CHAPTER 1

Introduction

1 Introduction

1.1 Background of the Study

The Republic of Nicaragua, in Central America, has a population of 3.9 million and extends over an area of about 130,000 km^2. It has suffered two major earthquakes this century, in 1931 and 1972, and has been plagued by civil war that started in 1979 and lasted a decade. These recent events have unfortunately led to a decline in the standards of infrastructure, public services and socio-economic make up.

In Nicaragua, principal cities are focal points of important economic activities and thus attract a large number of migrants from rural communities, resulting in drastic population increase. However, the cities' inferior infrastructure and dilapidated equipment have made the management of urban sanitation aspects difficult. Consequently, improper treatment of domestic and industrial wastewater led to the annual deterioration of fresh and groundwater quality, while illegal handling and dumping of municipal and industrial solid waste debased the urban living environment. Cases of water-related diseases are also rife. It is increasingly obvious that the cities are unable to cope with environmental degradation. To further exasperate the problem, the cities' financial capabilities are limited as well as there being a lack of environmental measures for major industries. Therefore, the formulation of remedial measures for urban sanitation environment (hereinafter referred to as USE) of the three cities was urgently required.

The Government of Nicaragua prioritized the mitigation of environmental problems and established the "Environmental Action Plan" (Plan de Acción Ambiental) in October 1993. The government has been encouraging decentralization, even in the field of municipal solid waste management and further advocates active participation in sewage treatment. However, local authorities lack the necessary equipment, financial and human resources to manage the demands to alleviate pressures on USE. Furthermore, with the national unemployment rate being 23.5%, (some reports put the under-employment rate close to 60% at present) central funds are dwindling, thereby hampering economic development.

Under these difficult conditions, the Government of Nicaragua requested the Government of Japan to implement a development study on the improvement of USE of the principal cities, Leon, Chinandega and Granada, in September 1994. In response to the request, the Government of Japan decided to conduct the Study on the Improvement of USE of the Principal Cities. Accordingly, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, undertakes the study in close cooperation with the authorities concerned of the Government of Nicaragua. Kokusai Kogyo Co., Ltd. was selected by JICA as the consultant of the study.

1.2 Outline of the Study

1.2.1 Objectives of the Study

The objectives of the Study are:

- to conduct a basic study on the urban sanitation environment of the principal cities of Leon, Chinandega, and Granada,
- to formulate a master plan targeting the year 2010 for the improvement of one of the three principal cities and a conceptual master plan for the other two cities,
- to conduct a feasibility study on the first priority project(s) based on the Master Plan, and
- to transfer technology to the counterpart personnel in the course of the Study.

1.2.2 Study Area

The study area consists of three cities; Leon, Chinandega and Granada as shown in Figure 1-1, Figure 1-2 and Figure 1-3.

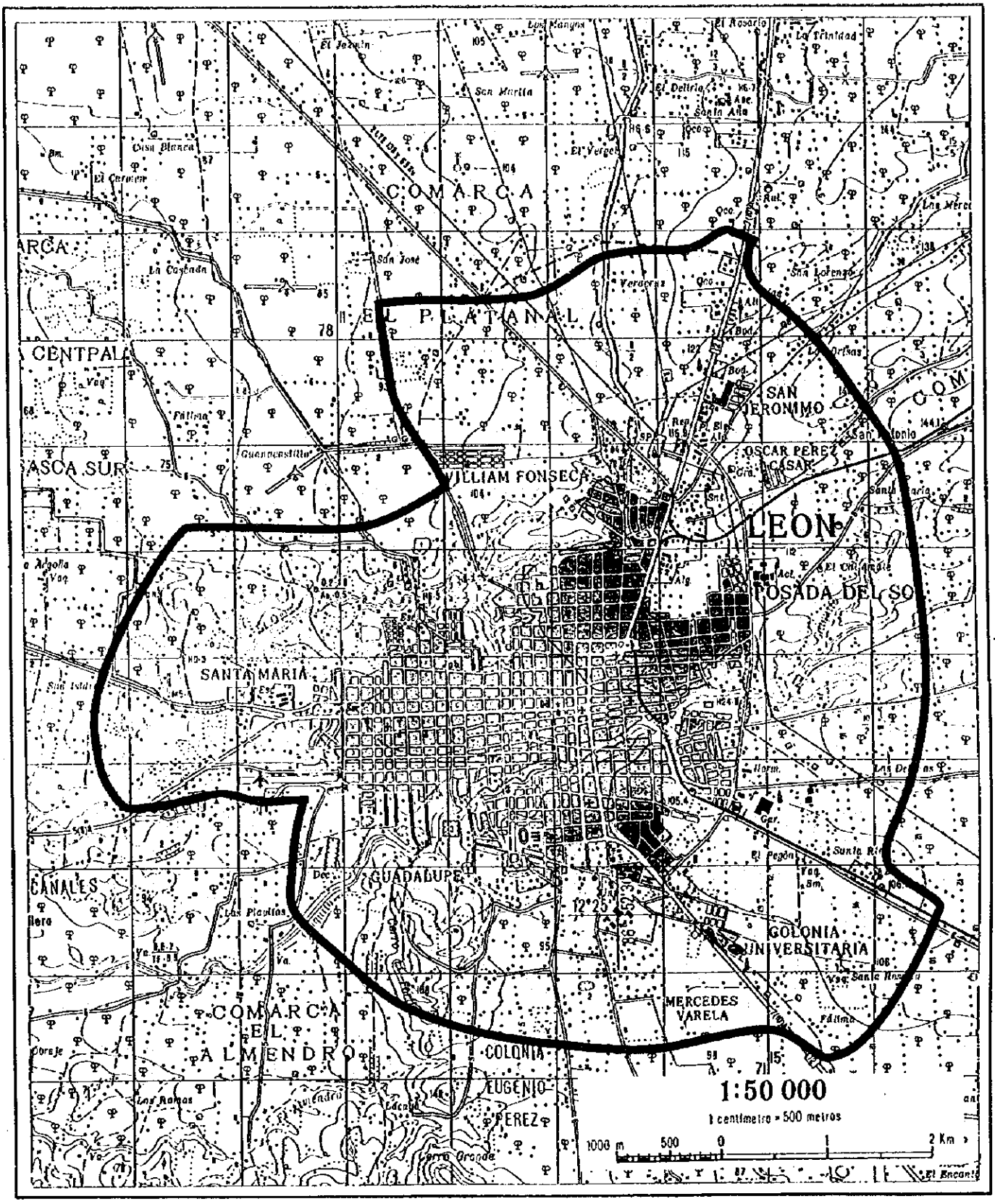


Figure 1-1: Study Area (1) Leon

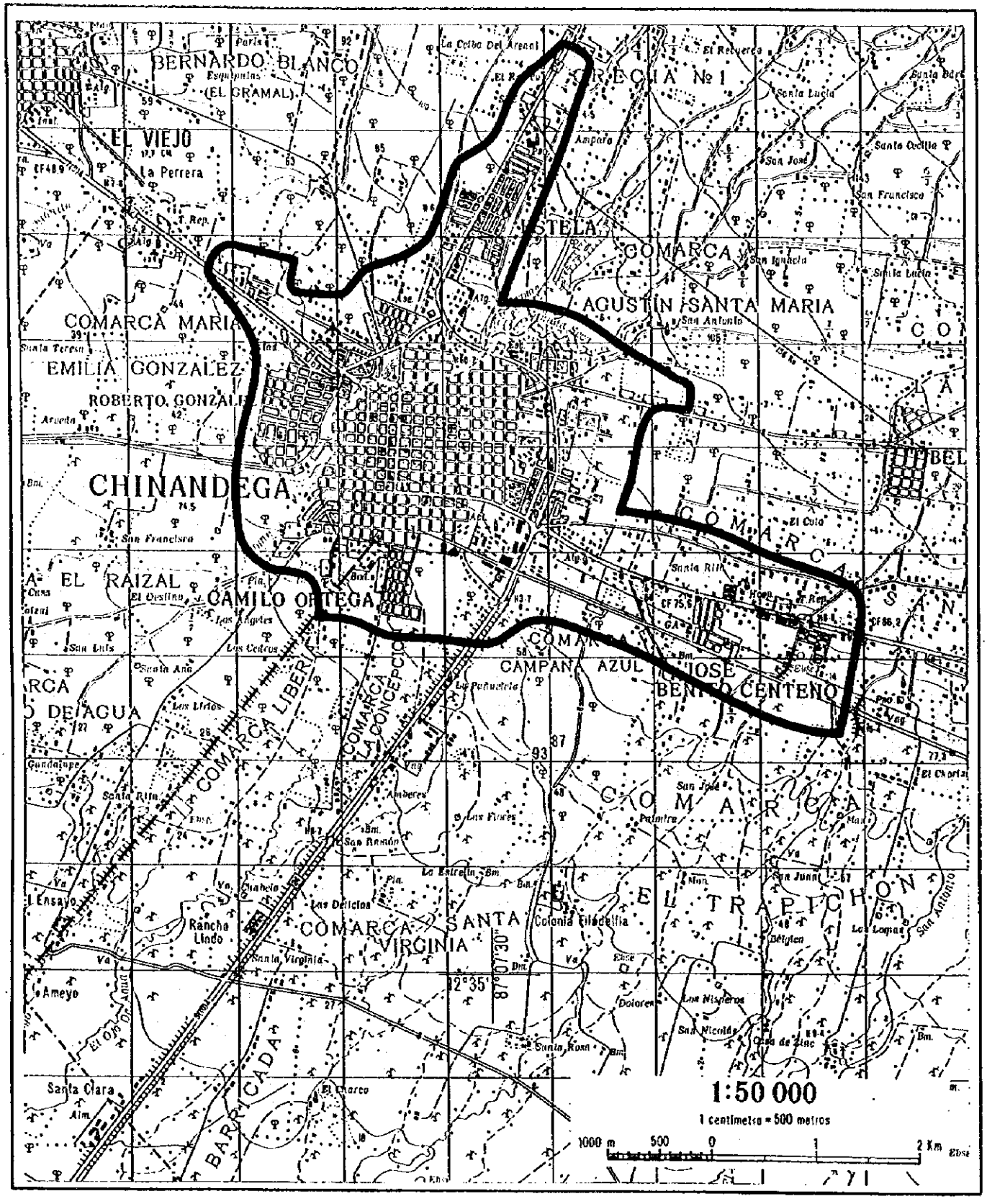


Figure 1-2: Study Area (2) Chinandega

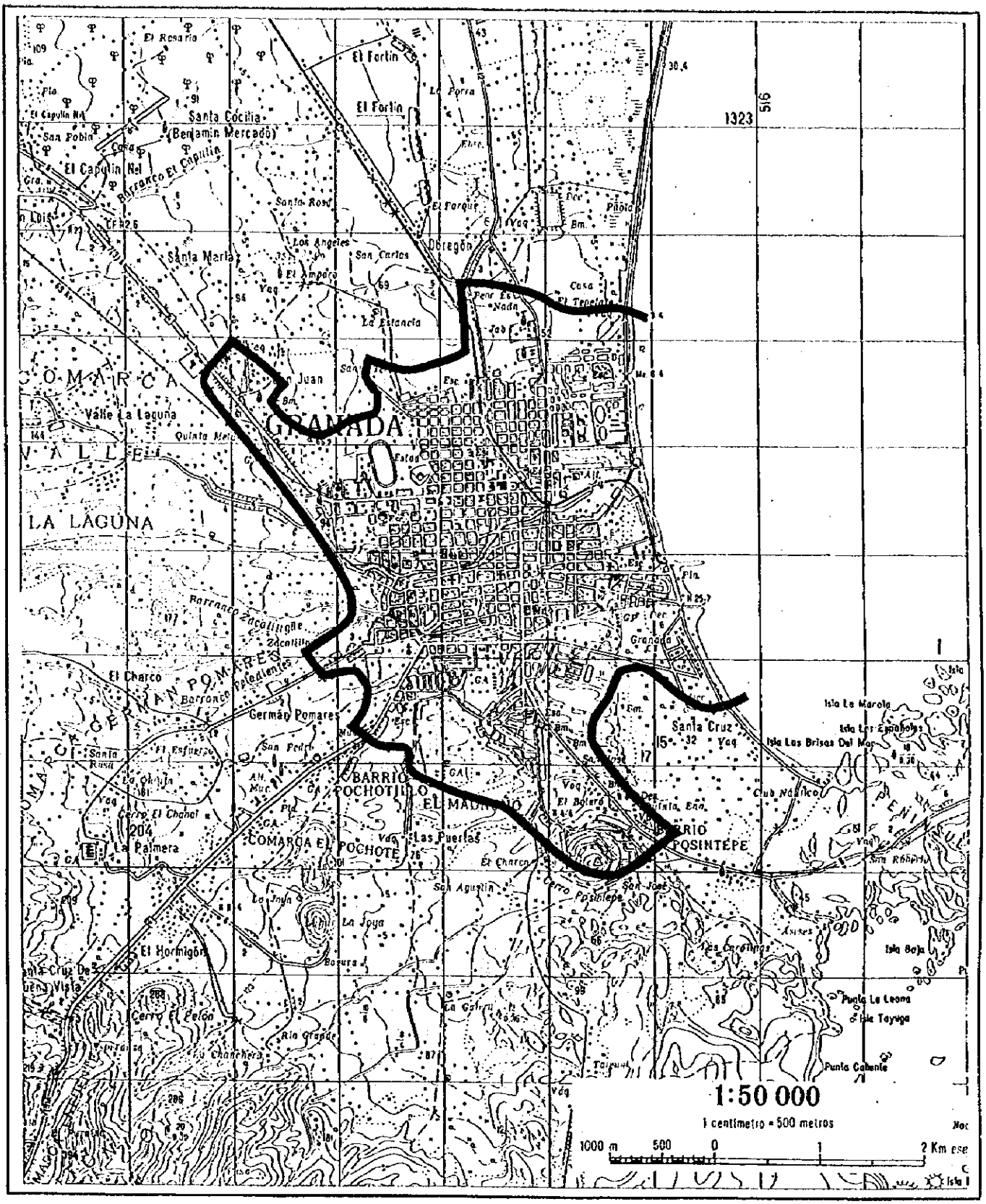


Figure 1-3: Study Area (3) Granada

1.2.3 Study Fields and Definition of Wording

This study shall cover the fields of (i) water supply (ii) storm water/wastewater and (iii) solid waste management of the 3 principal cities.

In the study area, storm water and wastewater are handled separately. And wastewater is further classified as domestic and industrial wastewater. Optimum treatment methods differ for each type of wastewater, and the term "sewage" is defined in Figure 1-4. For this study, it is important for the Team and the Nicaraguan counterparts to examine and agree to the definitions.

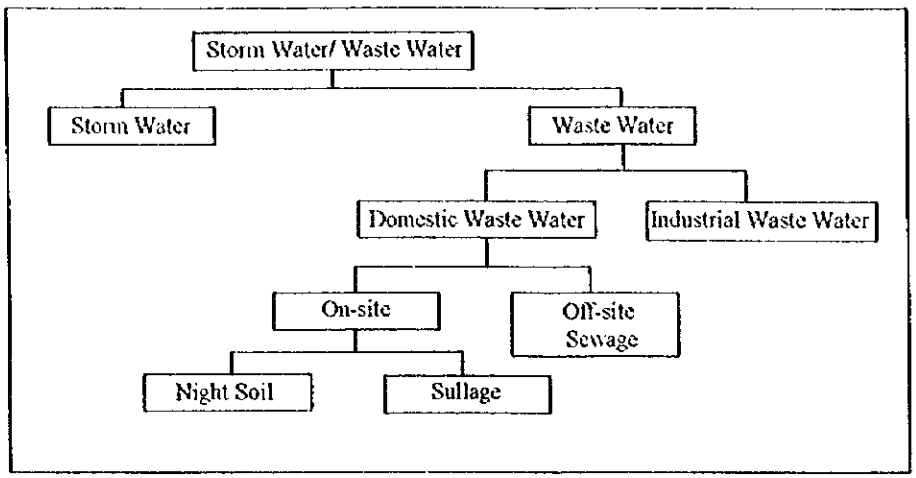


Figure 1-4: Definition of Storm Water/Waste Water in the Study

Each field has a different supervising agency, and the geographical distribution of the three cities made information gathering difficult. The way in which the basic study was conducted during Phase I was assumed to affect the outcome of the whole study.

