan hill. Other erosion susceptible areas are the Tagaytay upland, the Sampiro hill, the Rizal upland area and most part of the Bondoc peninsula in Quezon. In the Laguna basins, 47% of the total land area is susceptible to erosion. The watershed management of the Marikina river basin is particularly important as the erodable area is quite large.

(2) Context of environmental management

It has been widely recognized that high economic growth in any region cannot be sustained without concomitant environmental management. With this respect, the real issue is not a trade-off between economic development and environmental conservation, but rather the environmental management for sustained economic growth.

The Laguna Lake, for instance, has been a source of livelihood in various ways for many people. The challenge is how to lend the lake environment to the livelihood of a wider range of people at present and in the future. This cannot be realized just by trying to preserve the physical conditions of the lake, as it undergoes natural process of transformation as well. The basic concept of the Master Plan is in fact environmental development as expressed in the objective (Section 3.1).

The Project CALABARZON, being a large scale, multi-sectoral project complex, will have significant effects on the environment. This is particularly true as the CALABARZON region is characterized by relatively vulnerable water and related land environment. Laguna de Bay has been undergoing transformation accelerated by various human interventions. Lands in CALABARZON are extensively covered by volcanic ash and tuff to make them

vulnerable to soil erosion. The Marikina river basin is also susceptible to erosion due to its topography and soil conditions.

If the Project CALABARZON is implemented without paying proper attention to the environment, a range of problems will arise. Effects of such problems will be as fundamental and long-lasting as the socio-economic impact of the Project CALABARZON. Therefore, the environmental aspect should be taken as an integrated part of the CALABARZON regional development, and a wholistic approach should be adopted consistently with other measures for socio-economic development.

(3) Strategy for environmental management

Various environmental problems foreseen may be categorized into two classes: those that can be dealt with on a project-wise basis and others calling for a more integrated approach. For the latter, the watershed management approach should be taken as already mentioned in subsection 5.1.5, in view of the importance of water and related land issues. Of the former, wastewater treatment and solid waste disposal are two important issues, considering the future urbanization/industrialization of CALABARZON. Monitoring is essential for the both types of problems.

Wastewater and solid waste management

At present, serious water quality problems are observed in and around Laguna de Bay only during dry seasons, when the surface water discharge is minimal. During dry seasons, wastewater is in fact only significant source of discharge into the lake, being fed primarily by groundwater. Therefore, in principle, the discharge should not be reduced by interceptors or other diversion systems. Rather, quality of the discharge should be improved to increase self-purification capacity of the discharge itself. Thus, wastewater treatment at sources should be the basic principle to be pursued for the long-term solution of the lake water quality problems.

For domestic wastewater, a small scale treatment system should be the basic unit to be established. This may be called a community treatment system and serve the population of some 30,000.

For planning the domestic wastewater treatment system, the whole basin may be divided into several planning zones. One community treatment system will be provided to each zone. For unit processes, either stabilization pond or lagoon system may be preferred

initially for economic reasons. This system can be easily converted to a mechanically aerated lagoon system.

In defining the planning zones and planning the treatment system by zone, solid waste disposal should also be taken into account. This would call for an extensive survey to identify sites suitable for receiving solid wastes not only from CALABARZON municipalities but also from Metro Manila. Hydrological relationships with the Laguna lake as well as capacity of each site should be taken into account.

For industrial effluents, individual treatment systems are recommended in principle as the short-to mid-term measures. For each planning zone, wet industries should be identified by type of industry, and treatment standards should be established for each type. For industrial estates, a community treatment system is more recommendable.

Priority for implementing the comprehensive treatment system by zone including the domestic sewerage and solid waste disposal should be established by LLDA on the basis of existing wet industries, planned industrialization, and expected population growth. The first priority may be given to the area west and northwest of Laguna de Bay.

Monitoring

Monitoring is essential for identifying environmental problems at an early stage of development and taking corrective measures to minimize possible adverse effects. On-going monitoring activities by LLDA, DENR and other agencies need to be much expanded and integrated. Monitoring should cover not only physico-chemical indices as presently done by LLDA, but also biological and socio-economic indices.

As a first step, a survey should be conducted to assess the data available from various agencies to determine indices to be used for monitoring and to identify needs for further data collection. An environmental data base should be established, consisting of data related to both natural and socio-economic conditions. The data base will allow processing these data and providing output in the form necessary for planning and control functions. Also, it will provide a common basic for carrying out the environmental impact assessment (EIA) of individual projects consistently.

(4) Measures for Laguna Lake

In view of the importance of the Laguna Lake environment within the overall CALABARZON regional development and the imminence and complexity of the

environmental problems facing the lake, the Master Plan proposes measures to be taken or principles to be observed specifically for the Laguna Lake.

1) There should in principle be no full scale extraction of Lake water for domestic and industrial water supply at least upto the mid-term future except minor extraction to satisfy urgent needs. Exceptions may be made of a few towns in Rizal where available data prove that no viable alternative exists.

2) Groundwater should continue to be the prime source of industrial water; a groundwater potential study should be carried out in view of rapidly increasing demand for industrial water, covering an extensive area within CALABARZON.

3) Status quo water quality in the Lake should be taken as the basis for planning future development of the Laguna catchment area; i.e. the status quo quality should be maintained.

4) Further location of industries should be regulated (discouraged) first by strict land use control based on land use plans to be prepared by municipality, and second by stepwise enforcement of wastewater discharge and solid waste disposal regulations; priority should be established for land use planning and implementation of sewerage and solid waste treatment systems.

5) Vigorous reforestation should be conducted in the denuded forest areas to enhance water retaining capacity and reduce soil erosion as a necessary condition for watershed management; as a sufficient condition, projects should be initiated to provide means of livelihood for people already living in the upper catchment area.

6) An environmental monitoring and evaluation system should be established for the Laguna basins with the participation of NGO's, research institutes and international experts as well as local people and government agencies.

Immediate actions recommended

Public fora should be created for the Laguna Lake environment to discuss the strategy and measures described above and any related matters with the participation of local groups of people, research institutes, government agencies, NGO's and other relevant entities. It

should prepare recommendation on those strategy and measures with modifications as necessary for adaption, as matter of principle, by the relevant government authority.

An information and communication system appropriate for continuous monitoring of activities and phenomena within the Laguna Lake catchment area, discussion thereon and coordination thereof should be worked out also in the forum and recommended to the relevant government authority. As the first component of the system, the Laguna Lake environmental monitoring and evaluation system should be designed, possibly with the assistance of international aid organization, clarifying roles to be played by NGO's, research institutes and government agencies and their relationships with international community.