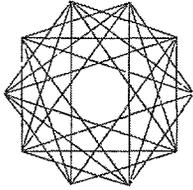


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P A D C O

Strategic Environmental Infrastructure Plan for the Municipal Corporation of Cochin

Prepared for
Cochin Municipal Corporation
and
Regional Urban Development Office/New Delhi
(USAID/India)

Prepared by
Jacob Joseph
Program Coordinator
PADCO, Inc
Washington, DC, USA

Contract No. PCE 10081076008 00
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Table of Contents

Introduction	1
Part I Overview of the Existing Situation	3
1 Background	3
1 1 History of Urbanization in Cochin	3
1 2 Last 50 Years of Urban Planning and Administration	4
1 3 Socio-Demographic Trends	6
1 4 Economic Base of Cochin	6
2 Institutional and Administrative Structure	7
2 1 The Role of Central City Cochin	9
2 2 Administrative Structure of Cochin Corporation	10
3 Infrastructure	11
3 1 Water Supply and Distribution	11
3 2 Health and Sanitation	12
3 3 Solid Waste Collection and Disposal	12
3 4 Stormwater Drainage	14
3 5 Transport and Communications	14
3 6 Energy and Power Supply	17
4 Existing Regulatory Framework for Land Development and Building Construction	18
5 Revenue and Expenditure Base of the Corporation of Cochin	19
6 Ongoing and/or Proposed Infrastructure Projects for Cochin	23
6 1 Local Initiatives	23
6 1 1 Water Supply and Distribution	23
6 1 2 Solid Waste Collection and Disposal	23
6 1 3 Stormwater Drainage	23
6 1 4 Transport and Communications	24
6 1 5 Health and Sanitation	24
6 1 6 Technical Assistance	24
6 2 Interventions of Multi-/Bilateral Organizations	25
6 2 1 Water Supply and Distribution	25
6 2 2 Solid Waste Collection and Disposal	25
6 2 3 Stormwater Drainage	25
6 2 4 Transport and Communications	25
6 2 5 Health and Sanitation	25
6 2 6 Technical Assistance	26



Part II Recommendations for the Provision of Environmental Infrastructure	27
1 Institutional Strengthening	27
1 1 Issues	27
1 2 Recommendations	27
2 Infrastructure Provision	28
2 1 Water Supply and Distribution	28
2 1 1 Issues	28
2 1 2 Recommendations	28
2 2 Solid Waste Management	28
2 2 1 Issues	28
2 2 2 Recommendations	29
2 3 Drainage	29
2 3 1 Issues	29
2 3 2 Recommendations	30
2 4 Transport	30
2 4 1 Issues	30
2 4 2 Recommendations	30
2 5 Power Conservation	31
2 5 1 Issues	31
2 5 2 Recommendations	31
3 Mapping and Documentation	32
3 1 Issues	32
3 2 Recommendations	32
Part III Short-Term Action Plans for the Provision of Environmental Infrastructure in Cochin	33
1 Assistance to Cochin Corporation in Institutional Strengthening	36
2 Environmental Plan for Cochin Corporation/Pilot Plans for Divisions 6 and 31	36
2 1 DIVISION 6	36
2 2 DIVISION 31	37
3 Stormwater Drainage Schemes for East and West Cochin	37
4 Cochin Backwater Cargo/Mass-Transport Plan	37
5 Tenement Upgrading in the Heritage Zone of Mattancherry	38



Appendices

- Appendix 1 Household Demographic Profiles by Division of Cochin Corporation, 1991 Census
- Appendix 2 Map 1 The Central City Cochin Area as Defined by the Structure Plan for 1981-2001
Map 2 Cochin Corporation Area with the Boundaries Showing its 50 Local Administrative Divisions
- Appendix 3 Manpower List of Cochin Corporation's Secretary's Office
- Appendix 4 Power Consumption in the Cochin Corporation Area
- Appendix 5 List of Organizations with Interests in the Various Urban Issues in Cochin

**List of Abbreviations**

AEC	Ahmedabad Electric Company
AMC	Ahmedabad Municipal Corporation
ANERT	Agency for Nonconventional Energy Research and Technology
ASI	Archeological Survey of India
CEPZ	Cochin Export Processing Zone
CESS	Center for Earth Science Studies
CMEF	Central Ministry of Environment and Forest
CPT	Cochin Port Trust
CPWD	Central Public Works Department
CSIR	Council of Scientific and Industrial Research
CSL	Cochin Shipyard Ltd
CTPT	Cochin Town Planning Trust
CUST	Cochin University of Science and Technology
CZM	Coastal Zone Management
DFID	Department for International Development (formerly ODA)
DPC	District Planning Committee
DSM	Demand Side Management
DTP	Detailed Town Planning
DTPC	District Tourism Promotion Council
EC	European Community
ESDC	Eco Sensitive Development Center
EWS	Economic Weaker Section
GCDA	Greater Cochin Development Authority
GIDA	Gosri Island Development Authority
GIS	Geographic Information Systems
GSI	Geological Survey of India
HDFC	Housing Development Finance Corporation
HLC	High-Level Committee
HT	High Tension
HUDCO	Housing and Urban Development Corporation
ICCI	Indian Chamber of Commerce and Industry
IEI	Institute of Engineers India
IIA	Indian Institute of Architects
INTACH	Indian National Trust for Art and Cultural Heritage
IWWAI	Inland Water Ways Authority of India
KFC	Kerala Financial Corporation
KHA	Kerala History Association
KILA	Kerala Institute of Local Administration
KINFRA	Kerala Industrial Infrastructure Development Corporation
KMA	Kerala Municipal Act
KSEB	Kerala State Electricity Board
KSHB	Kerala State Housing Board
KSIDC	Kerala State Industrial Development Corporation
KSINCO	Kerala Shipping and Inland Navigation Corporation Ltd
KSPCB	Kerala State Pollution Control Board