1.2.4 Target year

The target year of the Master Plan is 2010 and that of the Feasibility Study on the priority project(s), which was be selected during the Phase II of the study, is 2005.

1.3 Policies of the Study

a. Characteristics of a USE Study

The eminent characteristics of a USE (urban sanitation environment) study are as follows.

- USE, with the exception of water supply improvement, does very little to promote industrial production. Therefore, it is low in the list of priorities in developing countries and is often given a limited budget.
- It is important for the plan to be implemented gradually rather than in a single large step. Also, operation and maintenance of facilities shall be covered financially by beneficiaries, e.g., residents, through fees, taxes, etc.

- The formulation of a USE plan will be difficult without understanding the natural and socio-economic conditions of the area as well as its history, cultural and educational background, residents' way of thinking, social habits and their lifestyle. Furthermore, with each aspect of USE (such as water supply, sewage and solid waste), the needs and priority for the improvement of each city will differ.
- The proper understanding of the social, natural and economic conditions of the study area is essential in the preparation of a USE plan.
- Summarizing the above, it is desirable to formulate a USE improvement plan which effectively utilizes the limited resources and enables cost recovery for improvement based on the use of appropriate technology. It is crucially important and effective to carry out pilot projects (e.g., community sanitation, landfill operation, etc.), in order to prove a proposed plan is workable.

b. Policies of the Study

The following were set up as the basic policies of the study, taking into account the present economic climate as well as knowledge from previous studies in Nicaragua.

- **Sustainable Plan**

  At present, the urban environment sanitation of the principal cities is unsatisfactory. It is a clear reflection of the lack of concrete environmental legislation required to maintain a sanitary environment; under these conditions it is impossible to consolidate facilities. Therefore, by improving facilities such as sewage treatment plants and waste disposal sites, in conjunction with the consolidation of the legal aspects, a USE plan that would ensure a sustainable USE system should be formulated.

- **Workable Plan**

  The USE plan to be formulated must suit the inherent conditions of the principal cities and aim at solving problems in the medium and long run rather than looking for short term solutions, i.e., the plan should be workable.

- **Appropriate Technology**

  The plan shall develop and employ technologies most appropriate for the principal cities, taking into account the local natural conditions, customs, history and any other aspects which may affect the implementation of the study.

c. Joint Study

With the above mentioned reasons, the Study Team implemented the study with the cooperation and active participation of the Nicaraguan side, especially regarding the following works:

- public opinion survey
- water pollution loading survey
- study on waste amount and composition
- survey of recycling system and market for reusable materials
- survey on industrial and medical wastes, including questionnaire survey
- execution of pilot project(s)

- educational campaign for the residents in conjunction with the pilot project(s)
- organizational and institutional planning
- financial planning
- prompt decision making for the selection of sites for primary facilities, level of fees for services and other important matters which require the decision of the Nicaraguan side.

1.4 Key Assumption

The following key assumptions were used in this Study.

a. M/P and Conceptual M/P

a.1 Socio-economic Conditions

Leon City

Items	Unit	1995	2000	2005	2010
1. Population					
City population	Person	161,530	224,295	257,084	292,511
Population of the Study Area	Person	123,865	183,519	213,156	245,421
Increase of population in the areas subject to the Study	%/year	8.18	3.04	2.86	
2. Economic					
GRDP (Leon City)	C$ million	700.7	924.1	1,179.4	1,421.2
Annual growth rate of GRDP	%/year	6.0	5.0	3.8	
Budget of the municipality	C$ 1,000	32,213	42,482	54,219	65,335
Income level	C$/year	15,708	13,972	15,353	16,068

Chinandega City

Items	Unit	1995	2000	2005	2010
1. Population					
City population	Person	117,037	136,076	155,523	176,359
Population of the Study Area	Person	97,387	115,393	133,753	153,444
Increase of population in the areas subject to the Study	%/year	3.45	3.00	2.78	
2. Economic					
GRDP (Chinandega City)	C$ million	657.0	866.5	1,105.9	1,332.6
Annual growth rate of GRDP	%/year	6.0	5.0	3.8	
Budget of the municipality	C$ 1,000	14,604	19,260	24,581	29,620
Income level	C$/year	14,772	16,410	18,069	18,979

Granada City

Items	Unit	1995	2000	2005	2010
1. Population					
City population	Person	96,996	126,307	147,830	171,618
Population of the Study Area	Person	71,783	97,078	114,760	135,106
Increase of population in the areas subject to the Study	%/year		6.22	3.40	3.32
2. Economic					
GRDP	C$ million	247.0	325.7	415.7	500.9
Annual growth rate of GRDP (Granada City)	%/year		6.0	5.0	3.8
Budget of the municipality	C$ 1,000	13,071	17,240	22,000	26,511
Income level	C$/year	15,300	15,228	16,494	16,883

a.2 Water Supply and Sewer System Coverage and Waste Collection Rate

	*1 1995 Water Supply Coverage (% of population)	*1 1995 Sewerage System Coverage (% of population)	*2 1996 Waste Collection Rate (% of population)
Leon	92.2%	55.3%	80.0%
Chinandega	74.0%	33.6%	51.0%
Granada	89.7%	21.9%	63.0%

Note: *1 Source: INAA Performance Indicators
*2 The figures are based on the "Waste Amount and Composition Survey" carried out by the Study Team.

1.5 Work Schedule of the Study

The Study consisted of the following three phases.

Phase I: Basic Study (from July 1996 to December 1996)

Phase II: Formulation of a Master Plan (M/P) (from January 1997 to May 1997)

Phase III: Feasibility Study (F/S) on the First Priority Project(s) (from June 1997 to February 1998)

An extension of on calendar month for Phase III was approved by both Nicaraguan side and JICA, in order to implement proposed pilot projects in Phase III.

Phase I: Basic Study (Understanding and Analysis of Present Urban Sanitation Environment Conditions for Three Cities)

A Preparation work in Japan

- Preparation of the inception report

B First study work in Nicaragua (basic study)

- Survey of the present USE condition
- Evaluation of present USE

- Preliminary examination of criteria for selecting a first priority city

C First study work in Japan

- Analysis of the basic study
- Selection of a first priority city

Phase 2: Formulation of a Master Plan

D Second study work in Nicaragua

- Survey of present USE condition (continued)
- Formulation of a master plan

E Second study work in Japan

- Selection of first priority project(s)
- Selection of pilot project(s)

Phase 3: Feasibility Study on the First Priority Project(s)

F Third study work in Nicaragua

- Field surveys for the first priority project(s)
- Implementation and evaluation of pilot project(s)

G Third study work in Japan

- Preliminary design of the first priority project(s)
- Environmental impact assessment
- Financial plan
- Project evaluation, etc.

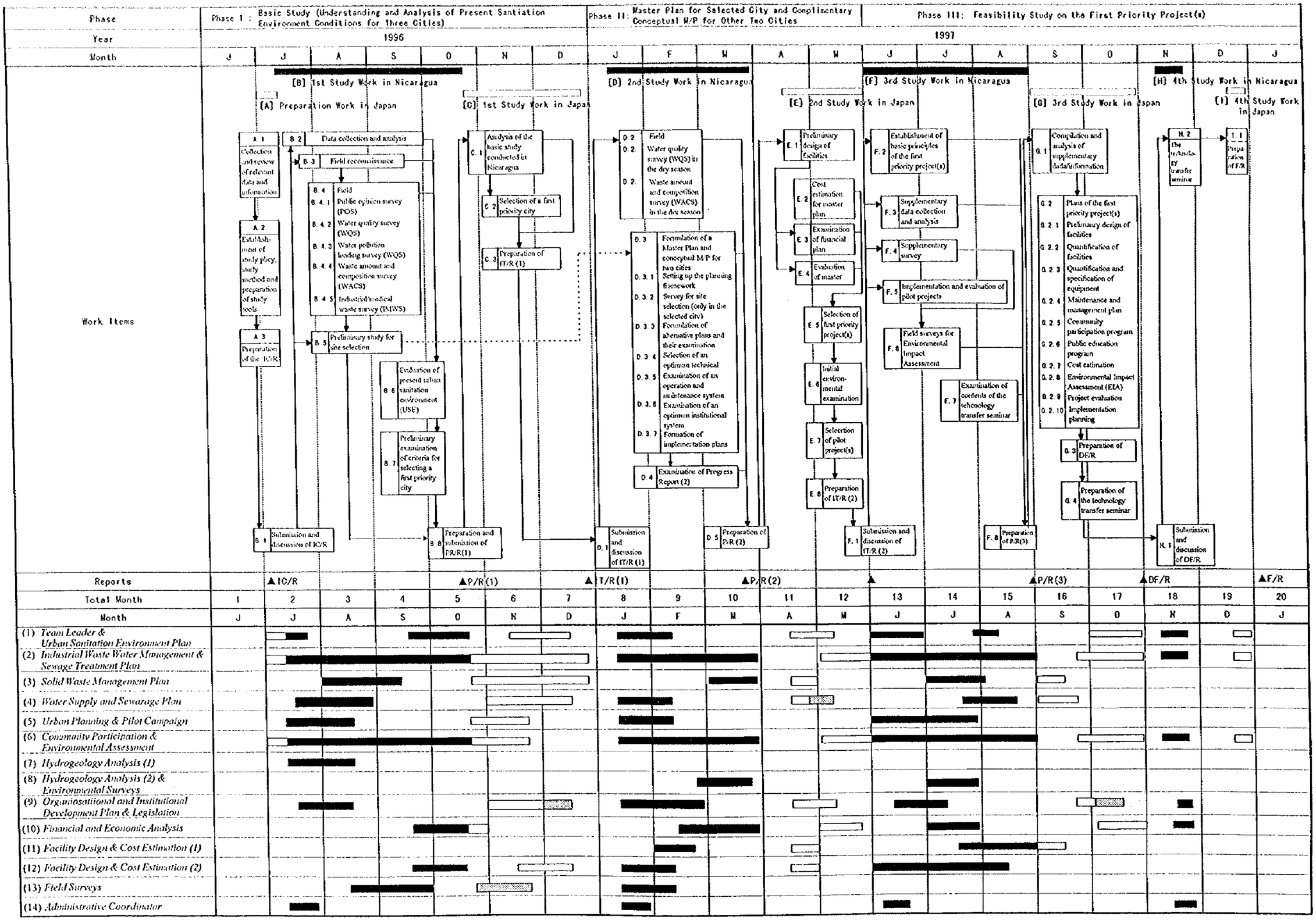
H Fourth study work in Nicaragua

- Discussion of the DF/R
- Technology Transfer Seminar

I Fourth study work in Japan

- Final report formulation

Figure 1-5: Study Work Schedule



1.6 Study Organization and Persons Involved

1.6.1 Study Organization

Nicaragua Institute of Municipality Formation (referred to as "INIFOM") is the counterpart agency of the Team and the coordinating body in relation with other governmental and non-governmental organizations concerned.

INIFOM organized the counterpart team for the Study Team. The counterpart team consists of the appropriate number of counterpart personnel (e.g., leader of the counterpart, appropriate number of officers) in charge of various aspects of the management of USE.

The Steering Committee, which is presided by the Director of INIFOM and composed of the highest authorities from INAA, INETER, MARENA, MINSA, and the three Municipal Governments, will convene at the time of the submission of the Inception Report, Interim Reports and Draft Final Report, to make strategic decisions related to the Study.

The Technical Committee is organized and presided by a Technical Coordinator. This Committee is composed of Technical Delegates from each of the institutions mentioned above. The Technical Committee is the working counterpart of the Study Team.

An Advisory Committee was organized by JICA for the study.

The study organizational structure is shown in Figure 1-6.

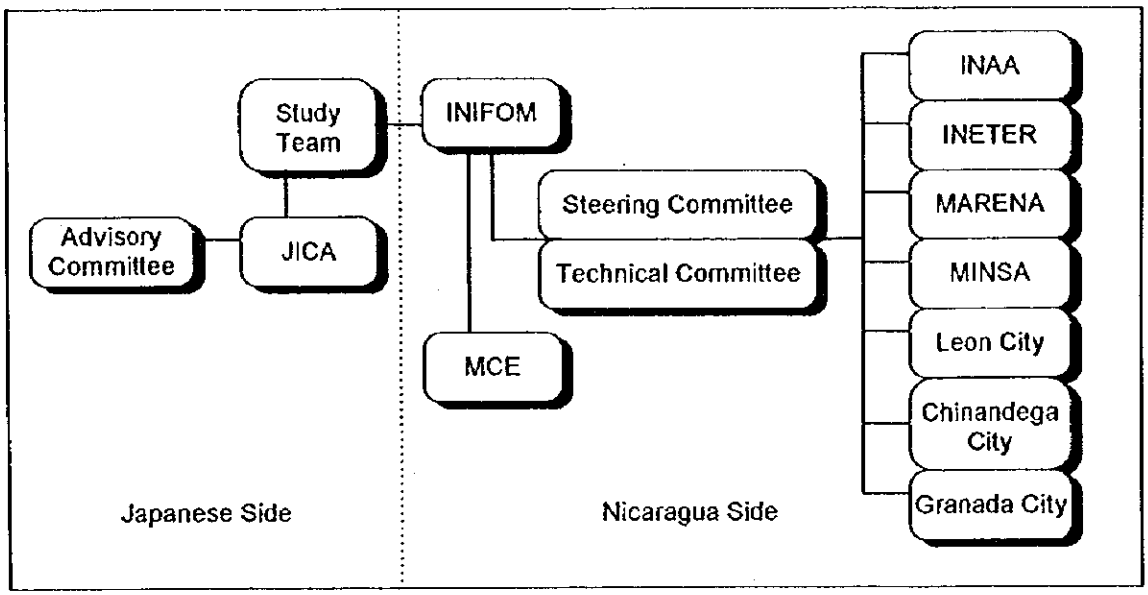


Figure 1-6: Study Organizational Structure

1.6.2 Persons Involved

a. Member of the Steering Committee

	Name	Position	
1.	Lic. Cristian Matus	INIFOM	Executive Director
2.	Arq. Róger Solórzano Marín	INAA	Minister
3.	Ing. Adolfo Tórrez	INETER	Vice-minister
4.	Dr. Federico Prado	MINSA	Vice-minister
5.	Lic. Roberto Standtdhagen	MARENA	Minister
6.	Lic. Rigoberto H. Sampson	Leon	Mayor
7.	Lic. Rodolfo Grios H.	Chinandega	Mayor
8.	Lic. Tatiana Raskoski	Granada	Mayor

b. Member of the Technical Committee

Organization	Name
1. INIFOM	Ing. Guilleermo Guevara Arq. Marvin Palacio Rodriguez Ing. Asunción Ortega S.
2. INAA	Ing. Sergio Tercero Ing. Sergio Mayorga Ing. Carlos T. Deshon
3. INETER	Ing. Luis Zuniga
4. MINSA	Dr. Juan José Amador Ing. Maritza Obando
5. MARENA	Ing. Helio C. Zamora
6. Leon City	Arq. Gustavo Garcia Ing. Ignacio Estrada Ing. Harmodio Paredes
7. Chinandega City	Lic. Azarias I. Chaves F. Ing. Presentación Rodriguez Francisco Blanco
8. Granada City	Lic. Marisa de Pasos Ing. Gerardo Espinoza Ing. Luis Javier Gutierrez

c. Members of the JICA Advisory Committee

Assignment	Expert
Chairman	Koichiro KATSURAI (-March 1997) Ken-ichi TANAKA (April 1997-) Development Specialist, Institute for International Cooperation, JICA
Solid Waste Management Planning	Tomohiko ISHIKURO Department of Research and Assessment (Waste Management) Japan Environmental Sanitation Center
Sewerage/Drainage System Planning	Koken KONOTOH Planning Section, Construction Department Sewerage Bureau, Sendai City

d. Members of the Study Team

Assignment	Expert	Nationality
Team Leader & Urban Sanitation Environment Plan	Susumu SHIMURA	Japanese
Industrial Wastewater Management & Sewage Treatment Plan	Hiroshi KATO	Japanese
Solid Waste Management Plan	Takeshi TOMIYASU	Japanese
Water Supply and Sewerage Plan (1)	Ernani de SOUZA COSTA	Brazilian
Water Supply and Sewerage Plan (2)	Gustavo MARTINEZ	Nicaraguan
Urban Planning	Masaharu KINA	Japanese
Community Participation & Environmental Assessment	Tadaya YAMAMOTO	Japanese
Hydrogeology Analysis (1)	Kunio FUJIWARA	Japanese
Hydrogeology Analysis (2) & Environmental Surveys	Carlos VALLE G.	Salvadoran
Organizational and Institutional Development Plan & Legislation	José Felicio HADDAD	Brazilian
Financial and Economic Analysis	Kozo BABA	Japanese
Facility Design & Cost Estimation (1) [Wastewater Treatment]	Hiroto HOSAKA	Japanese
Facility Design & Cost Estimation (2) [Solid Waste Final Disposal]	Ikuo MORI	Japanese
Field Surveys	Precha CHUNTAKORN	Thai
Administrative Coordinator	Masami HAYASHI	Japanese

1.6.3 Reports

The JICA Study Team prepared and submitted the following reports to the Government of Nicaragua.

	Report	Period of Submission	Number of copies to be submitted
1.	Inception Report (IC/R):	middle of July 1996	English: 20 copies Spanish: 20 copies
2.	Progress Report(1) (P/R(1)):	end of October 1996	English: 20 copies Spanish Summary: 20 copies
3.	Interim Report (1) (IT/R):	middle of January 1997	English: 20 copies Spanish Summary: 20 copies
4.	Progress Report(2) (P/R(2)):	end of March 1997	English: 20 copies Spanish Summary: 20 copies
5.	Interim Report (2) (IT/R):	beginning of June 1997	English: 20 copies Spanish Summary: 20 copies
6.	Progress Report(3) (P/R(3)):	end of August 1997	English: 20 copies Spanish Summary: 20 copies
7.	Draft Final Report (DF/R):	middle of November 1997	Summary (English) 20 copies Main report(English) 20 copies Supporting report (Eng.) 10 copies Data book (English) 10 copies Summary (Spanish) 20 copies Main report(Spanish) 20 copies
8.	Final Report (F/R)	January 1998	Summary (English) 30 copies Main report(English) 30 copies Supporting report (Eng.) 20 copies Data book (English) 10 copies Summary (Spanish) 50 copies Main report(Spanish) 50 copies

1.6.4 Technology Transfer

The Study Team pursued technology transfer for the Nicaraguan counterparts through the conduct of the following during the study:

- On the job training (OJT)
- Counterpart training in Japan under the Japanese technical cooperation scheme
- The Technology Transfer Seminar

CHAPTER 2

Profile of the Study Area

2 Profile of the Study Area

2.1 Country Profile on Urban Sanitation Environment (USE)

2.1.1 National Development Plan

a. Strategy for Urban Development

According to the census in 1995, the population of the ten largest cities in Nicaragua totaled 1,785,205, equivalent to about 43 percent of the total population of the country (4,139,486) as shown below.

Table 2-1: Population of Ten Largest Cities in Nicaragua

	Name of 10 Cities	Population 1995	(1971)	Population of Urbanized Area and Its Percentage	
1.	Managua	882,945	(430,690)	819,731	(92.8%)
2.	Leon	159,780	(75,584)	124,117	(77.7%)
3.	Masaya	120,856	(45,174)	80,051	(66.2%)
4.	Chinandega	118,078	(45,298)	84,281	(71.4%)
5.	Matagalpa	96,076	(60,325)	49,148	(51.2%)
6.	Granada	95,426	(44,453)	74,396	(78.0%)
7.	Esteli	86,183	(34,828)	65,036	(75.5%)
8.	Tipitapa	81,106	(20,315)	47,779	(58.9%)
9.	Jinotega	73,973	(69,919)	41,053	(55.5%)
10.	El Viejo	70,782	(24,084)	33,320	(47.1%)
	Sub-total	1,785,205	(887,370)		

Nicaragua is characterized by the remarkably large population of the capital city compared to other cities. As of 1995, Managua's population, about 21.3% of the national population, was about 2.2 times the combined population of the three major cities, Leon, Masaya and Chinandega. Regarding population distribution, the Republic of Nicaragua is also characterized by a concentration in the Pacific regions: of the ten largest cities above, seven are located in the Pacific zone, three are in the Central Highland zone and none in the Caribbean zone.

The national strategy for the development of the urban areas through the improvement of land use conditions focuses on the following points.

i. To achieve an even development in the Pacific regions

ii. To reinforce the urban areas in the Central Highland as the core of the system, as well as to create a new urban system to be linked with each other to finalize an urban system network in the Central regions.

iii. To strengthen the areas of comparatively high development potential in the Caribbean regions to join the system network of the central regions.

In order to realize the above development plan, the following strategies have been established in view of the population distribution in the urban areas.

i. Decrease the population of Managua under a decentralization policy

ii. Promote the development of the middle-class cities based on the agricultural potential of their surrounding areas. The middle-class cities are Leon, Granada, Masaya, Chinandega, Esteli, Matagalpa, Rivas, Jinotepe, Bluefields, Diriamba, Corinto, Jinotega, Chichigalpa, Juigalpa, El Viejo, Ocotal, Nagarote, Tipitapa, etc.

iii. Establish a different population plan for the Pacific, Central and Caribbean regions

2.1.2 National Environmental Action Plan

a. Preparation of the Environmental Action Plan

Out of recognition that conservation of the environment is particularly essential for Nicaragua, especially in view of the national conservation strategy for sustainable development (ECODESNIC), the Government of Nicaragua has prepared the National Environmental Action Plan, which became official in December 1993.

b. Environmental Problems and Countermeasures

The environmental problems in the urban areas have been studied during the preparatory work for establishment of the action plan. One of the most marked problem is related to water.

Although Nicaragua is generally blessed with abundant water resources, many of the cities have a shortage of water supply service due to the partial distribution of the water resource, and also to the disparity in urban population distribution, resulting in difficulties in eradicating water-born diseases. Coverage of the sewage system is lower than the water supply allowing poor environmental hygiene to thrive. The service level in the water related sector of Nicaragua is the lowest among the countries in Central America.

The problems of deteriorating quality of water supply sources, e.g., lakes that are potential tourist attraction, have become the subjects to be taken into consideration. In order to deal with the problems, the Ministry of Natural Resource and Environment (MARENA) and the Nicaraguan Institute of Water Supply and Sewage (INAA) have been given the task. MARENA is responsible for the preparation of watershed conservation plans, establishment of restricted areas for water resource development and preparation of water quality standards; INAA should undertake every possible means to manage drinking water and the treatment of DWW.

Another marked problem in urban sanitary environment is the inadequate disposal of solid waste, including industrial and medical solid waste, in many of the cities where population increase is rapid. The National Action Plan describes that the problems should be resolved by each of the concerned city authorities.

2.1.3 Administration and Organization Concerning USE

a. Political and Administrative Division of the Country

The Republic of Nicaragua's political structure is divided into four central powers: Executive (Central Government), Legislative (National Assembly), Judiciary, and Electoral. Municipalities are the political and administrative units of the state, with a deliberative council (Consejo Municipal) and Mayor (Alcalde), all of which are directly elected by the citizens for a four year mandate (starting with the election in 1996 according to the amended constitution).

The country is divided geographically in zones, regions and departments for planning and management purposes, except for two regions (RAAN and RAAS) that have special political and administrative autonomy. Central government authorities may decentralize by establishing offices in various departments or regions headed by a delegate. Delegates are posted in either the departmental or regional capital to oversee the authority's operation within that region or department.

b. Municipal Autonomy and Competence

Municipalities have constitutional, political, administrative and financial autonomies. Constitutional autonomies are stipulated in the Municipalities Law (Ley de Municipios No. 40 - 88), of the Municipal Financing Plan (Plan de Arbitrios Municipal ratified by the central government through Dec. Ejec. No. 455 - 89 for all municipalities except Managua that has an exclusive plan), and would be supported by the pending Tributary Code (Código Tributario).

In order to make the financial autonomy feasible, the eligibility to collect national taxes on real estate (bienes inmuebles) and vehicles (rodamiento) was temporarily transferred to municipalities representing a high percentage of the municipal income.

The 2% Municipal Consumption Tax (IMI : Impuesto Municipal sobre ingresos) was the largest source of income for municipalities, charged together with the national consumption tax of 15% on sales of goods and services. The recent National Tributary System, Law No. 257-97 (published in La Gaceta in June 6, 1997) established the General Value Added Tax (IGV : Impuesto General al Valor) of 15% on sales and importation of goods and services, as well as the reduction of the IMI to 1.5% from January 1, 1998 and to 1% from January 1, 2000.

To compensate the reduction in income, municipalities were allowed to extend the consumption tax to cigarettes and alcoholic beverages levied on consumers and net the producers.

Municipalities have their own obligations and may share them with national institutions such as ministries and institutes. In addition, they may assume Central Government duties and acquire revenue, as part of the decentralization policy. The municipalities may also become affiliated to develop or cooperate in common projects.

c. National Institutions Concerning USE

Ministries and national autonomous bodies (directly under the Presidential Cabinet - Ministerio de la Presidencia) more deeply involved in USE are:

- Ministry of Health (MINSA)

- Ministry of Environment and Natural Resources (MARENA)
- Ministry of Agriculture and Livestock (MAG)
- Ministry of Economy and Development (MEDE)
- Ministry of Construction and Transportation (MCT)
- Nicaraguan Institute of Municipal Development (INIFOM)
- Nicaraguan Institute of Water and Wastewater (INAA)
- Nicaraguan Institute of Territorial (INITER)
- Nicaraguan Institute of Technology (INATEC)

Universities and non-governmental organizations also play an important role that should be extended further.

2.1.4 Legislation on USE

It is very important to keep in mind that the decrees (Decree 27-95, 31-95, 32-95, 33-95) mentioned have not been approved and transformed into laws to date (September 30, 1997) by the National Assembly. Anticipating their approval, these decrees are referred to in this study in view of current political trends.

The main national act is the General Law for Environment and Natural Resources - Law No. 217, June 6, 1996. However, in order to apply most of its contents, supportive regulations must be enacted.

The Sanitary Code - Dec. No. 394, October 21, 1988, regulated by Dec. No. 432, April 17. 1989, is the main national regulation on health and sanitation, at present, and also to complement it is a Sanitary Inspection Regulation - Dec. No. 432, April 17,1989. At a local level, the main legal act, with a strong impact on USE, is the law of Municipalities - Law No. 40, August 17,1988. The National Assembly in discussing a substitute with deep alternations of this Law. National acts that regulate water and wastewater under the responsibility of INAA, and the norms established by this institute, Decree No. 33, June, 26, 1995, also play an important role in regulating domestic, industrial and agricultural wastewater.

The Municipal Tributary Plan - Dec. No. 455, July 31, 1989, and municipal resolutions (Ordenanzas y Acuerdos) usually determine the effectiveness of any action on USE.

Some resolutions of Ministries strongly affect USE, such as norms on agrochemicals (MAG, MARENA) and on land usage and protected areas (MARENA, INETER).

2.1.5 Policy on USE

Nicaragua's current state has shown signs of prosperity: in the past two decades, various foreign organizations have conducted studies that today have contributed to shaping present environmental policies.

Changes in legislation have taken place in a short period, fueling the rapid growth of the institutional structure; development of human resources and evaluation of new proposals have not kept in line with these changes.

The overall situation has seen many advances, however, implementation of plans have been rather chaotic at times. Details on "Policies on USE" are presented in Annex B, Volume IV.

2.1.6 National Economy

a. GDP and Per Capita GDP

The Central Bank of Nicaragua (BCN) has announced the Gross Domestic Product (GDP) on a yearly basis. Annual figures tend to be constant, therefore, the latest figures published in August 1996 are adopted in this study. The GDP in the period from 1987 to 1989, which were not reported in the previous publication, are based on the "Statistical Summary 1987-1991" published by INEC (refer to Table 2-2).

This table shows that GDP had decreased from C$21.1 billion in 1987 to C$18.1 billion in 1993, and has increased rapidly to C$19.5 billion in 1995 (all figures are measured at constant price (1980)). The figure in 1995 was 92.5 percent of that in 1987.

Table 2-2: Changes in GDP of Nicaragua

	Unit	1987	1988	1989	1990	1991	1992	1993	1994	1995
GDP	C$ million in 1980	21,100	18,473	18,159	18,156	18,127	18,202	18,136	18,743	19,523
Growth Rate	%		-12.4	-1.7	0.0	-0.2	0.4	-0.4	3.3	4.2

Sources: Compendio Estadistico, INEC 1987-1991
Indicadores Economicos Agosto 1996, BCN
Growth rate is calculated by JICA Study Team

Concerning per capita GDP, the figure given will be amended because the population, as a denominator, has to be revised as a result of the population census survey in 1995.

The per capita GDP announced was estimated at C$4,716 at a constant price (1980) (about US$ 463) in 1995 based on the estimated population of 4,139,600.

b. Employment

Figures for the economically active population should be revised in accordance with the revision in population estimates. The rate of economically active population in 1995 was announced as 35.2 percent. The figure of employed persons in 1995 was 1,193,800 within the economically active population: these figures show that the unemployment rate may be calculated as 22.2 percent, which is higher than the 18.2 percent announced by BCN.

The population census survey in 1995: 4,357,100
The economically active population:

$$4,357,100 \times 35.2/100 = 1,533,700$$

Unemployment rate:

$$(1,533,700 - 1,193,800)/1,533,700 \times 100 = 22.2$$

The unemployment rate in the eight major cities was announced as 14.8 percent in 1995. About 58 percent of employees work in the informal sector, and the rate of sub-utilized work force, which is the sum of unemployment and under-employment, reaches 42.3 percent.

2.2 Leon

2.2.1 Definition of the Study Area

At the meeting of the discussion on the inception report (IC/R) for the Study, the Nicaraguan side requested to expand the boundary of the Study Area from that shown in the IC/R. Although the boundary of the Study Area of the IC/R was defined as the present (1995) urban area in the S/W (scope of work) for the Study, agreed upon between INIFOM and the JICA Preparatory Study Team in November 1995, the Team agreed that the expansion will be the urban limit in the target year 2010, on condition that the Nicaraguan side clarify and provide information necessary for projecting the improvement plan of USE, such as proposed boundary, projected population, etc., in the target year 2010.

Based on the above-mentioned discussion, counterparts from Leon Municipality presented a map showing the boundary of the urban area of Leon City in 1995 (see Figure 2-1) and the urban expansion area for 2010. Consequently the Study Area for the city of Leon covering about 43 km^2, was defined as the projected urban area in 2010 as shown in Figure 2-2.