KSRTC	Kerala State Road Transport Corporation
KSSP	Kerala Sastra Sahitya Parishad
KSWTC	Kerala State Water Transport Corporation
KTDC	Kerala Tourism Development Corporation Ltd
KUDP	Kerala Urban Development Project
KWA	Kerala Water Authority
kVA	Kilovolt Ampere
kWh	Kilowatt Hour
LPG	Liquid Petroleum Gas
MES	Military Engineering Service
MG	Mahatma Gandhi
MLD	Million Liters per Day
MPC	Metropolitan Planning Committee
MVA	Megavolt Ampere
MW	Megawatt
NEERI	National Environmental Engineering Research Institute
NGO	Nongovernmental Organization
NH	National Highways
NPOL	Naval Physical Oceanic Laboratories
PIB	Press Information Bureau
PWD	Public Works Department
RITES	Rail India Technical and Economic Services Ltd
RTPD	Regional Town Planning Department
SA	Sahodaran Ayyappan
SIP	Slum Improvement Project
SR	Southern Railway
STPD	State Town Planning Department
SWM	Solid Waste Management
USAID	United States Agency for International Development
VSNL	Vidhesh Sanchar Nigam Ltd

List of Conversions

1	US\$1	=	42 Indian Rupees (approximately)
2	100,000	=	1 lac
	10 lac	=	1 million
	10 million	=	1 crore

**List of Tables**

Table 1	Demographic Profile of Cochin Corporation
Table 2	Area Subdivisions and the Corresponding Population of Central City Cochin
Table 3	Existing Land Use in Central City Cochin
Table 4	Corporation Resources for Health Services, including Waste Collection/ Disposal
Table 5	Traffic Survey Data for Main Roads in the Inner City of Ernakulam
Table 6	Pedestrian Traffic Data at Main Locations in the Inner City of Ernakulam
Table 7	Accidents Occurring in Last Five Years, Cochin
Table 8	Location and Distribution of Electrical Substations in Cochin
Table 9	Projected Income/Collection for Cochin Corporation, 1993-96 (lacs)
Table 10	Expenditures for Cochin Corporation, 1994-96
Table 11	Estimated Revenue Sources for Cochin Corporation, 1998-99
Table 12	Annual Budget Allocation by Sector for Cochin Corporation, 1998-99
Table 13	Linkages between Priority Projects and Issues and Recommendations

Strategic Environmental Infrastructure Plan for the Municipal Corporation of Cochin

Introduction

The last 50 years have had a major impact on the development of the city of Cochin. During this period, Cochin has grown into an urban agglomeration with an administrative structure very different from that of the earlier colonial days.

Although it remains the main commercial hub of the State of Kerala, dating from the time of its origin in the early 14th century, Cochin is currently facing serious difficulties due to the inadequate provision of infrastructure. The image of Cochin described by the Italian traveler Nicolo Conti five centuries ago as "the place prosperous enough to spend the money one makes in China" contradicts the present reality, where an average resident constantly worries about electric power cuts, shortage of drinking water, transportation and parking problems in the inner city, and, above all, unemployment and lack of job opportunities. At the crossroads of the next millennium, Cochin awaits a much-needed revival in its overall functioning as an urban center.

After briefly describing the process by which the city of Cochin has developed, from its earliest days through the last 50 years, this document presents a broad discussion of the present urban environmental conditions and prospective infrastructure growth potentials in Cochin. The goal here is to highlight strategic issues pertaining to the comprehensive planning of urban environmental infrastructure for the city of Cochin. Next, the document makes a series of recommendations aimed at addressing the amelioration of these issues. The last section proposes immediate actions and pilot projects that would initiate and test the execution of these recommendations. Neither time nor resources permit the provision of a comprehensive or detailed plan for the provision of environmental infrastructure in Cochin. Rather, the document aims to identify and highlight potential technical assistance and project activities for Cochin Corporation in the sphere of environmental infrastructure whose ultimate viability and feasibility is left to future investigation.

Part I

Overview of the Existing Situation

1 Background

This section describes the historical evolution of the city of Cochin. It also presents a profile of the city's socio-demographic trends and economic base.

1.1 History of Urbanization in Cochin

Before the Christian era, Phoenicians and Romans and later Arabs and Jews came in successive waves with their merchant fleets to the port of Cranganore,¹ which is located 20 miles to the north of Cochin. It is believed that due to dramatic geo-political turbulence in the area,² the role of Cranganore as the major port in the Malabar Coast shifted to the newly formed Cochin by early 14th century AD. The urbanization of Cochin started primarily in Mattancherry.³ Initial settlement encompassed the new local chieftain's family, the shop-warehouses along the backwaters forming the harbor, the Jewish and the naturalized Arab merchant settlements, and the settlements of the native servant community of the king. Trade flourished at this location due to both the natural suitability of the backwaters for safe anchorage of ships and country boats and the availability of harbor facilities along the shores of Mattancherry. The various canals and rivers flowing into the Vembanad Lake provided easy means of transporting goods on country boats from the hinterlands to the Cochin backwaters, where wooden sailing ships would transport the goods to foreign destinations.

In 1500 AD, the Portuguese, after failing to establish a hold on Calicut, arrived in Mattancherry, marking the beginning of European colonialism in Cochin. In 1503, under the leadership of Vasco da Gama, a fortified township was built adjacent to Mattancherry at the consent of the local king. Later, in 1538, the fort⁴ was expanded from the mouth of Calvathy canal in the east, up to the western sea coast along the northern edge of the peninsula. Trading communities from the region as well as other parts of the subcontinent came and settled in Mattancherry at the behest of the King of Cochin. Among the new dwellers in a myriad of communities were different sects of converted Christians⁵, local Hindu caste groups, and various Hindu-Jain-Muslim

¹ Referred to in early history as Muziris. It is now called Kodungallor.

² A flood in 1300 AD initially opened Cochin's *kochazhi* (literally small sea outlet) which was later flushed open to its bigger size in a great flood in 1341 AD. This flooding simultaneously silted up the port at Cranganore. Subsequently trade moved south from Cranganore to Cochin at the enterprise of Jews who fled from Cranganore fearing devastation from Arabs supported by the Zamorin kings. In 1404 the royal family of Perumpadappu Swaroopam from the vicinity of Cranganore moved its capital to Mattancherry taking refuge from the attacks of the Zamorins.

³ Often mentioned in history as Malabar Cochin.

⁴ Called Manuel Fort.

⁵ Native Syrian Christians who were followers of the Apostle St. Thomas arrived at Malabar coast in 52 AD. With the arrival of the Portuguese many of these Christians who followed nestorian practices were forced to convert to the Latin rite of Catholicism propagated by Jesuit monks from Portugal.