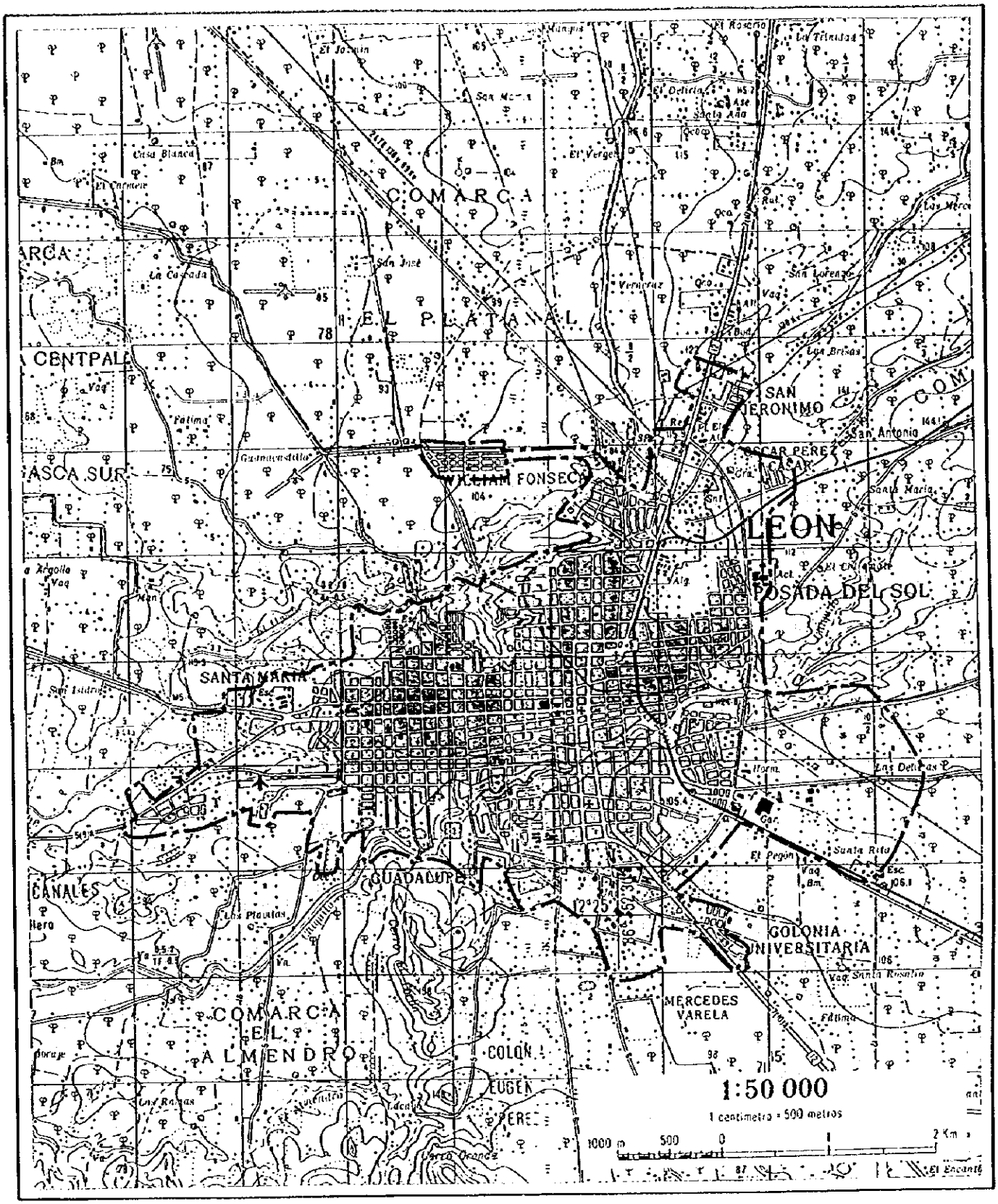


Figure 2-1: Urban Area of Leon in 1995

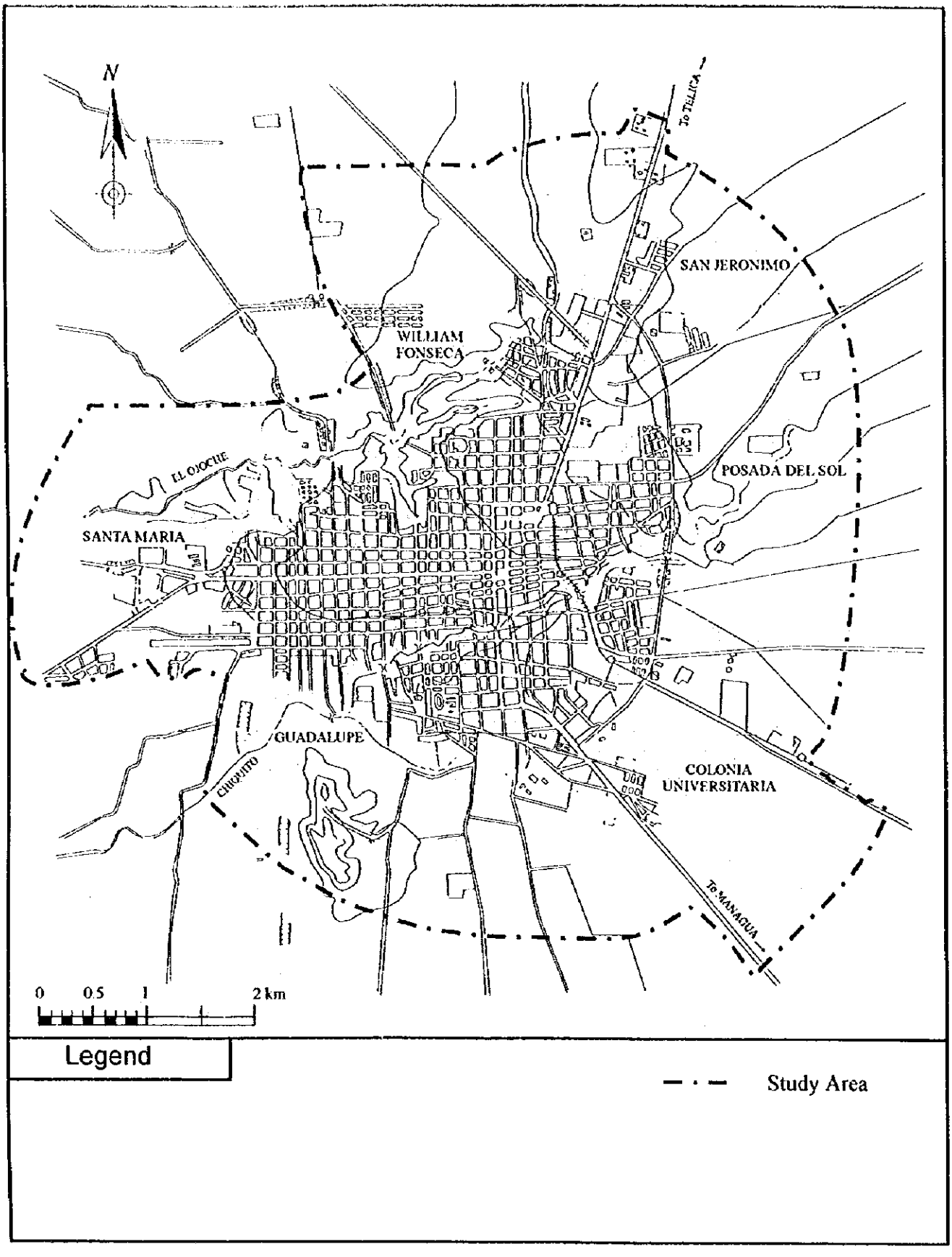


Figure 2-2: Study Area in Leon

2.2.2 Local Conditions

a. Location and Area

The city of Leon is located on a gently sloping area off the western coastal plain of Nicaragua.

The "Mesa de Tamarindo" plateau is located south, south-west of Leon. The Plain of Leon, therefore, is situated between the volcanic mountain range and the Tamarindo plateau.

Leon City falls between the northern latitude of 12°25' and 12°28' and 86°51' and 86°55' longitude. It has an elevation ranging from 120m in the east to 80m in the west.

b. Climate and Hydrology

b.1 Precipitation

The rainy season usually begins in May and ends at the beginning of November. The peak monthly rainfall is more or less 300 mm in September. The dry season is from November to April. Monthly precipitation in the dry season is usually limited to less than 20 mm and usually zero in January and February.

About 95 % of the annual rainfall occurs in the rainy season, while the remaining 5 % falls in the dry season.

b.2 Hydrology

The city has only two perennial rivers, namely El Ojoche and Chiquito. El Ojoche, which originates from the northern end of the city area, flows W-S-Westerly direction to join the Chiquito River at Cristobal Caballero about 6 km west from the city center.

c. Geology and Hydrogeology

c.1 Geological structure

The gently sloping plain on which Leon is situated extends to or near the western edge of the Nicaraguan Depression. The basement rocks of the area consist of the Tamarindo Formation, which is composed of hard and compact ignimbrite rocks formed during a period of active volcanism in the Miocene of the Tertiary Period.

c.2 Hydrogeology

The area has a relatively high potential for groundwater development because the thick volcanic deposits are characterized by high permeability and high storativity, and also due to its gently sloping topography.

2.2.3 Social Conditions

a. Administration

As established in Law No. 40 - 88, and in a Constitution amendment in 1996, the municipal government is made of the Municipal Council (ten councilors directly elected by the citizens) and the Executive Organ, composed by the mayor and vice-mayor, all them directly elected by the citizens.

a.1 Executive Structure and Some Relevant Procedures

Under the Mayor and Vice Mayor are the four departments and four divisions, employing a total of 517 employees.

a.2 Support from MINSA

Since 1992 MINSA has appointed specialists on sanitation and environment to the municipality, aiming to coordinate the two.

Direct activities of MINSA are performed through the SILAIS of the Leon Department, that is extended to ten municipalities offering the services presented in the flowchart in Annex B. Within the municipality of Leon, SILAIS operates through the executive divisions that offer personal and environmental assistance.

There is a good relationship between SILAIS, the municipal government and the University of Leon.

a.3 Relevant Aspects of the Municipal Budget (MB)

Some indices may be calculated from the MB summarized in Annex B for a macro-analysis of the 1995 and 1996 budgets:

TsI /MB =	0.41
HI / MB =	0.08
D / MB =	0.35
R / MB =	0.13
MiT / TsI =	0.62
MT / TsI =	0.28
R / TsI =	0.33

Other indices may be calculated for a specific analysis, taking Relevant Costs as = RC = PpE + (S.M.P):

WRC =	5097
MkRC =	1817
A RC =	576
WT / WRC =	0.71
MkT / MkRC =	1.19
AT /ARC =	0.79

Note: **TsI**: Tax Incomes **MB**: Municipal Budget **HI**: Heritage Incomes
D: Donations **R**: Recoveries **MiT**: Municipal Imposed Taxed
MT: Municipal Taxes **RC**: Relevant Costs **PpE**: Permanent Personnel
SMP: Municipal Services **WRC**: Relevant Costs
MkRC: Markets Tax Covers the Relevant Costs
ARC: Abattoir Taxes Cover the Relevant Costs **WT**: Waste and Cleansing
MkT: Municipal Taxes **AT**: Municipal Abat

Some conclusions are as follows:

- Taxes correspond to 41% of the MB, and 35% is from foreign donations.
- In proportion to the total tax income (TsI), direct municipal taxes for services and usage (MT) correspond to only 28%, and imposed taxes (MiT) correspond to 62% (these were national taxes provisionally transferred to the municipalities).
- 49% of TsI correspond to the tax on sales and services.
- Outstanding debts reach 33% of TsI.
- The waste & cleaning tax covers 71% of the relevant costs (RC) of the services.
- Market and abattoir taxes cover 119% and 79% of the services respectively.

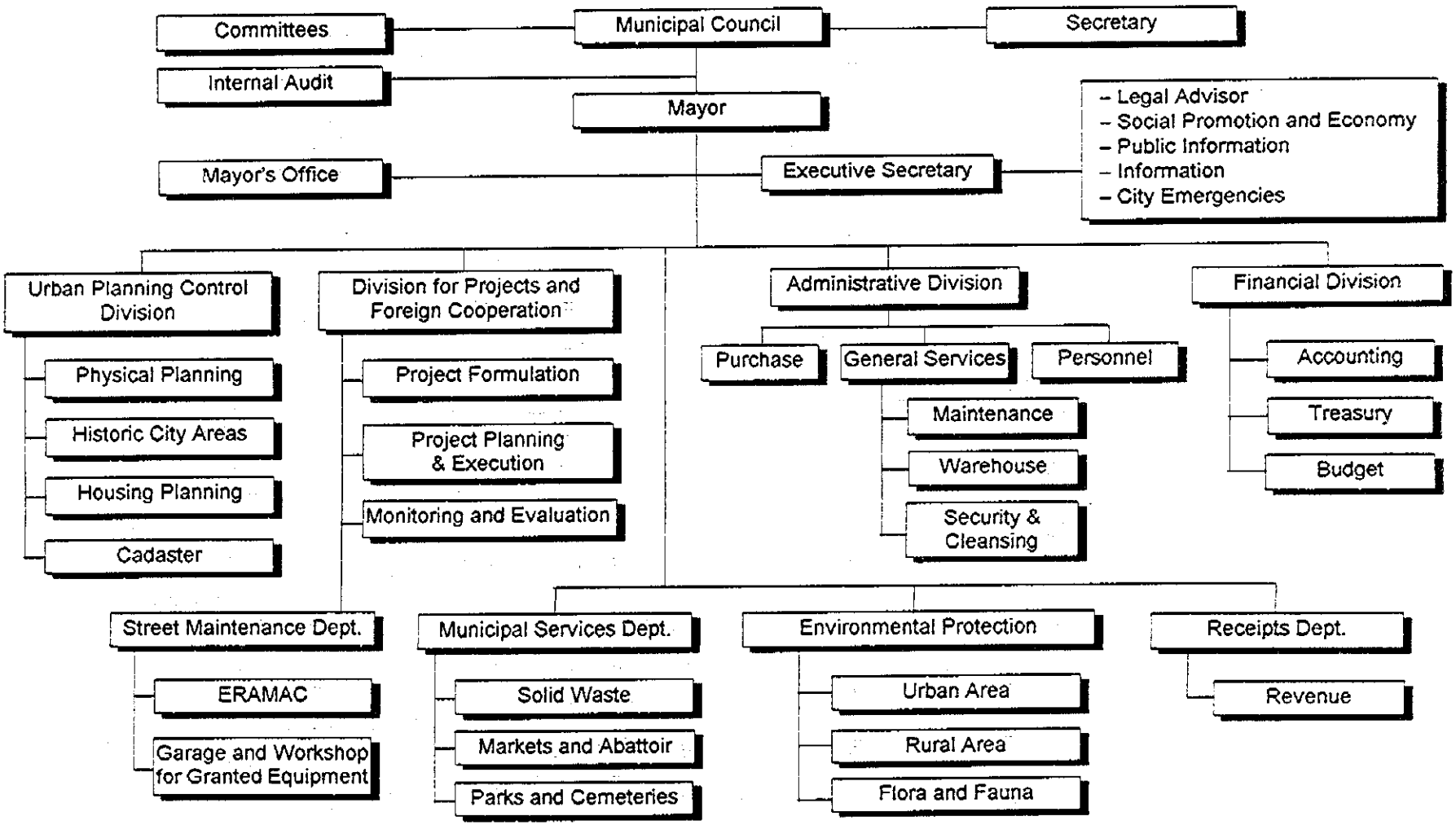


Figure 2-3: Organization Chart of the Municipal Government of Leon

b. Employment

"Statistics of socio-labor in Leon City" surveyed by the ministry of work (MITRAB) reported that the number of employees in Leon was 40,768 in 1994. From that data, the unemployment rate can be calculated as 10.3%. The major economic activity is "social, community services", with 16,688 people involved, followed by "commerce, restaurant and hotel", with 11,312. The employees of these two major activities occupied about 70 percent of the total. The employees in the informal sector was 63 percent, involving 25,816 people, therefore the EAP seems considerably low.

c. Income Level

"Department of Leon" edited by INAA reported that the average monthly income per household in Leon was C$961 in 1994. The above mentioned survey by MITRAB reported that 30.5% of households had a monthly income of less than C$500.

INSSBI reported that the average weekly salary of was C$249.02.

2.2.4 Population of Leon

a. Population by Municipality in Leon Department

With a population of 336,894 (INEC 1995 final census data), the department of Leon represents 7.7% of the country's total population. Occupying a land area of 5,107 km², it has a population density of 66 persons/km². The department is made up of 10 municipalities: Leon, Quezalguaque, Telica, Larreynaga, El Sauce, Achuapa, Santa Rosa del Peñón, El Jicaral, La Paz Centro and Nagarote.

Forty eight percent of the department's population is focused in the municipality of Leon, which is inhabited by 161,530 people.

b. Population of the Urban Area of Leon Municipality

With 123,865 inhabitants in a land area of 19.09 km², the urban area of Leon Municipality has a population density of 6,488 persons/km², as shown in Table 2-3.