PROT...



communities from Goa, Tamilnadu, Udipi, Kutch, Gujarat, Maharashtra, Uttar Pradesh, etc. The harmonious cohabitation of the diverse groups gave Cochin a much-praised cosmopolitan outlook. During this period of Portuguese colonization and later under the Dutch, Cochin was considered a flourishing town comparable with some of the best cities in Europe. In 1663, the Dutch arrived and the Portuguese fort was destroyed with all its 20 bastions. Five years later, the new colonizers rebuilt a fort on the site of the previous one, but one-third its original size. The location of its seven bastions is easily identified today. After more than a century of Dutch domination, Fort Cochin was captured by the British in 1795, who razed the fort and formed British Cochin.

Dating from the 13th century, the mainland, across the backwaters from the original Cochin settlement, had a small town surrounding the Shiva temple called "rishu nagakulam," from which it got the name Ernakulam. By 1840, overcrowding and degradation of the urban environment prompted the King to shift his administrative capital to Ernakulam.⁶ The King moved his palace and associated domestic activities to Tripunithura, which was located 10 kilometers farther east into the mainland. This shift of administration to East Cochin gradually caused West Cochin to weaken economically and to physically deteriorate over time. In 1866, Fort Cochin became the Cochin area's first municipal town under British rule. Ernakulam Municipality was formed in 1912 and Mattancherry Municipality in 1913. The British brought in various modern technological developments to Cochin, including the railway, the telegraph, public health, transportation, and trade. Though the first plan for developing the harbor was prepared in 1835, it was not until 1913 that any dredging operations were commenced. In 1920, under the supervision of the harbor engineer-in-chief, Sir Robert Bristow, Willingdon Island, an area of approximately 900 acres, was reclaimed around the originally small island of Venduruthy. A modern port was developed at Willingdon Island soon after its reclamation. By 1930, a potable water system was provided and two Cochin-Ernakulam bridges were built. A road to the west and a railroad to the east, which connected the island to the mainland, were completed in 1940. By this time, Cochin had become a major port in India, particularly for containerization. Sandwiched between the historic district to the west and the emerging urban center of Ernakulam to the east, the port developed as the focus of business activities in the city. The electrification of Ernakulam that followed the port development boosted industrial growth along the major arteries radiating from the center (the development of the Eloor and Ambalamugal regions created an industrial belt on the outskirts of the city). By this time (1947), India had become an independent country.

1.2 Last 50 Years of Urban Planning and Administration

The pre-independence states of Cochin and Travancore were united in 1949 to form a single state called Thiru-Kochi. Later, in 1956, the state of Kerala was formed with the unification of British Malabar and Thiru-Kochi. Ernakulam district was formed in 1958, taking the name of

⁶ The existing administrative buildings along Park Avenue and adjacent to the Ernakulam Temple which now house the Old Collectorate, Maharajas College, Government Hospital, Law College, etc. were built as part of this administrative relocation to Ernakulam.



the capital of the former Cochin state. As part of introducing planning for Cochin's physical environment, in 1966 the Government constituted a town planning committee to coordinate the planning efforts in the three municipalities of Cochin (Fort Cochin, Mattancherry, and Ernakulam). Following this, in 1967, the Corporation of Cochin was formed in an effort to consolidate municipal administration in the three municipalities of Fort Cochin, Mattancherry, and Ernakulam, Willingdon Island, and the adjoining four panchayats (Palluruthy, Vyttila, Vennala, and Edappally). Altogether, the Corporation comprised 50 divisions.

In 1966, the Kerala State Town Planning Department (STPD) initiated preparations for an "Interim Development Plan" for Cochin and its suburbs. The State Government established a committee to formulate a comprehensive development plan for the "Greater Cochin Area" and to create a statutory local authority under the Town Planning Act, which resulted in the formation of the Cochin Town Planning Trust (CTPT) in 1968. The Greater Cochin Development Authority (GCDA) took over the planning functions from the defunct CTPT in 1976. As a follow-up to the earlier planning initiatives, GCDA, at the request of the STPD in 1981, coordinated the preparation of a 20-year master plan for comprehensive development of Cochin. This master plan was called the "Structure Plan for Central City Cochin-2001" and encompassed the Greater Cochin area (see Section 2.2).

In the last 20 years, GCDA and Cochin Corporation, with assistance from the STPD, jointly carried out various projects that benefited mainly Ernakulam. Hence, Ernakulam has developed as the Corporation's modern center. Extensive real estate development and business activities along Ernakulam's Shanmugham Road, Mahatma Gandhi (MG) Road, Broad Way, and Banerji Road today form the main activity corridors of downtown Ernakulam. Presently, the Marine Drive is gradually catching up as a busy retail center. The Drive's promenade and adjacent parks form attractive recreation areas for the city. The foreshore of the Marine Drive has witnessed the development of new luxury hotels and apartments and has the highest real estate values in the region. The tree-lined Park Avenue, which houses old government and educational institutions, and the market lane of Broad Way are located adjacent to this area. MG Road has emerged as the main commercial district only in the last 20 years. Along its length are located bustling shopping centers, restaurants and hotels, cinemas, banks and finance firms, hospitals, office complexes, and shops selling jewelry, handicrafts, textiles and garments, electronic goods, books, footwear, etc. MG Road at peak hours has the most vehicular traffic and the most active nightlife of the entire city.

By 1991, GCDA had declared Fort Cochin a Heritage Conservation Zone. Gosri Island Development Authority (GIDA) was formed in 1994 to initiate and administer the development of the four islands⁷ lying adjacent to the mainland. These islands are cut off from the mainland of Ernakulam, as there are no bridge connections. GIDA proposed to finance the construction of a series of bridges that would connect the four islands to the mainland by reclaiming adjacent backwaters and selling the reclaimed land. All these efforts ultimately had to be abandoned when

⁷ Thanthoni, Mulavukad, Vallarpadam, and Vypeen islands.



the Central Ministry of Environment and Forest (CMEF) banned the proposed reclamation of backwaters on environmental grounds

The 74th Amendment to the Constitution (1992) modified the Municipal Act or “Nagara Palika Bill” to empower local administrative departments to plan and implement development schemes. Based on its enhanced powers, in 1996 Cochin Corporation initiated its first People’s Planning Program, referred to locally as “Janakiyasootranam”. Janakiyasootranam forms part of the state-wide restructuring of the mechanisms for policy and planning envisaged under the 9th Five-Year Plan. In 1998, the Zen Committee, as part of its study of the impact on existing legislation of implementing the 74th Amendment, proposed to dissolve all the 11 state development authorities, including GCDA.

1.3 Socio-Demographic Trends

According to the 1991 census, Cochin Corporation has 564,589 residents. It is estimated that the population grew to 593,600 and 609,536 in 1996 and 1997, respectively. The city’s estimated density in 1996 was 6,250 persons per square kilometer. According to the 1991 census, the male-female ratio was 99:100. Appendix 1 gives detailed household and demographic profiles for the Corporation’s 50 divisions as per 1991 census. Population density is highest in Division 37 and lowest in Division 25. A comparison of demographic trends in Cochin Corporation in the last two decades is given below in Table 1.

Table 1
Demographic Profile of Cochin Corporation

Item/Year	1971	1981	1991	1996 Est *	2001 Projection	2011 Projection
Population	439,066	513,249	564,589	593,600	623,880	689,151
Annual Percentage Increase	—	1.57	0.96	1.01	1.00**	1.00**
Population Density (persons/sq km)	4,628	5,409	5,950	6,256	6,575	7,263
Male:Female Ratio (%)	95:1	98:7	99:0	na	na	na
Birth Rate (%)	—	25.9	31.0	na	na	na
Death Rate (%)	—	8.0	6.7	na	na	na

* Estimated on basis of birth and death records maintained by Cochin Corporation

** Assumes a similar growth rate to that experienced over the period 1981-96

1.4 Economic Base of Cochin

Cochin is considered the commercial and industrial capital of Kerala State. The Cochin Port Trust (CPT) and the economic activities associated with it form the major economic base of Cochin. The city’s principal industrial activities are located in Udyogamandal, Kalamassery, Ambalamedu, the Cochin Export Processing Zone (CEPZ) in Kakkanad, Cochin Shipyard Ltd (CSL) in the heart of the city, and the seafood industry in the Edacochin-Palluruthy area. Endowed by natural beauty and historical wealth, Cochin anticipates tourism to grow into the



predominant sector in the near future. Local commercial activity in textiles, jewelry, banking, hoteliering along MG Road, Banerji Road, and Broad Way, and Ernakulam's and Mattancherry's wholesale markets form the consumer hub of the entire State of Kerala.

2 Institutional and Administrative Structure

The 74th Amendment to the Constitution (1992) devolved new responsibilities to municipalities, including "nagar panchayats" for suburban-rural areas, municipal councils for smaller urban areas, and municipal corporations for larger urban areas. By this Amendment, municipalities attained the authority

- to hold direct elections for all municipal seats,
- to constitute division committees in every municipality having a population of three lacs or more,
- to prepare plans for economic development and social justice and for the implementation of development schemes,
- to finance municipal activities by securing authorization from the state legislature to access grants-in-aid from the state Consolidated Funds,
- to be assigned revenue appropriations from designated taxes, duties, tolls, and fees,
- to authorize the State Financing Commission to review the financial position of the municipalities,
- to authorize District Planning Committees (DPCs) to consolidate the plans prepared by the panchayats and municipalities in the district and to prepare draft development plans for the district,
- to constitute a Metropolitan Planning Committee (MPC) for every metropolitan area having a population of 10 lacs or more to prepare draft development plans for the area, and
- to empower the state legislatures to make laws with respect to municipal elections and other matters.

Each municipal area with a population of more than three lacs is divided into territorial constituencies known as "wards" or "divisions," which will be represented by an elected representative. One or more divisions can form a division committee. The chairperson of the division committee becomes the "councilor" to the municipal council of the respective municipality. There will be a chairman and vice chairmen in every town panchayat and municipal council and a mayor and a deputy mayor in every municipal corporation. These officials are elected by and selected from among the councilors of the respective bodies. Every municipality will have a secretary appointed by the state government in consultation with the municipality. The secretary is the municipality's executive officer. Other municipal officers and employees shall be subordinate to him/her. Administration of the municipality is vested in the council. Unless dissolved due to certain special circumstances, municipal councils will continue for five years. The chairperson of the municipality convenes council meetings and exercises the powers and discharges the duties stipulated in the Kerala Municipal Act (KMA). He/she supervises and coordinates the functions of the municipality, the secretary, and the committees thereof.



Every municipality will constitute standing committees as follows

- town panchayats comprise one standing committee,
- municipal councils comprise standing committees for (1) taxation, finance, and accounts, (2) public works, and (3) health and the environment, and
- municipal corporations comprise the same three standing committees as municipal councils plus standing committees for (1) town planning, tradition, and heritage and (2) tax appeals

The functions of the standing committees are to supervise budget utilization, monitor timely assessment and collection of taxes, fees, rents, etc., inspect the accounts, conduct monthly audits of accounts and check monthly expenditures, and collect, balance, and reconcile receipts and disbursements from the previous month as furnished by the secretary. Every standing committee shall consist of a chairman and four members elected from the municipal council. The standing committee for taxation, finance, and accounts, however, will consist of a chairman and three members.

Municipal corporations will constitute steering committees consisting of the mayor, the deputy mayor, and chairmen of the standing committees; the mayor will chair this committee. The steering committee coordinates the functioning of the standing committees, examines and guides the functioning of the division committees, and discharges the powers and functions entrusted to it by the council. Municipal councils will also constitute joint committees of the standing committees for carrying out activities of mutual interest. The chairperson of the municipality will nominate the chairman of the joint committee from among the chairmen of the standing committees. The secretary will be custodian of all municipal properties and records, including all papers, documents, and proceedings of the council and standing committees and other committees. He/she arranges the scheduling of municipal functions. The Government has constituted a DPC at the district level to consolidate the plans prepared by the panchayats and municipalities and to prepare a draft development plan for the district as a whole.

The DPC comprises 15 members: 12 of whom will be elected by and selected from among the elected panchayat members in proportion to the urban-rural ratio of population, as well as the president of the respective district panchayat, a Government-nominated administrator and planner, and the district collector. By notification in the gazette, the Government will constitute a MPC in a metropolitan area to prepare a draft development plan for that area. The MPC will consist of 15 members, 10 of whom will be elected by and selected from among the elected members of the municipalities and the presidents of the village panchayats in proportion to the ratio between the population of the municipalities and panchayats in that area. The remaining five members of the MPC will be Government-nominated and will consist of the secretary to Government, the deputy secretary to Government, the senior town planner of the Town Planning Department, the superintendent engineer of the Public Works Department (PWD), and the district collector.