Table 2-3: Urban and Rural Area Population of Leon Municipality

Leon	Area (km²)	Population (1971)	Population (1995)	Population Density (p/km²)	Growth Rate (1971/1995)
Urban Area	19.09	54,841	123,865	6,488	3.45
Rural Area	800.91	20,743	37,665	47	2.52
Total	820.00	75,584	161,530	197	3.21

Source : Population data (INEC); Growth rates estimated by the Study Team

The above 1995 population census placed the total population of the municipality of Leon at 161,530 people. The table above also indicates that the urban area of Leon covers 76.7% of the total municipal population.

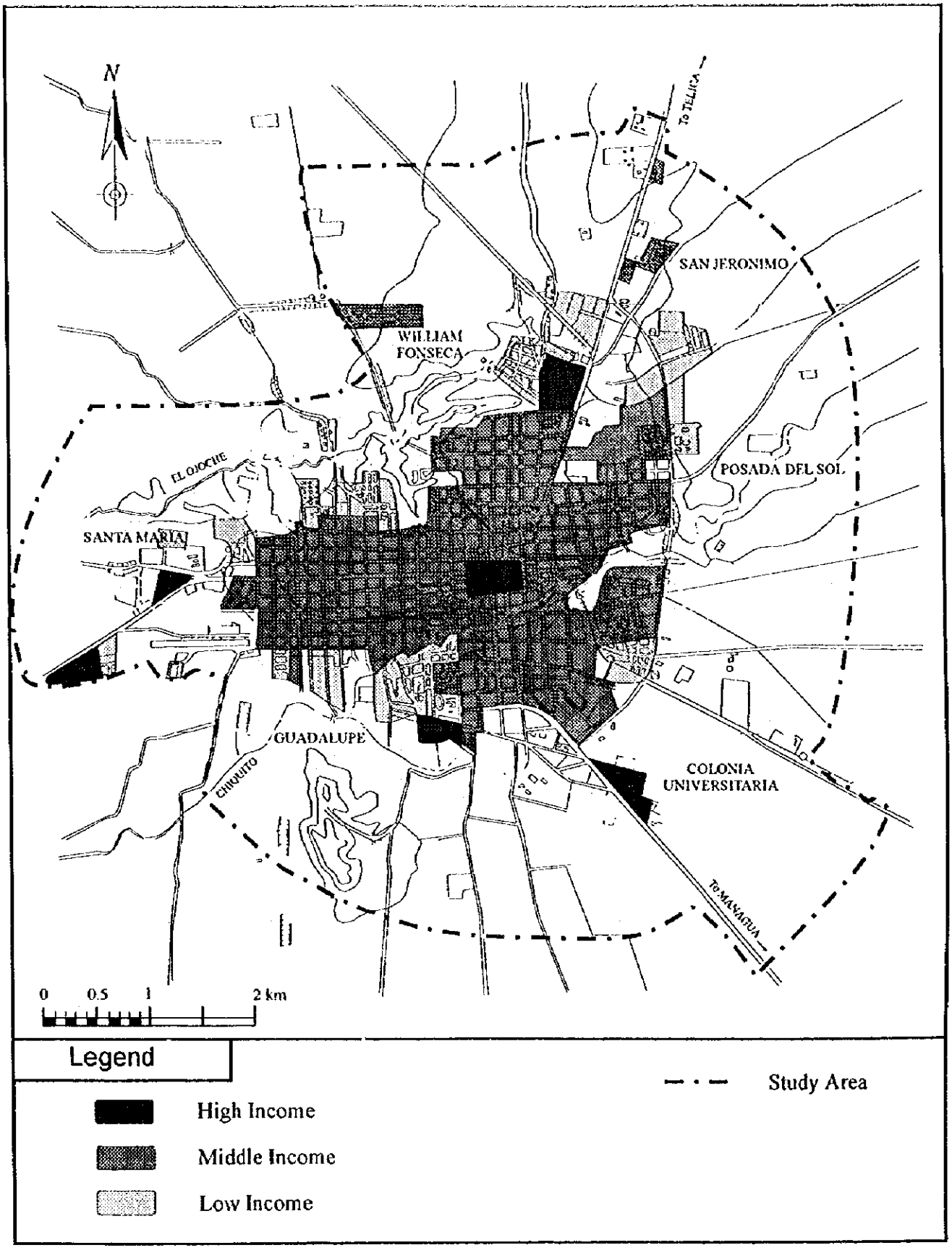


Figure 2-4: Zones Categorized by Income in Leon

2.2.5 Housing Conditions in Leon

a. Housing

a.1 General

According to INEC, housing units in 1995 totaled 145,192: 57,606 in Leon Department, 60,780 in Chinandega Department, and 26,806 in Granada Department.

Among the municipalities, Leon has the highest number of housing units with 28,066, followed by Chinandega with 20,324, and Granada with 16,731. As for the urban areas, Leon has also the highest number of urban housing units (21,906), followed by Chinandega (16,935) and Granada (12,651).

Table 2-4: Number of Housing Units in Leon Department

Municipality	1971			1995			Growth Rates		
	Total	Urban	Rural	Total	Urban	Rural	71/95 (T)	71/95 (U)	71/95 (R)
1. Leon	14,796	6,165	8,631	28,066	21,906	6,160	2.70	5.42	-1.40
2. Achuapa	963	722	241	2,129	429	1,700	3.36	-2.15	8.48
3. El Jicaral	300	234	66	1,652	104	1,548	7.37	-3.32	14.05
4. Larreynaga	2,369	1,389	980	4,855	849	4,006	3.03	-2.03	-
5. Nagarote	2,192	1,063	1,129	5,425	3,596	1,829	3.85	5.21	2.03
6. La Paz Centro	1,994	1,040	954	4,631	2,951	1,680	3.57	4.44	2.39
7. Quezalguaque	300	250	50	1,294	178	1,116	6.28	-1.41	13.81
8. El Sauce	1,515	1,008	507	4,346	1,314	3,032	4.49	1.11	7.74
9. San Nicolas *	278	252	26	-	-	-	-	-	-
10. S.R.del Penon	476	386	90	1,453	368	1,085	4.76	-0.20	10.93
11. Telica	1,126	787	339	3,755	1,057	2,698	5.15	1.24	9.03
Total	26,309	13,296	13,013	57,606	32,752	24,854	3.32	3.83	2.73

Source : Population Census Data, 1995 (INEC)

a.2 Housing Conditions in the Urban Area of Leon Municipality

According to INEC, the urban area of Leon has about 21,906 housing units as of 1995, with an average of 5.7 persons/household.

2.2.6 Urban Structure

a. City Development Plan

The municipal government of Leon prepares plans for urban development and the improvement of the city's various public systems. With the aim to establish urban integration, the municipal government has been working on urban development programs since 1990, laying down objectives for the present and future integrated development of the city.

Preliminary studies such as "Territorial Planning of Leon" and "Urban Development Planning", were conducted by the municipal government in cooperation with INETER (December 1993).

Based on these studies, the municipal government of Leon formulated the "Structural Master Plan" in January 1996 in cooperation (technical assistance and finance) with the municipality of Utrecht (Holland) for the development of urban and rural areas in Leon, and for the strategic implementation of development proposals.

The Structural Master Plan is made up of two parts:

- Master Plan Main Report 1995-2010
- List of Strategical Projects 1995-2000

The main report describes the long term objectives of physical and economic development strategies and plans (1995-2010). The list of strategic projects consists of projects for the implementation plans to achieve the objectives of the main report (1995-2000).

The municipal government is responsible for the formulation of the main report, but the implementation of the strategic projects involves several institutions.

b. Current Land Use

The land use map covering the entire city area was prepared based on the information provided by the municipal government of Leon. The total land area was estimated at 1,909 ha, and the current land use conditions in the area are summarized in Table 2-5. The current common land use is shown in Figure 2-4.

Table 2-5: Current Land Use Conditions in Urban Area of Leon

Land Use		Area Coverage (ha)	Area Coverage (%)
Housing		927.9	48.6
Mixed Area (housing/commercial/service)		254.4	13.3
Commercial/Service		65.0	3.4
Public/Social Institutions		123.9	6.5
Industrial Area		83.3	4.4
Green Area	Forest	30.8	1.6
	Sport recreation	53.3	2.8
	Cemetery	28.0	1.5
Technical Installation		40.1	2.1
Vacant Area		302.3	15.8
Total		1,909.0	100.0

Source : Municipal Government of Leon (1996)

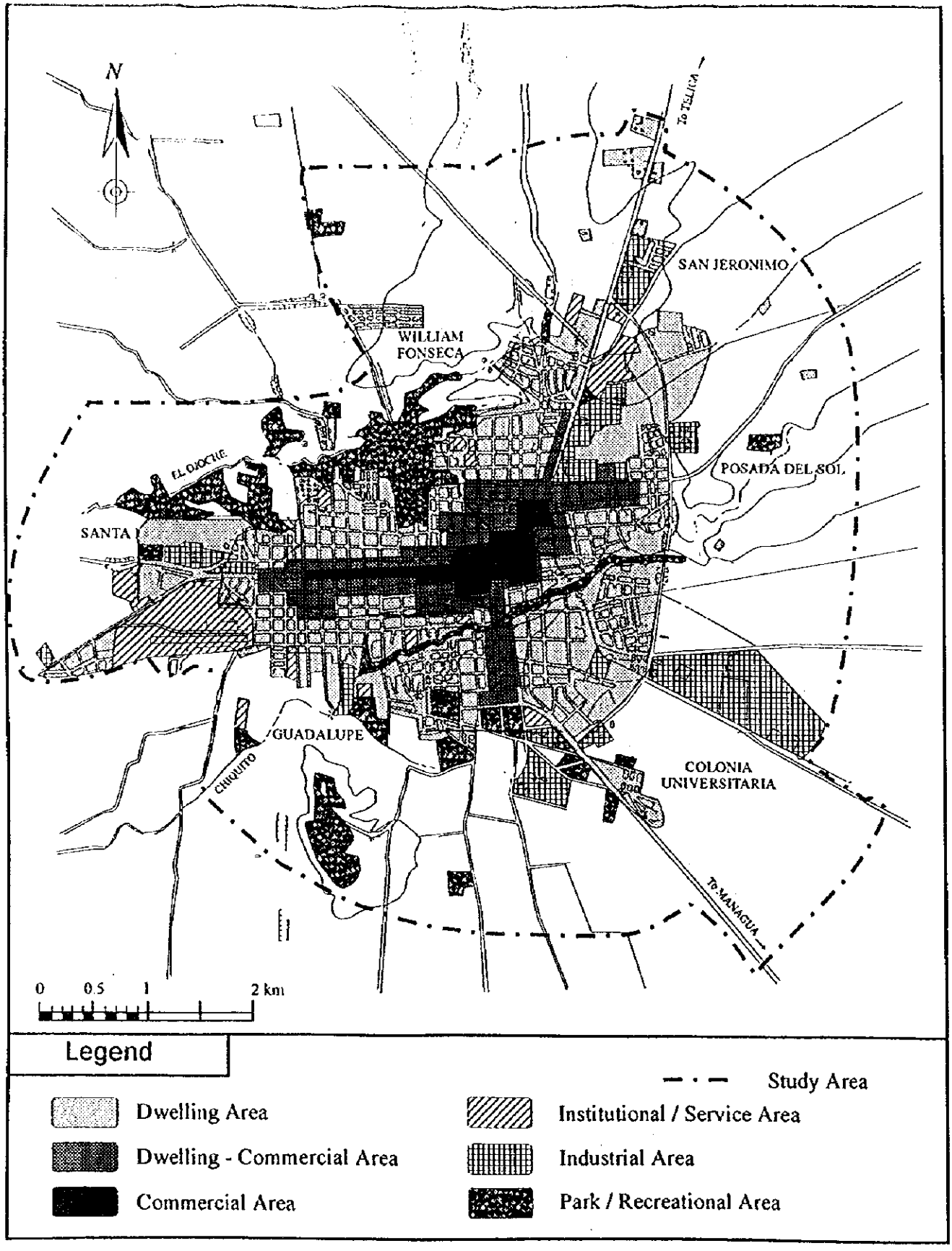


Figure 2-5: Current Land Use in the Urban Area of Leon

c. Industry

The city of Leon has 305 industrial establishments: food processing factories (55%), textile and leather factories (24.9%), factories for the manufacture of wooden products (5.4%), chemical factories (9.2%), and others (5%). These establishments are mostly concentrated in the northeast zone, along the highway to Chinandega. Some of the important establishments are sporadically located along the city periphery by-pass. Leather factories are usually located along the Chiquito River, while other small industries are dispersed within the urban area of Leon.

d. Infrastructure

d.1 Road Transport

Road transportation is the main means of transportation in the city. There are 70 public transportation units in the city: small trucks (54%), microbuses (24%) and buses (22%). There is also a local taxi company with 214 units.

d.2 Road Network

d.2.1 General

The development of a road network is important for the establishment of future growth trends, the development of city infrastructure, and the improvement of the urban sanitation environment in the three principal cities.

d.2.2 Road Network in the City of Leon

Roads in the city are arranged in a grid formation, radiating from the central area towards the outlying districts. Totaling 226.4 km, they are paved either in asphalt, stone blocks, rubble stones or macadam, or are unpaved. Roads in Leon are mostly paved with stone blocks or asphalt.

The proposed and planned road network of the urbanized area provided by the municipal government of Leon is shown in Figure 2-6.

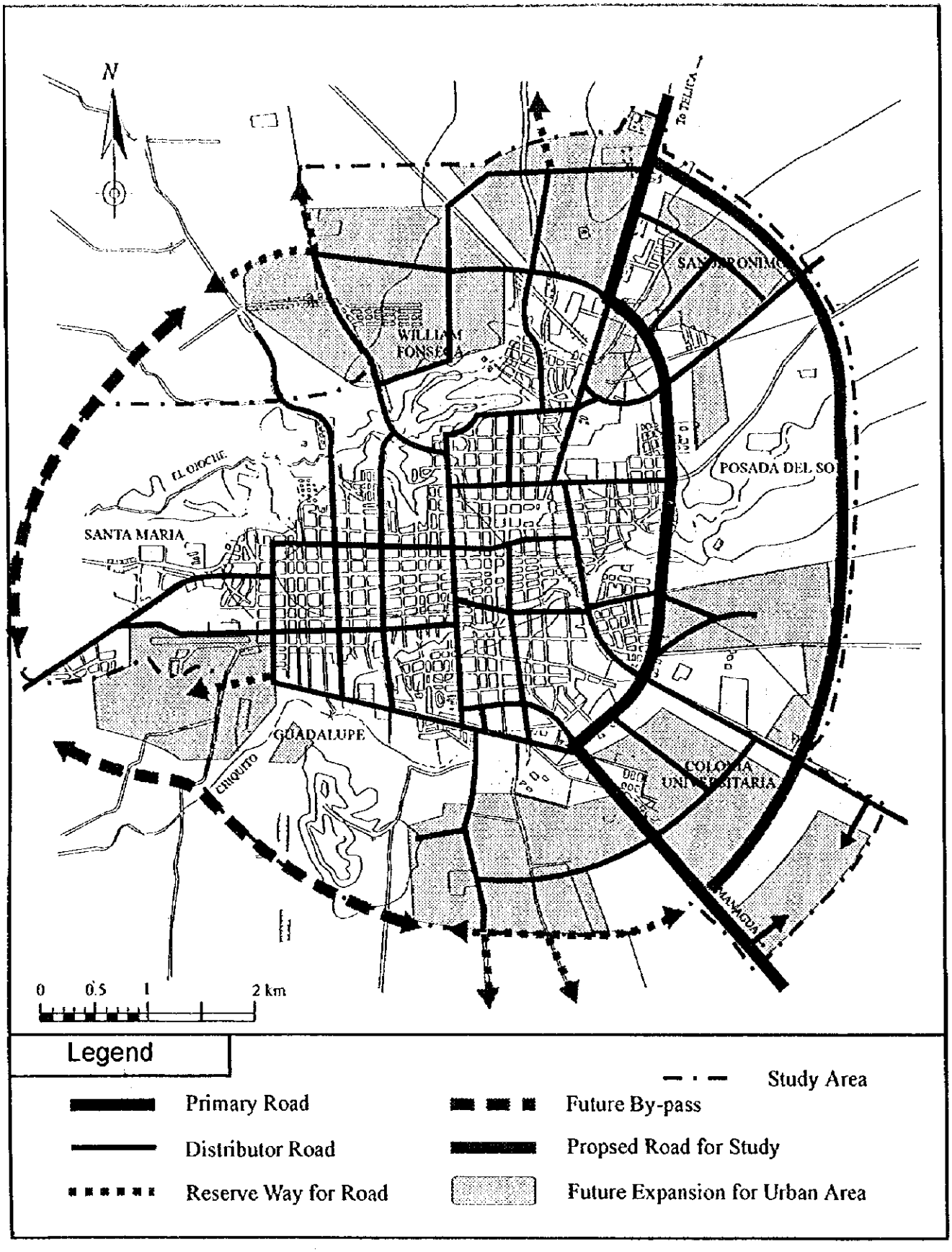


Figure 2-6: Planned Road Network in Leon

2.2.7 Economic Conditions

a. Regional Economy

There is no study on Gross Regional Domestic Product (GRDP) in Nicaragua. The basic data needed to estimate GRDP such as industrial production and commercial sales and services according to regions are too dated to estimate the current GRDP.