There will be also a high-level committee (HLC) for each metropolitan area to coordinate and monitor the urban development activities of Government and other agencies. The HLC will consist of the chief minister, who will be the chairman, the local administration minister, who



will be the vice chairman, the minister of transport, water supply, finance, electricity, and public works, the chief secretary to Government, the secretaries in charge of finance, local administration, transport, public works, water supply and electricity, the chairman of the MPC and the DPC, members of parliament, members of the legislative assembly from the respective metropolitan area, the concerned district panchayat president, the mayor of the municipal corporation, and the chairman of the development authority in the concerned metropolitan region

2.1 The Role of Central City Cochin

GCDA's 1980 Structure Plan delineates a region of urban influence for Cochin that it characterizes as "Central City Cochin"⁸. The Central City forms the greater Cochin area and includes Cochin Corporation, Tripunithura Municipality, and the panchayats of Elankunapuzha, Njarackal, Mulavukad, Kadamakudy, Cheranelloor, Eloor, Kalamassery, Trikkakara, Thiruvankulam, and Maradu. It forms a continuous urban area concentrated around the activity of Cochin Port. According to the Structure Plan, the Central City of Cochin encompasses an area of 275.85 square kilometers (Refer to Map 1 in Appendix 2). Of this area, Cochin Corporation is 94.9 square kilometers (34 percent). The constituent local bodies that comprise Central City Cochin and their respective areas and populations are given in Table 2 below.

Table 3 presents separate distributions of land utilization for Cochin Corporation and for the remaining peripheral areas in Central City Cochin. The land use table details developed land, which comprises 58 percent of the total gross area of Central City Cochin. The undeveloped portion consists of agricultural land (23 percent) and water bodies (19 percent). Residential use constitutes a very high 85 percent of total developed land uses. The remaining developed areas are divided among commercial (1.4 percent), industrial (2.5 percent), transport and communication (6.1 percent), public and semi-public (4.5 percent), and recreation and open space (0.8 percent) uses.

Table 2
Area Subdivisions and the Corresponding Population of Central City Cochin

Constituent Local Bodies	Area in sq km	Population in 1981
1 Cochin Urban Agglomeration		
(a) Cochin Corporation	94.88	513,249
(b) Eloor	21.95	52,528
(c) Tripunithura	18.69	43,646
(d) Kalamassery	27.00	43,767
(e) Trikkakara	27.46	38,318

⁸ The 20-year Structure Plan for Central City 2001 was approved in 1981.



Constituent Local Bodies	Area in sq km	Population in 1981
2 Contiguous Census Towns		
(a) Mulavukad	19 27	21 397
(b) Maradu	12 35	28 749
3 Intervening or Adjoining Panchayats		
(a) Njarackal	8 60	21 672
(b) Elamkunnappuzha	11 66	43 911
(c) Cheranelloor	10 59	18 381
(d) Thiruvankulam	10 49	15,517
(e) Kadamakkudy	12 91	13 696
Total	275 85	854,831

Table 3
Existing Land Use in Central City Cochin
(all areas given in sq km)

(Computed from the land use survey conducted by the Regional Town Planning Office in 1980 Cochin)

Constituent Areas	Residential	Commercial	Industrial	Transport and Communication	Public and Semi Public	Open Spaces	Total Developed Land
Cochin Corporation	47 52	1 56	1 63	5 44	3 95	0 64	60 73
Percentage to Total Developed Land	78 2	2 6	2 7	9 0	6 5	1 0	100
Peripheral Areas in the Central City	87 11	0 65	2 40	4 32	3 24	0 60	98 33
Percentage to Total Developed Land	88 6	0 7	2 4	4 4	3 3	0 6	100
Total Area	134 63	2 22	4 03	9 76	7 19	1 24	159 06
Total Percentage to Developed Land	84 6	1 4	2 5	6 1	4 5	0 8	100
Area per 1 000 Population	15 75	0 26	0 47	1 14	0 84	1 45	18 61

2 2 Administrative Structure of Cochin Corporation

Cochin Corporation is administratively located in the Ernakulam District and, as mentioned in the previous section, within Central City Cochin as delineated in GCDA's Structure Plan 2001. Cochin Corporation consists of 50 local administrative divisions or wards (Refer to Map 2 in Appendix 2, which shows the Corporation area and its 50 divisions) As a municipal corporation, the Corporation's council consists of six standing committees, including taxation, finance, and accounts, public works, health, tax appeals, town planning and heritage, and educational services. Appendix 3 provides manpower information for the departments included under the secretary's office of the Corporation.

To ensure effective community participation in the local administration through Janakiyasootranam Prastanam, each division is further subdivided into "ayalkootangal" or



neighborhoods. Each neighborhood is composed of approximately 100 houses. Meetings are conducted in each neighborhood to assess needs and to determine priorities for project formulation. Annual division conventions are held to synthesize the principal recommendations of the neighborhood meetings. At these division conventions, project proposals are compiled sectorally and sent for further discussion to the Corporation. A Corporation-level convention is held with representatives of the 50 divisions to finalize project selection based on priorities and available resources. The Corporation prepares a master list of preferred projects, which is forwarded to the DPC for approval. After final budget approval is received, a representative group of division leaders monitors the entire process of project execution. The division councilor coordinates the delivery and implementation of the different support activities provided by the Corporation's Janakiyasootranam program.

The main office of the Corporation of Cochin is located along Park Avenue in Ernakulam. The Corporation has zonal offices in Edappally, Vyttila, Pachalam, Fort Cochin, Mattancherry, and Palluruthy. Within the service area of the Corporation are located the lakeside campus of the Cochin University of Science and Technology (CUST), the naval base, the Naval Academy, the Southern Naval Command Office, CPT, CSL, the Kerala High Court, Cochin Airport, various central research institutes, three railway terminals at Ernakulam Junction, Ernakulam Town, and Willingdon Island, 144 educational institutions, and seven colleges.

3 Infrastructure

The Corporation has identified existing infrastructure deficiencies as the highest priority of urban development in Cochin. The city suffers from insufficient infrastructure provision due to extensive new development in the last 10 years. A real estate boom fueled by investment of non-resident Indians saw land prices escalate by 6-7 times over the period 1990-96. Many new commercial and high-rise residential structures were constructed in the heart of the city. This new construction dramatically increased the demand for basic infrastructure services, such as water supply, power distribution, parking, roads, drains, and waste collection and disposal. The various issues associated with this increased demand for infrastructure provision in the Corporation of Cochin are discussed below.