In this study, GRDP is estimated by calculating the share of each economic activity in Leon to the whole country. The income of each economic activity is calculated by the average salary multiplied by social security contributions. The calculation results are shown in Table 2-6.

Table 2-6: GRDP in Leon Region in 1991 and 1995

Unit : C$ million in 1980

	1991		1995	
		%		%
Total	1,282.1	100.0	726.8	100.0
Primary Sector	253.5	19.8	204.0	28.1
Secondary Sector				
Manufacturing	176.7	13.8	148.6	20.5
Construction	32.6	2.5	45.6	6.3
Mining	2.8	0.2	41.3	5.7
Tertiary Sector				
Commerce	112.6	8.8	67.4	9.3
Government	106.5	8.3	125.2	17.2
Transport & Communication	42.0	3.3	20.3	2.8
Bank, Security & others	23.2	1.8	18.4	2.5
Electric, Gas & Water Supply	3.0	0.2	11.7	1.6
Property & Dwelling	29.8	2.3	24.1	3.3
Other Services	499.3	38.9	20.2	2.8
Population			336.894	
GRDP/capita			2,157.3	

Source : Calculated by JICA Study Team based on;
Anuario Estadistico 1995, INSSBI
Informe Anual 1995, BCN
Compendio Estadistico 1987-1991, INEC

The GRDP in 1995 was 57 percent of 1991 because of the drastic decline in other service activities. Major activities such as agriculture, manufacturing and commerce decreased in 1995. GRDP in current price calculated in the same way is C$512 million.

GRDP per capita in 1995 was C$2,157 in constant price (1980), which is 48 percent of GDP per capita (C$4,481) in the same period.

2.2.8 Relevant Studies and Projects

Data and information regarding studies and projects realized in Leon, which are related with this Study, were obtained from the counterpart. Section B.2.8 in Annex B, lists those studies and projects.

2.3 Chinandega

2.3.1 Definition of the Study Area

At the meeting of the discussion on the inception report (IC/R) for the Study, the Nicaraguan side requested to expand the boundary of the Study Area from that shown in the IC/R. Although the boundary of the Study Area of the IC/R was defined as the present (1995) urban area (see Figure 2-7) in the S/W (scope of work) for the Study, agreed upon between INIFOM and the JICA Preparatory Study Team in November 1995, the Team agreed that the expansion will be the urban limit in the target year 2010, on condition that the Nicaraguan side clarify and provide information necessary for projecting the improvement plan of USE, such as proposed boundary, projected population, etc. in the target year 2010.

Based on the above-mentioned discussion, counterparts from Chinandega Municipality presented a map showing the boundary of the urban area of Chinandega City in 2010. Consequently the Study Area for the city of Chinandega covering 16.10 km^2, was defined as the projected urban area in 2010 as shown in Figure 2-8.

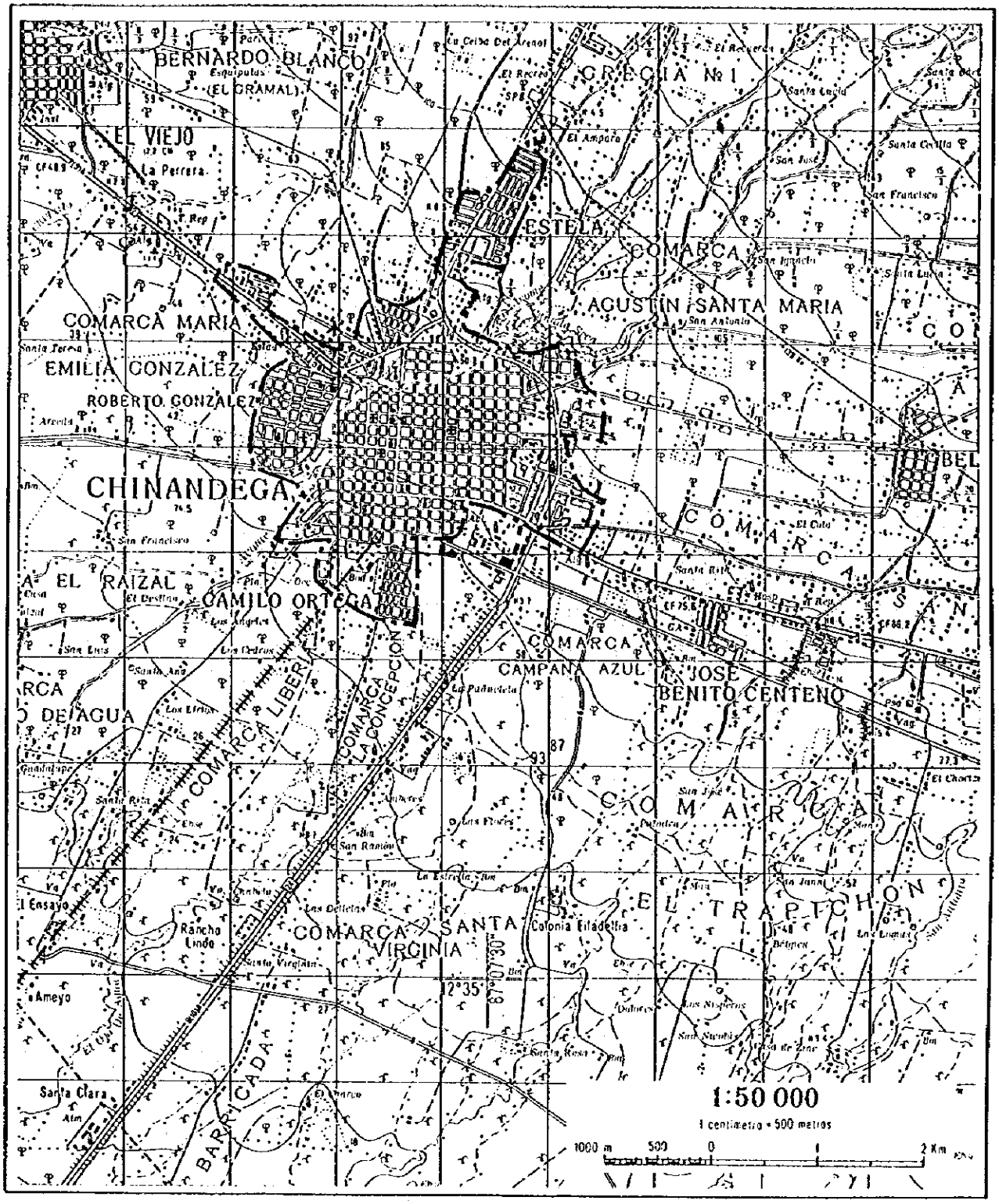


Figure 2-7: Urban Area of Chinandega in 1995

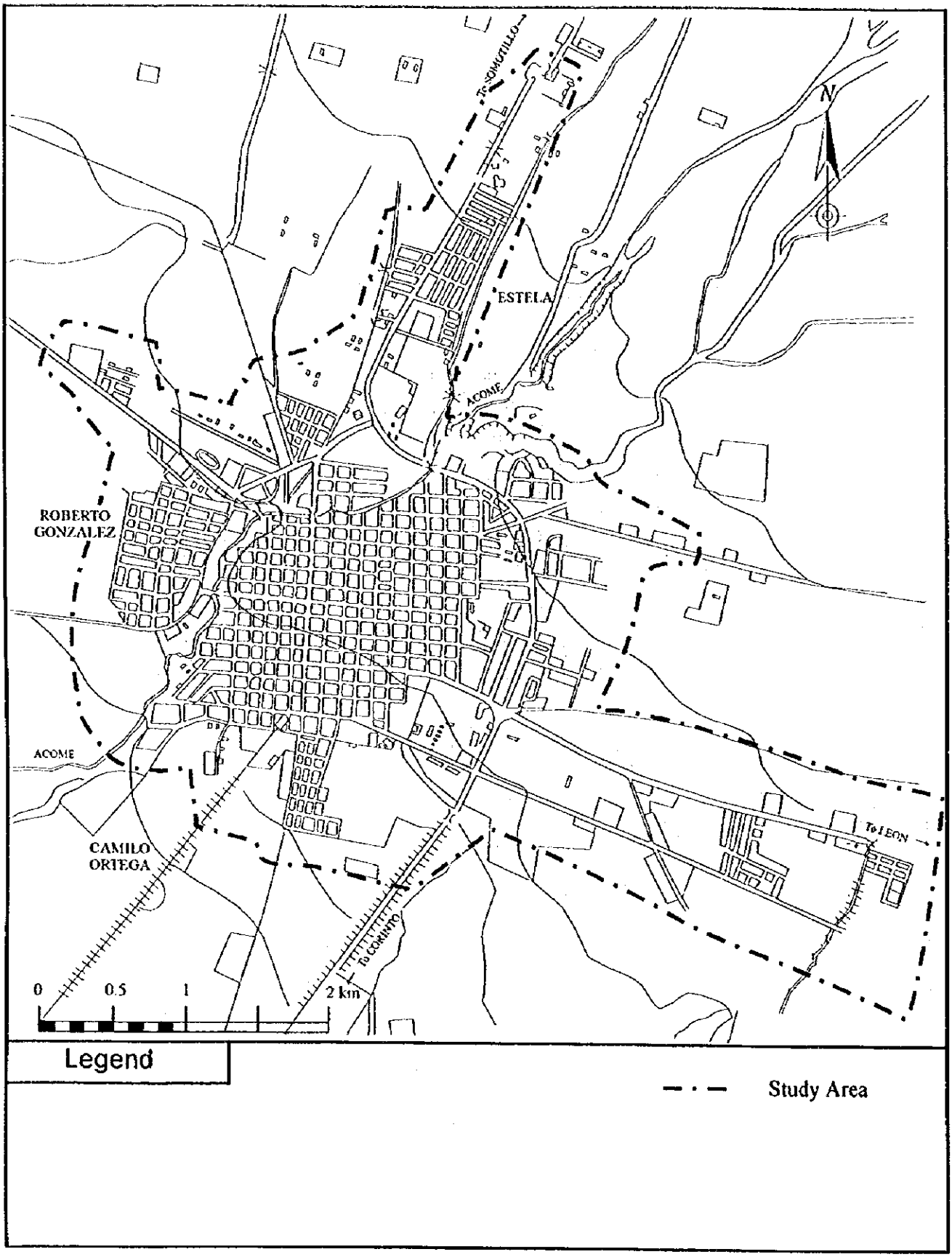


Figure 2-8: Study Area in Chinandega

2.3.2 National Conditions

a. Location and Area

The city of Chinandega is located on the northern part of the Pacific coastal plain, extending from the gently sloping foot of the Los Maribios mountain range.

The urbanized area is nearly 800ha, lying between 12°37' to 12°40' latitude and 87°06' to 87°09' longitude, with an elevation ranging from 40m in the southwest to 100m in the northeast.

b. Climate and Hydrology

b.1 Precipitation

According to the 28-year precipitation record from 1966 to 1993 taken at the station near the center of Chinandega City, the average annual precipitation is 1,920mm, the lowest recorded was1,085mm in 1972 and a maximum of 2,506mm in 1982. Usually, more than 90% of the total rainfall amount occurs in the rainy season between May and October, and there is hardly any rain in the dry season between November and April.

b.2 Hydrology

The major river system in the city of Chinandega is Acome River which originates northeast of the city and flows in a south-westerly direction. After flowing through the city area, Acome turns westward to join Atoya River at a point 9 km west from the city center. Acome River is an intermittent river; its flow is remarkably reduced in the dry season, and occasionally no flow is observed at the end of the season.

c. Geology and Hydrogeology

c.1 Geological Structure

The geological structure and composition of the Chinandega City area are similar to that of Leon, namely, the area is situated near the western edge of the Nicaraguan Depression, having the formations of Tamarindo as a basement, Las Sierras and the recent deposits of volcanic falls or flows in ascending order.

c.2 Hydrogeology

Similar to Leon, Chinandega City area has an abundance of groundwater resource. Since most of the area is covered by highly permeable soil, rainwater immediately infiltrates the ground reducing surface water runoff and also water loss by evapotranspiration.

2.3.3 Social Conditions

a. Administration

As established in Law No. 40 - 88, and in a Constitution amendment in 1996, the municipal government is made up of the Municipal Council (ten councilors) and the Executive Organ, composed by the mayor and the vice-mayor, all them directly elected by the citizens.

a.1 Executive Structure and Same Relevant Procedures

A new executive structure was recently approved by the Municipal Council, and the corresponding "Functions Handbook" would be approved shortly. The concept of this structure was created by an advisor from the Danish twin city of Eindhoven, and consists of three director level departments: Department of Municipal Services and Environment (the largest), Department of Urban Development and the Department of Finance. The cadastre will be relocated into the Department of Finance.

a.2 Support from Ministries and National Entities

The local SILAIS performs hygiene inspections at markets and abattoirs, and vermin control including fumigation, with the aid of ACEM -Malaria Control and Eradication Area. MAG should also inspect the markets.

It is important to consider that municipalities have several responsibilities fixed by the Law of Municipalities. However, this does not include authorization to impose strong sanctions such as closure of an establishment. Thus they need support from national authorities, mainly MINSA, that exercises the Sanitary Code, MARENA, the principal agency that enforces environmental laws, and INAA, the agency that manages all water and wastewater systems. Sewer nets that are poorly maintained encourage illegal discharge into the stormwater drainage system (surface or pipes), and insufficient supervision by INAA and the municipality promotes mixing of both stormwater and wastewater.

These facts are common in Chinandega and generally throughout the country.

INAA studied groundwater supply for Chinandega with the support of a Canadian Agency.

MARENA studied the hydrographic basins in Chinandega and conducted an Environmental Diagnosis on surface and groundwater.

SILVAH (Local Information System on Housing and Human Settlements) performed an inquiry into housing conditions in Chinandega.

As a newly developed nation, the Urban Development Plan for this city established in 1987 is considered dated and obsolete.

MCT sets standards for roads which are also used for urban structure.

a.3 Relevant Aspects of the Municipal Budget (MB)

Some indices may be calculated from the MB summarized in Annex B for a macro analysis of the 1995 and 1996 budgets:

TsI/MB=	0.86
HI/MB=	0.00
D/MB=	0.00
R/MB=	0.13
MiT/TsI=	0.52
MT/TsI=	0.25
R/TsI=	0.15

Other indices may be calculated for a specific analysis, taking Relevant Costs as

= RC =PpE + (S.M.P):

WRC=	4630
MkRC=	3241
ARC=	975
WT/WRC=	0.32
MkT/MkRC=	1.05
AT/ARC=	0.89

Some conclusions are as follows:

- Taxes correspond to 86% of the MB and there are no foreign donations.
- In proportion to the total tax income (TsI), direct municipal taxes for services and usage (MT) correspond to only 25%, and imposed taxes (MiT) correspond to 52% (these were national taxes transferred provisionally to the municipalities).
- 42% of TsI correspond to the tax on sales and services.
- Outstanding debts reach 14% of TsI.
- The waste & cleansing tax covers 32% of the relevant costs (RC) of the services.
- Market and abattoir taxes cover 105% and 89% of the services respectively.