3.1 Water Supply and Distribution

The Kerala Water Authority (KWA) continues to supply and distribute drinking water in the city, even though according to Section 30-1 of the amended KMA of 1994 this service is now the responsibility of the Corporation of Cochin. As part of the division conventions, the Corporation's residents have expressed support for this transfer of responsibility. Currently, the entire Cochin region experiences acute shortage of drinking water. The Corporation will require support to find solutions in meeting this demand as it takes over responsibility from the KWA.

The upper courses of the Periyar River serve as the source of drinking water for the Corporation. The water is pumped and treated in plants located in Alwaye Municipality. Currently, about 90 MLD of the total 190 MLD of treated water produced by these plants is supplied to the Corporation area. As per the 1991 census, it is estimated that Cochin Corporation requires 184 MLD of water.



A survey conducted by the National Environmental Engineering Research Institute (NEERI) estimated that out of a total length of 635 kilometers of distribution lines, about 190 kilometers have to be replaced and about 215 kilometers of new lines are required. According to 1990 records of the Town Planning Authority, about 33 percent of the households in the city of Cochin have independent water connections and the rest depend on about 7,000 public water taps. There is an approximate shortage of 113 MLD of drinking water in the city of Cochin.

3 2 Health and Sanitation

The Corporation's public health is undermined by a number of factors, including deficiencies in nutritious food, potable water, fresh air, clean environment, awareness, proper shelter, and employment opportunities. Public health is particularly challenging to the economic weaker sections (EWSs) of the population. There are about 64,111 lower-income people, dwelling in 231 slums scattered in pockets throughout the Corporation area and living in poverty and unhygienic conditions. Due to contamination of drinking water through the illegal tapping of water lines, various water-borne diseases, such as cholera, typhoid, jaundice, and dysentery, are prevalent primarily among Cochin's EWS residents. These diseases are seen more in West Cochin, as this area is affected more by the lack of potable water.

Air pollution is also increasing day by day due primarily to increased vehicular exhaust in the Corporation. Effluents from the Corporation's industrial belt are another cause of air pollution. The Corporation is trying to discourage its residents from burning solid waste within the city, while coordinating with the Vehicle Department and the Kerala Pollution Control Board (KPCB) to reduce pollution.

It is estimated that only 85 percent of the citizenry have private toilets, with the rest forced to dispose of human waste in open places. Due to poor drainage and the unsanitary conditions that commonly prevail in Cochin, mosquitoes have been a major problem for its residents for decades. The absence of covers on the vent pipes of septic tanks is one main source of mosquito breeding. Mosquito-borne epidemics are a serious concern of the Corporation Health Department. Due to a lack of organized and planned implementation, the Corporation has not been able to control the mosquito problem. Elephantiasis is another common disease found in Mattancherry area,⁹ which is considered to have the worst hygienic environment in the Corporation.

3 3 Solid Waste Collection and Disposal

Health problems are also caused by the improper collection and disposal of solid and liquid waste. Rotting garbage, the result of inefficient waste collection and disposal, is a common sight in the Corporation. It is estimated that within the Corporation of Cochin, about 360 tons of solid-liquid waste is produced daily. Even though the Corporation has purchased modern garbage bins and vehicles, collection and disposal are not executed effectively. The residents are of the opinion that the Corporation has failed in the delivery of this service.

⁹ Overcrowding and unhygienic environments are considered the reasons that the Cochin kings relocated their settlement to the mainland by the early 19th century.



Solids form the bulk of the generated waste. Currently, there is no attempt to separate organic from inorganic waste at source, even though there are proposals for introducing effective management methods for waste collection and disposal as part of Janakiyasootranam schemes. Every day, about 3,400 kilograms of paper, 1,800 kilograms of plastic, 4,800 kilograms of metal, 950 kilograms of glass, 3,000 kilograms or 6,000 bottles, and 1,000 kilograms or 2,000 jute bags are disposed of in the Corporation area. In addition to these inorganic wastes, there are other organic wastes generated mainly from markets, comfort stations, crematoriums, restaurants, hotels, hospitals, and slaughterhouses. There are about 33 comfort stations,¹⁰ 14 markets,¹¹ 174 health institutions,¹² 293 restaurants, 122 hotels, 48 cemeteries, 16 crematoriums, and 2 main slaughterhouses in the Corporation area. Cochin Corporation spends about 33 crores of rupees annually (about US\$795 thousand) for public health services, including solid waste collection and disposal. There is a common view that the manpower and other mechanical facilities are inadequate for effective collection and disposal of waste generated in the Corporation (Table 4).

Table 4
Corporation Resources for Health Services, including Waste Collection/Disposal

Machinery	No of units	Manpower	No of persons
Hand carts	115	Health circle offices	22
Wheel barrows	100	Health inspectors	22
Hand sprayers	156	Junior health inspectors	56
Large containers	101	City cleaning workers	717
Tractors	7	Mosquito eradication workers	144
Auto trailers	10	Cleaning workers on daily wage	89
Drinking water tanker lorry	1	Daily wage workers for garbage moving	44
Triller	1		
Dumper placer	4		
Tractor bull dozer	2		
Jeeps	2		
lorries	15		
Suction unit	1		

¹⁰ Twelve of which are open urinal stations. 13 are with urinal/toilets and 8 are with urinal/bath and toilet facilities.

¹¹ Ernakulam Kaloor, Palarivattom, Kadavanthara, and Thevara have markets on the mainland and Patel, Polakkandam, Pullupalam, Amaravathy, Pattalam, Palluruthy, Veli, Perumpadapu, Cherlai, and Mini have markets in West Cochin.

¹² Out of which there are 78 hospitals, 84 dispensaries, and 12 mother and child health centers.



The Corporation has used Kari Island, located in Nadama village along the northern boundary of the city, as the main garbage dumping area. Recently, the Corporation has acquired 8 acres of paddy land in Chittoor and 21 acres in Palluruthy for the purpose of garbage disposal. There are also proposals pending in the Corporation to introduce private participation in the mechanical separation of waste to generate power. Schemes have also been proposed for the Corporation to set up separate recycling units on Cochin's East and West sides, if approved, this recycling is also expected to generate employment and revenue.