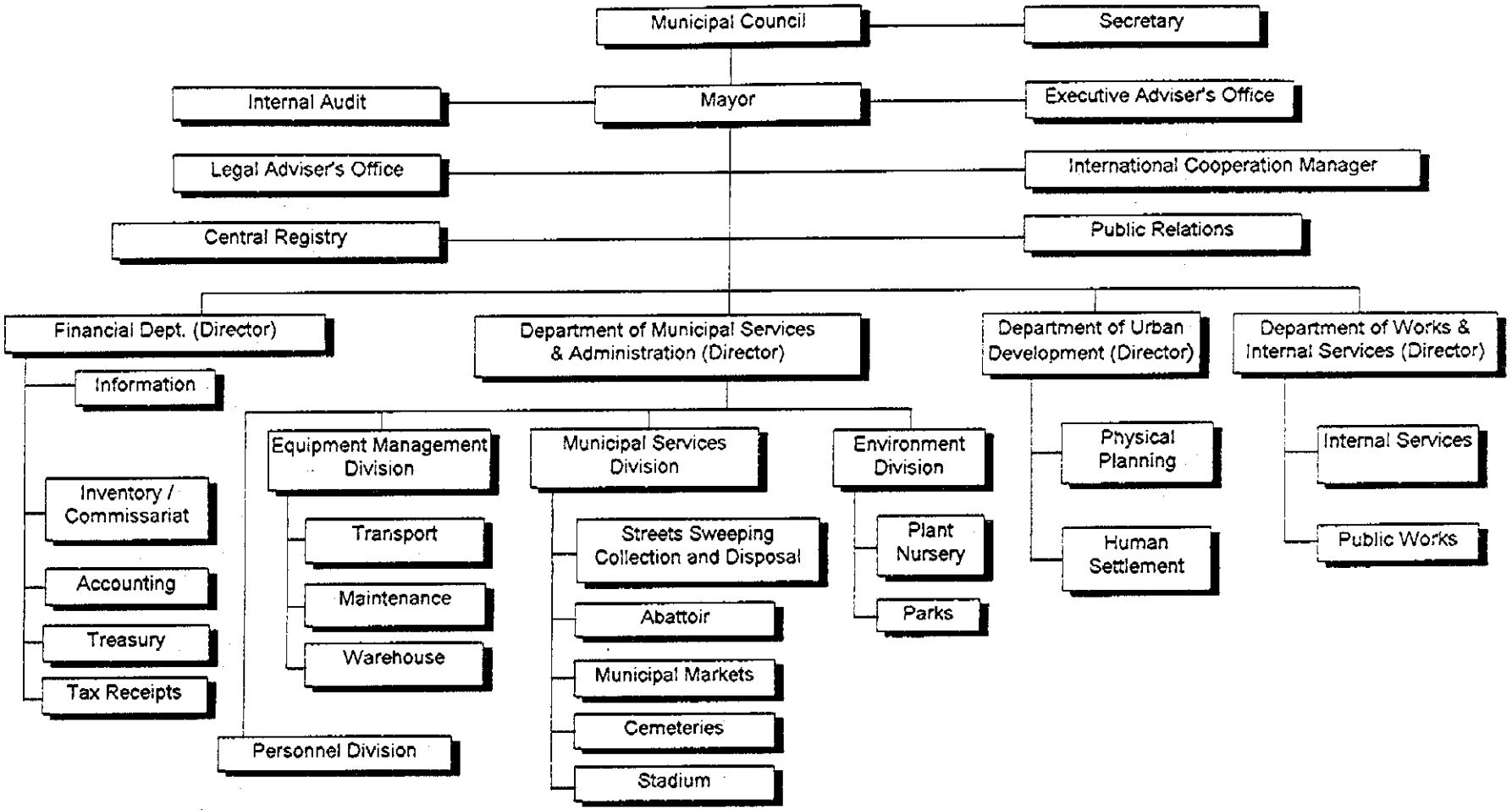


Figure 2-9: Organization Chart of the Municipal Government of Chinandega

b. Employment

"Statistics of socio-labor in Chinandega City" surveyed by MITRAB, reported that the number of employees in Chinandega was 23,464 in 1994. From that data, the unemployment rate can be calculated as 8.5%. The major economic activity is "commerce, restaurant and hotel", with 7,616 people involved, followed by "social, communal services", with 7,392. Employees of these two major activities occupied about 64 percent of the total. The employees in the informal sector shared 60 percent, involving 14,000 people, therefore the EAP seems considerably low.

c. Income Level

The above mentioned survey by MITRAB reported that the number of households with an income of less than C$500 per month was 29.4 percent and those with an income between C$ 501 and 1,000 per month was 30.3 percent, which is a little higher than Leon.

INSSBI reported that the average weekly salary was C$273.27.

2.3.4 Population of Chinandega

a. Population by Municipality in Chinandega Department

The department of Chinandega covers an area of 4,926 km². It has a population density of 71 persons/km² and comprises 13 municipalities: Chinandega, Chichigalpa, Cinco Pinos, Corinto, Puerto Morazan, Pozoltega, El Realejo, San Francisco, San Pedro, Santo Tomas, Somotillo, El Viejo and Villa Nueva.

Over thirty three percent of the department's total population is concentrated in the municipality of Chinandega, which is inhabited by 117,037 people.

b. Population of the Urban Area of Chinandega Municipality

With 97,387 people in a land area of 16.10 km^2, the urban area of Chinandega Municipality has a population density of 6,049 persons/km^2.

Table 2-7: Urban and Rural Area Population of Chinandega Municipality

Chinandega	Area (km^2)	Population (1971)	Population (1995)	Population Density (p/km^2)	Growth Rate (1971/1995)
Urban Area	16.10	29,922	97,387	6,049	5.04
Rural Area	630.90	15,376	19,650	31	1.03
Total	647.00	45,298	117,037	181	4.03

Source : Population data (INEC); Growth rates estimated by the Study Team

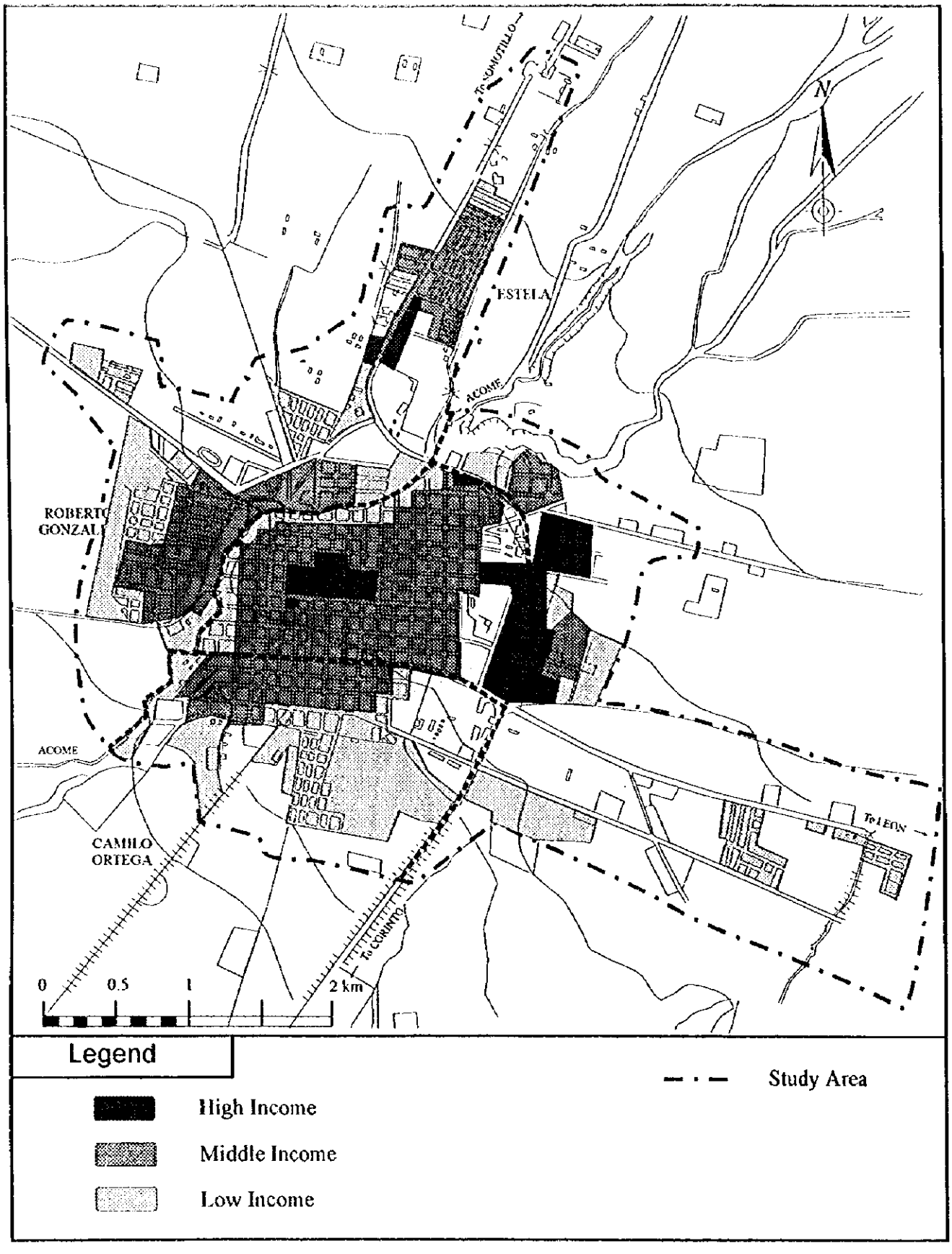


Figure 2-10: Zones Categorized by Income in Chinandega

2.3.5 Housing Conditions in Chinandega

a. Housing

As of 1995, the municipality of Chinandega was estimated to have a total of about 20,324 housing units: 16,935 in the urban area and 3,389 in the rural area. The urban and rural housing units can accommodate an average size of 5.8 persons/unit. The housing figures of Chinandega department are shown in Table 2-8.

Table 2-8: Number of Housing Units in Chinandega Department

Municipality	1971			1995			Growth Rates		
	Total	Urban	Rural	Total	Urban	Rural	71/95 (T)	71/95 (U)	71/95 (R)
1. Chinandega	8,698	3,827	4,871	20,324	16,935	3,389	3.60	6.39	-1.50
2. Chichigalpa	4,169	1,946	2,223	7,510	5,240	2,270	2.48	4.21	0.09
3. Cinco Pinos	423	346	77	993	101	892	3.62	-5.00	10.75
4. Corinto	3,673	1,331	2,342	3,472	3,420	52	-0.23	4.01	-
5. Pto. Morazan	576	295	281	1,981	743	1,238	5.28	3.92	6.37
6. Posoltega	804	589	215	2,553	705	1,848	4.93	0.75	9.38
7. El Realejo	360	245	115	1,495	624	871	6.11	3.97	8.80
8. San Francisco	448	366	82	984	109	875	3.33	-4.92	10.37
9. San Pedro	324	259	65	647	71	576	2.92	-5.25	9.52
10. Santo Tomas	348	258	90	1,069	62	1,007	4.79	-5.77	10.59
11. Somotillo	1,295	965	330	4,230	1,773	2,457	5.06	2.57	8.72
12. El Viejo	3,191	1,912	1,279	11,910	5,668	6,242	5.64	4.63	6.83
13. Villa Nueva	844	621	223	3,612	554	3,058	6.25	-0.47	11.53
Total	25,153	12,960	12,193	60,780	36,005	24,775	3.74	4.35	3.00

Source : Population Census Data, 1995 (INEC)

2.3.6 Urban Structure

a. City Development Plan

There are no current city development plans. The "Physical Program for Urban Development" (EUDOFP) is the latest development plan available and was made between 1986-1987. The Department of Housing and Human Settlements and the Department of Urban Planning (VIAH-PLAFU) of the municipal government of Chinandega carry out city planning projects.

b. Land Use

b.1 Current Land Use

As mentioned above, there are no land use maps of the study area. Therefore, a land use map was prepared based on information provided by the municipal government of Chinandega and the field survey carried out by the Study Team using the available cartographic map. This land use map is shown in Figure 2-11.

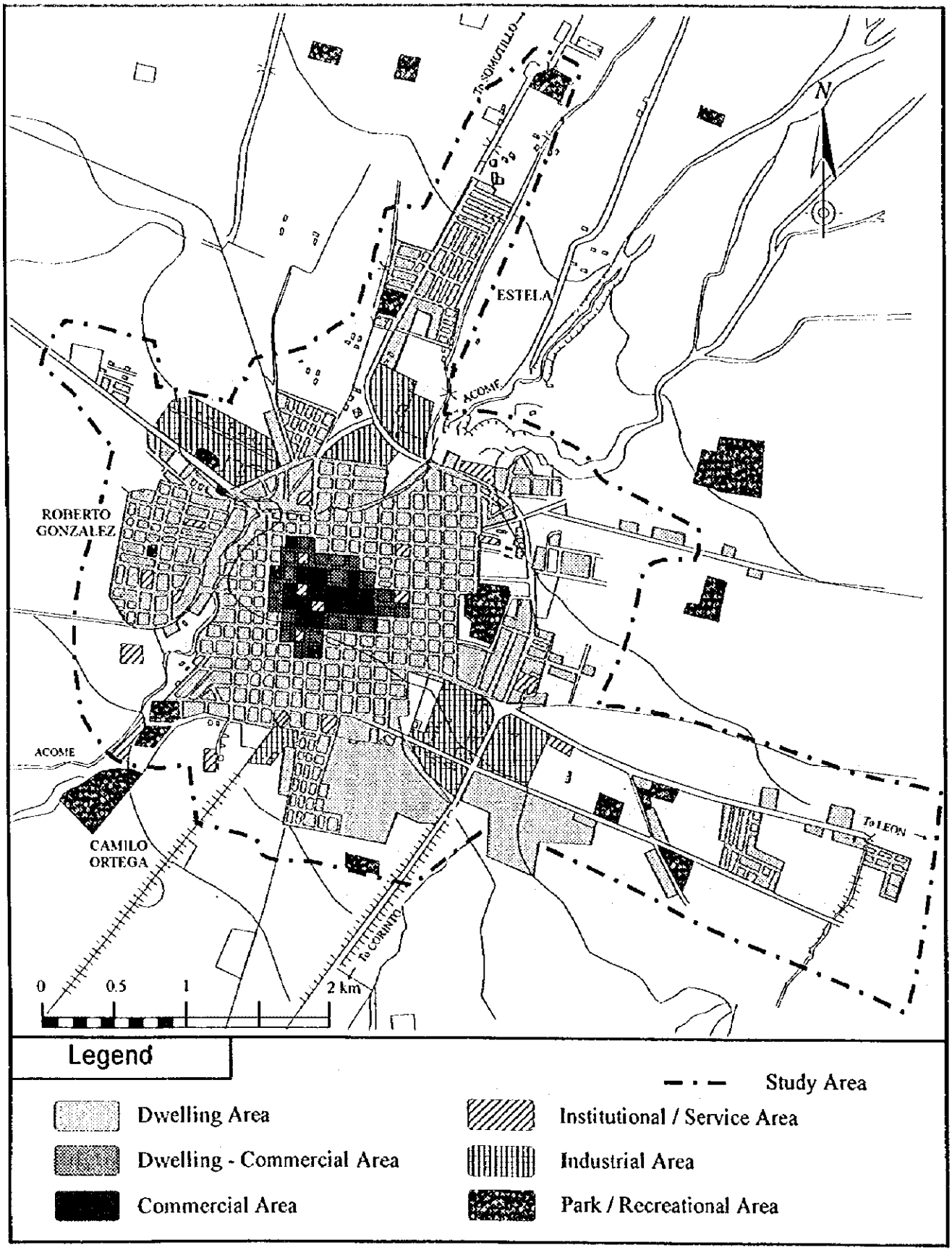


Figure 2-11: Current Land Use in the Urban Area of Chinandega

c. Industry

The city of Chinandega has about 95 industrial establishments: mills (42%), iron casting shops (15%), factories for construction materials (13%) and others (30%). Seven large and important industrial establishments namely GRACSA (oil and grease production plant), GEMINA (wheat flour processing plant), DEPSA, CENTRAL SAN CRISTOBAL, INA and EXPASA (cotton and gin factories), and ALMESA (concentrated food processing plant), are located at the city periphery.

d. Infrastructure

d.1 Road Transport

Cars, motorcycles, horse drawn carts, busses, taxis, and trucks make up the city's transportation system.

d.2 Road Network

d.2.1 General

The development of a road network is important for the establishment of future growth trends, the development of city infrastructure, and the improvement of the urban sanitation environment in the three principal cities.

d.2.2 Road Network in the City of Chinandega

The roads in the city are arranged in a grid formation, extending from the central plaza area towards the city periphery.

The Pan American Highway intersects Chinandega as it extends toward Honduras and Managua. This highway is in a very poor condition due to passages of heavy vehicles and inefficient maintenance. Roads paved with asphalt connects the area to El Viejo and Corinto. Several unpaved roads connect the towns of the municipality to each other.

2.3.7 Economic Conditions

a. Regional Economy

There is no study on Gross Regional Domestic Product(GRDP) in Nicaragua. The basic data needed to estimate GRDP such as industrial production and commercial sales and services according to region are too dated to estimate the current GRDP.

The results of the calculation of GRDP are shown in Table 2-9.

Table 2-9: GRDP in Chinandega Region in 1991 and 1995

Unit : C$ million in 1980

	1991		1995	
		%		%
Total	2,626.9	100.0	1,935.1	100.0
Primary Sector	1,704.0	64.9	938.1	48.5
Secondary Sector				
Manufacturing	333.6	12.7	722.1	37.3
Construction	3.7	0.1	14.6	0.8
Mining	0.6	0.0	1.7	0.1
Tertiary Sector				
Commerce	102.1	3.9	54.7	2.8
Government	190.7	7.3	77.0	4.0
Transport & Communication	231.5	8.8	82.8	4.3
Bank, Security & others	18.4	0.7	11.0	0.6
Electric, Gas & Water Supply	0.0	0.0	6.0	0.3
Property & Dwelling	23.7	0.9	14.5	0.7
Other Services	18.5	0.7	12.6	0.7
Population	350.212			
GRDP/capita	5,525.4			

Source : Calculated by JICA Study Team based on;
Anuario Estadistico 1995, INSSBI
Informe Anual 1995, BCN
Compendio Estadistico 1987-1991, INEC

The GRDP in 1995 was 74 percent of 1991 because of the drastic decline in agricultural activity. The GRDP of manufacturing sector has increased to 2.2 times of 1991, and is the second major industry following agriculture. GRDP in the current price calculated in the same way is C$1,431 million, which is 2.8 times of Leon region.

GRDP per capita in 1995 was C$5,525 in constant price (1980), which is far more than GDP per capita (C$4,481).

2.3.8 Relevant Studies and Projects

Data and information regarding studies and projects realized in Chinandega, which are related to this Study, were obtained from the counterpart. Section B.3.8 in Annex B, Volume IV, lists those studies and projects.

2.4 Granada

2.4.1 Definition of the Study Area

At the meeting of the discussion on the inception report (IC/R) for the Study, the Nicaraguan side requested to expand the boundary of the Study Area from that shown in the IC/R. Although the boundary of the Study Area of the IC/R was defined as the present (1995) urban area (see Figure 2-12) in the S/W (scope of work) for the Study, agreed upon between INIFOM and the JICA Preparatory Study Team in November 1995, the Team agreed that the expansion will be the urban limit in the target year 2010, on condition that the Nicaraguan side clarify and provide information necessary for

projecting the improvement plan of USE, such as proposed boundary, projected population, etc. in the target year 2010.

Based on the above-mentioned discussion, counterparts from Granada Municipality presented a map showing the boundary of the urban area of Granada City in 2010. Consequently the Study Area for the city of Granada covering 14.30 km^2, is defined as the project urban area in 2010 as shown in Figure 2-13.

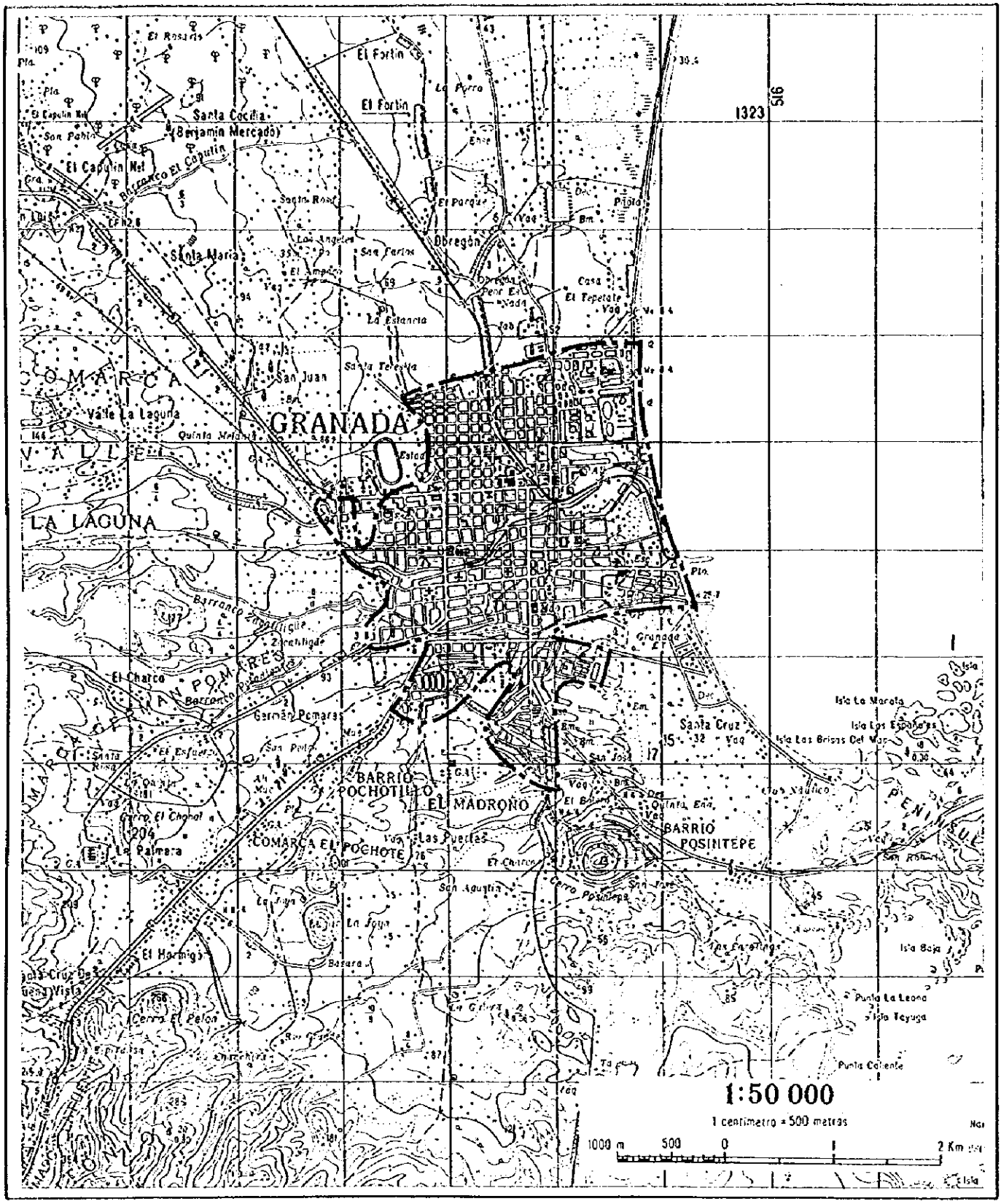


Figure 2-12: Urban Area of Granada in 1995

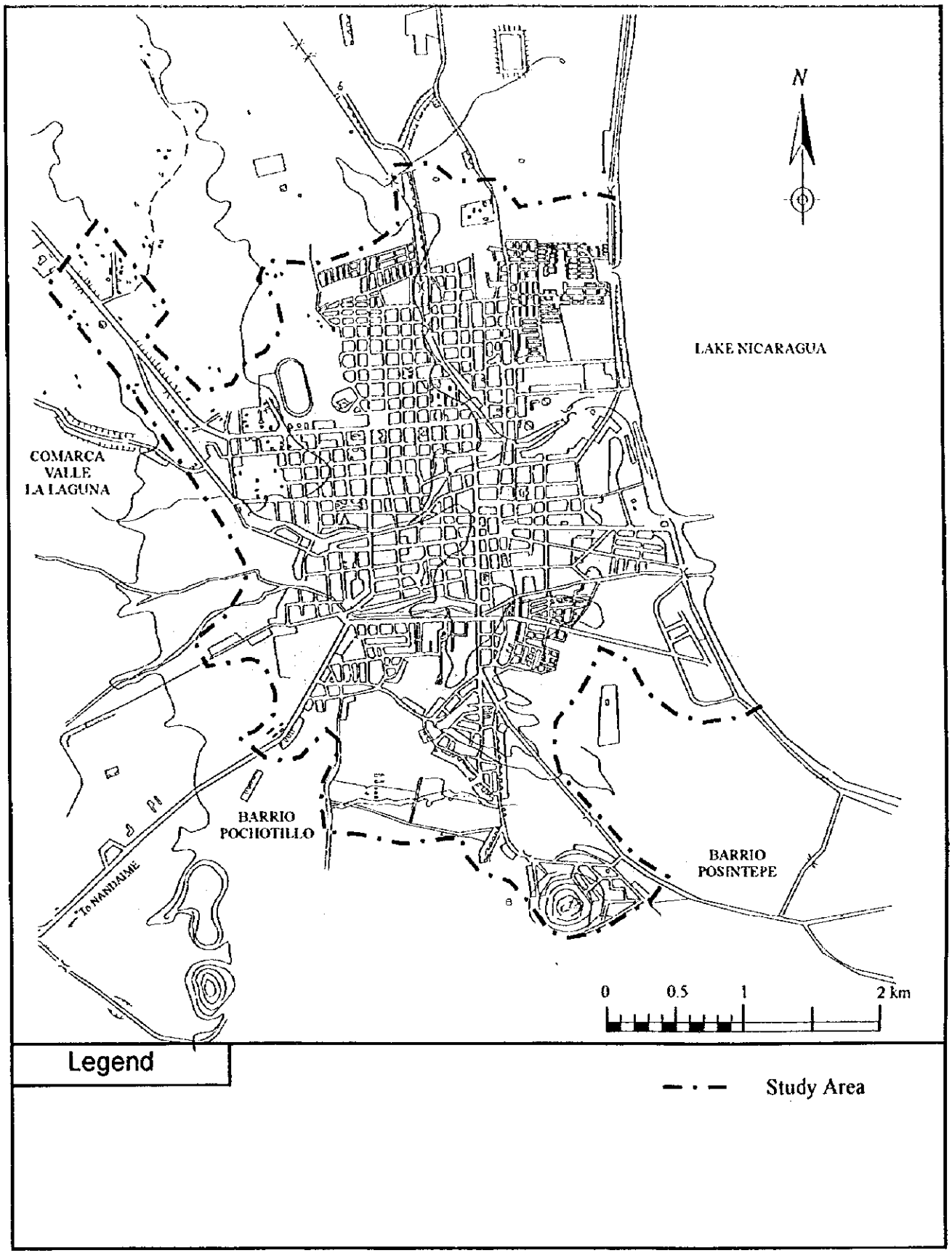


Figure 2-13: Study Area in Granada

2.4.2 National Conditions

a. Location and Area

The city of Granada is located on the northeastern coast off Lake Nicaragua, which is the biggest lake in Central America having an area of 8,270 km^2 and a maximum depth of 70m.

The city area lies between 11°54' to 11°57' latitude and 85°56' to 85°59' longitude, situated 15 km west-northwestern of Masaya City and 40 km southwest of Managua. The elevation of the city of Granada ranges from 30.4 m, the level of Lake Nicaragua, to nearly 100 m in the west.

b. Climate and Hydrology

b.1 Precipitation

According to the 17 year precipitation record from 1969 to 1985 taken at Granada city, the average annual precipitation is 1,517 mm; the lowest recorded was 1,022 mm in 1979 and a maximum of 1,932 mm in 1972. Similar to the areas of the Pacific coastal plain, the rainy season begins in May and ends in the beginning of November. More than 90 % of the annual precipitation falls in the rainy season between May to October, and nearly 10 % in the remaining 6 months.

b.2 Hydrology

There are no perennial rivers in the vicinity of Granada City. Most of the river flow originates from halfway down the slope of Los Pueblos plateau and moves westward. Since the stream gradient is steep and due to the high erodability of the surface soil, majority of the streams have become V-shaped valleys. When there is no rain, the rivers get depleted.

c. Geology and Hydrology

c.1 Geological Structure

Granada City and Lake Nicaragua are situated in the Nicaraguan Depression (Graben). Since Granada City is about 10 km apart from the western edge of the depression, the hydrological basement rock in this area, "the Brito Formation", is at a depth of probably more than 1,000 m.

c.2 Hydrogeology

The highly permeable pyroclastic materials widely distributed in the area allow rapid penetration of rain water into the ground, providing a convenient situation for groundwater recharge. On the other hand, however, such condition also facilitates contamination of groundwater by the rapid infiltration of polluted water like untreated effluents from factories, untreated DWW and leachate through the dumped solid wastes into the ground.

2.4.3 Social Conditions

a. Administration

As established in Law No. 40 - 88, and in a Constitution amendment in 1996, the municipal government is made up of the Municipal Council (ten councilors) and the Executive Organ, composed by the mayor and the vice-mayor, all them directly elected by the citizens.

a.1 Executive Structure and Some Relevant Procedures

The municipal government (MG) employs officials distributed in three director level departments: Municipal Services, Research & Projects, Administration and Finance, in tow officer: Real Estate, Cadastre and a Central Registry Office, as well as two Citizens Advisory Teams for Tenants and Juridical questions, and Management of Temporary Projects: reforming the "Casa de los Tres Mundos" (with Spanish aid), and creating a university (Santo Tomas, in an old Franciscan convent). The new municipal administration started a new structure this year of 1997, as well as a complete study on municipal organization (granted by foreign agency) in being developed for Granada and several Nicaraguan municipalities.

a.2 Support from Ministries and National Entities

The local SILAIS performs hygiene inspections at markets and abattoirs and vermin control including fumigation, with the aid of ACEM -Malaria Control and Eradication Area. MAG should also inspect the markets.

It is important to consider that municipalities have several responsibilities fixed by the Law of Municipalities. However, this does not include authorization to impose strong sanctions such as closure of an establishment. Thus they need support from national authorities, mainly MINSA that exercises the Sanitary Code, MARENA, the principal agency that manages environmental laws, and INAA, the agency that manages all water and wastewater systems. Sewer nets that are poorly maintained encourage illegal discharge into the stormwater drainage system (surface or pipes), and insufficient supervision by INAA and the municipality promotes the mixing of both stormwater and wastewater.

MCT sets standards for urban streets, and is responsible for street maintenance outside the urban area.

A large discussion on environmental problems aiming to establish an Environmental Plan for Granada under the grant of the Canadian Government was held by CIRA/UNAN during 1995/1996, with the participation of municipal, governmental and non-governmental organizations. The same grant includes studying and planning a SWMS as well as designing a sanitary landfill.

a.3 Relevant Aspects of the Municipal Project Budget (MB)

Some indices may be calculated from the MB summarized in Annex B for a macro-analysis of budgets for 1995 and 1996:

TsI/MB=	0.88
HI/MB=	0.01
D/MB=	0.07