3 4 Stormwater Drainage

Based on reports from the Corporation's various division-level consultations, it is clear that there exist severe drainage problems in almost all 50 divisions on the East and West sides of Cochin. The perception is that the existing drains are inadequate and often clogged. This problem is aggravated by the area's unique topographic conditions that do not provide sufficient slope to permit proper flows in the drains. The water table is also high. Small drains many times do not flush properly into the bigger drains, and illegal dumping of solid waste and erosion of side walls result in clogged drains. Finally, and perhaps most importantly, flooding and bad drainage is due to the extensive reclamation and inappropriate development of wetlands within the city. A comprehensive environmental assessment and plan are immediately required for the Corporation to deal with this problem.

The Corporation's elevation varies from 7.5 meters in the East to 1 meter in the West. The Corporation area is bisected by the large Vembanad Lake, which forms the catchment for all drainage in the region. The drains and canals in West Cochin, therefore, flow to the east, while those in East Cochin flow to the west. In many areas, the drains also serve as sewers, since many septic tanks in the city overflow, particularly during the rainy season. This ultimately causes the contamination of the backwaters, which in turn, presents a serious health hazard for the Corporation. In many places, railway and road culverts are obstructed by crossing pipelines and cable lines of the KWA and the Telecommunications Department. During the rainy season, the Corporation area often turns into a swamp, which unfortunately has now become the characteristic image of the city.

3 5 Transport and Communications

Traffic into and within the inner city has become very congested. This is due primarily to inappropriate building and land development caused by the absence of adequate enforcement of development and building regulations. The existing regulatory system for awarding building permits fails to adequately check for the availability of parking spaces or the resultant volume of traffic generated. Currently, there is a feasibility study under way for an elevated, inner-city mass rapid transport system whose aim is to address future traffic congestion in light of Cochin's continued development. Considering the coastal characteristics of Cochin, it would be prudent to also consider the potential of water transport to alleviate some of the inner-city congestion.

Since Cochin is a port city, efficiencies in the shipping and handling of cargo are of major concern. Anticipating the proposed development of the container terminal on Vallarpadam and Puthuvypin islands, the concept for diverting the transport of cargo through the inland waterways



requires further exploration. Surrounded by islands and waterways, a large proportion of Cochin's population depends on water transport for commuting to Ernakulam. It is estimated that around 80,000 people cross the backwaters by ferry each day to reach mainland employment, shopping, education, and medical needs. The Janakiyasootranam development report proposes making water transport more efficient by introducing more frequent service and routes¹³ and by adding faster boats and new jetties. It is expected that this proposal would also reduce vehicular exhaust, which accounts for 70 percent of the city's pollution.

Cochin's roadways face difficulties of traffic congestion due to the ever-increasing number of vehicles and the lack of required width for carriageways. Poorly constructed and maintained road surfaces, sidewalks and lack of required traffic bays, side parking, flyovers, underpasses, street lighting, signages, etc. all add to difficulties in the city's traffic corridors. Cochin Corporation is responsible for maintaining about 95 square kilometers of road with length of 2,678 kilometers. Of this total length, 1,600 kilometers are paved with bitumen, 316 kilometers with stone metal, 440 kilometers with gravel, and 322 kilometers with concrete. The national highways (NH), such as NH-47 and NH-17, and the state highways in the Corporation area have a total length of 11.86 kilometers and 20.8 kilometers, respectively. Cochin's development report proposes specific road development to be carried out in various administrative divisions.

The Kerala Urban Development Project (KUDP) conducted traffic surveys in 1991 that identified the major traffic bottlenecks in Cochin city. Besides bus stands, major bottlenecks include the two bridges connecting Fort Cochin to Ernakulam, Banerji Road Junction at MG Road, Chittoor Road, and the area opposite the GCDA market on Shanmugham Road. It was found that the lack of bus bays at bus stands causes 15 to 20 percent of the peak-hour traffic to experience delays of 30 seconds for every kilometer of road. During peak hours, long queues of up to 50 vehicles form at either end of the two bridges between Fort Cochin and Ernakulam. The stream speeds varied from 15 to 30 kph during peak hours and 19 to 34 kph during off-peak hours. The maximum variance of 8 kph in peak and off-peak speeds was measured on Banerji Road, while on all other roads the variance was 4 to 5 kph (refer to Tables 5 and 6).

The railways are still the principal form of transport linking cities across the Indian subcontinent. The linear geography of Kerala State, which lies between the Arabian sea and the Western Ghat mountain ranges, results in an arrangement of urban centers in a north-south direction. Cochin is well connected by rail to other urban centers within and outside the state, even though there is a demand for more frequent service. There are three main railway terminals in Cochin. One is on Willingdon Island and the other two are in Ernakulam. A new international airport has been constructed and awaits commissioning by the end of 1998. The Indian Air Force aerodrome located on Willingdon Island has previously been used for domestic services. The new airport is expected to boost commercial and tourism activities in the near term.

¹³ The 1996 Janakiyasootranam - Development Report (p. 97) proposes 12 new boat service routes to effectively exploit the waterways of Cochin.



Table 5
Traffic Survey Data for Main Roads in the Inner City of Ernakulam

Name of Road	Road Width in Meters	Traffic Count at Peak Hours	Total Traffic Count per Day
Banerji Road	18	2,789	32,704
Chittoor Road	9	1,639	18,506
MG Road at Deepa Junction	23	2 106	67 484
MG Road at Jos Junction	21	2,119	24,240
MG Road at Padma Junction	20	2,740	27 667
Park Avenue	14 5	2,133	19 998
Shanmugham Road	34	2 496	28,264
S A Road	12 5	2,961	34 977

Table 6
Pedestrian Traffic Data at Main Locations in the Inner City of Ernakulam
(The table shows the pedestrian count by specified time and location)

Name of Road	6am to 11am	11am to 12pm	12pm to 5pm	5pm to 6pm
MG Road	7 840	4,191	1 150	320
MG Road at Pallimukku	9,750	9,822	1 054	1 340
MG Road at Jos Junction	11,234	12 692	1,230	1 400
MG Road at Padma Junction	6 074	5 688	754	776
MG Road at Pharmacy Junction	3,656	2,827	460	296
Valanjambalam Junction	4 504	2 596	694	304
Kacheripady Junction	10 498	9,038	1 390	968
Broad Way	23 722	—	3,369	—
Park Avenue at Boat Jetty	7,628	6,636	1 006	1 088

When compared to other cities in the state, accident rates are relatively higher in Cochin (refer to Table 7)

Table 7
Accidents Occurring in Last Five Years, Cochin

Years	1992	1993	1994	1995	1996
No of Accidents	1 493	1 707	2,224	3 007	2,918
No of People Killed	101	111	130	153	119
No of People Injured	1,563	1 678	2,332	3 104	2,290



3 6 Energy and Power Supply

The major sources of energy used currently in Cochin include electricity, cooking gas,¹⁴ kerosene, diesel/petrol, and firewood. Liquid petroleum gas (LPG) forms the main energy source for cooking within the city limits, whereas kerosene and firewood are widely used for cooking outside the city limits. Of the 108,242 families in the Corporation, about 37,708 families use cooking gas, 17,974 families use firewood, and 52,560 families use kerosene for cooking. Every month, 3,540 tons of fire wood, 968,655 liters of kerosene, and 51,709 cylinders of LPG¹⁵ are consumed in the Corporation. Firewood users satisfy 20 percent of need from their premises, while the remainder is purchased. Despite the promotion of fuel-efficient types of firewood and kerosene stoves, the continued use of traditional stoves is the main reason for the heavy consumption of firewood. Biogas has proven to be popular in certain areas, even though it is less popular than LPG.

Table 8
Location and Distribution of Electrical Substations in Cochin

Corporation Divisions	West Cochin (Division 1 to 24)	East Cochin (Divisions 25 to 50)	
Electrical Section Office	Fort Cochin, Mattancherry, Thopumpady, Palluruthy	Thevara, Grimagar, Kaloor, Palarivattom, Edappally, Vaduthala, Vyttila	Total
Consumers			
Household No	36 976	71 399	108 375
Commercial No	11 688	18 584	30 272
Industrial High Tension No	31	83	114
Industrial Low Tension No	713	1 605	2 318
Agriculture No	29	190	219
Other No	10	20	30
Street Lighting No	7 410	12 527	19 937
No of Transformers	188	446	634
Total Capacity of Transformers (KVA)	34 465	86 649	121 114
Total Length of 11KV Line (km)	104 23	284 42	388 65
Total Length of 3 Phase LT Line (km)	352 55	538 82	891 37
Total Length of Single Phase Line (km)	170 01	453 13	623 14

The main energy source for all other household activities is electric power. Electric power distribution in the Corporation is provided by nine substations (Refer to Table 8 for the locations and distribution details of these nine substations). It is estimated that there are about 141,328 electricity consumers in the Corporation area covered by 11 major electrical districts.

¹⁴ Liquid petroleum gas and biogas form the principal cooking gases used in Cochin

¹⁵ Each cylinder weighs 14.5 kilograms



and 2 satellite districts. These districts come under the control of the three electrical divisions of the Ernakulam Electrical Circle (Refer to Appendix 4 for information on power consumption in Cochin Corporation). Currently, the total required electrical power in Cochin Corporation is 300 MVA, while only 130.5 MVA is being supplied. It is expected that in the next 10 years the requirement will grow to 600 MVA. By the end of 1996, there were 4,705 pending applications for electrical connection in Cochin Corporation. The state's major power generation comes from 16 hydroelectric power plants located along its length. The total power generated in the state is 1,503.5 MVA versus an estimated requirement by the year 2005 of 4,282 MVA. A number of feasibility studies point to solar power as the ideal alternate electricity source to meet this future demand.

4 Existing Regulatory Framework for Land Development and Building Construction

The STPD in Thiruvananthapuram is responsible for the preparation of town planning schemes, which are implemented and monitored by the regional town planning departments in each district. The town planning departments prepare special development plans called Detailed Town Planning (DTP) schemes.

GCDA is Cochin's local development authority responsible for reviewing applications to develop land and to change land use. It is responsible for maintaining building lines along roads and for approving layouts for new areas in conformity with zoning regulations. It issues planning permits called development permits. GCDA coordinates the implementation of DTP schemes within its jurisdiction. It coordinates the planning, design, and implementation of development works, such as roads, industrial estates, water supply and drainage, etc. GCDA also directly undertakes housing projects, infrastructure, recreational development, and commercial centers. On the other hand, GIDA holds the administrative responsibility for planning and implementing development activities for the islands around Cochin.

Local authorities, such as corporations, municipalities, and panchayats, are responsible for reviewing applications for building permits and for issuing permits according to the stipulations of the building bylaws, the "Kerala Building Rules." This permit is called the building permit. Following the creation of the CMEF under the Environment Protection Act of 1986, controls on the development of coastal areas came into effect in 1991. This act will ultimately have a major impact on Cochin, since a large section of the city falls within its jurisdiction. This new regulation, called the Coastal Zone Management (CZM) Plan, is now applicable throughout the coastal belt in Kerala State. As such, the particulars of the Coastal Regulation Zone Plan need to be clarified to adequately address the specific urban characteristics of Cochin. Implementation of the CZM Plan will be an additional responsibility of the development authorities.

CPT is an autonomous body responsible for the development of port activities. CPT controls and maintains the development of the entire Willingdon Island and the several islands and berths adjacent to the ship channel. Even though GCDA, the Corporation of Cochin, GIDA, and the Town Planning Department are routinely consulted on development plans for port facilities, the



Port Authority is ultimately responsible for the administration of this strategic area located in the heart of the city

As per the amended KMA, the process of preparing and executing development plans has been reformed to make it more responsive at the division level. Accordingly, division committees shall prepare annual development plans, including an estimate of proposed expenditures, for submission to the respective municipality. The municipality, in turn, prepares an annual development plan incorporating the plans proposed by the division committees for submission to the respective DPC. Notwithstanding anything contained in the Town Planning Act, for the time being, municipalities shall have the authority to prepare and implement their DTP schemes subject to the master plan prepared by the respective development authority. The draft development plan prepared by the MPC shall consolidate the plans prepared by the municipalities and panchayats in the metropolitan area in compliance with the overall objectives set by the central and state governments. These metropolitan plans will be forwarded by the MPC Secretary for state government approval.

The prevailing development plan for Cochin, called "Structure Plan for Central City Cochin-2001" and jointly prepared by GCDA and the STPD in 1980, is long out of date. This is due to several factors: (1) sole responsibility for the Corporation's development changed with the formation of GIDA, (2) empowerment of local bodies under the new constitutional amendment to plan and implement development, (3) the creation of CZM, and (4) unforeseen CPT development schemes. A comprehensive approach and strategy to coordinating the planning of the city's overall development, in light of the above factors, is an indispensable requirement for guiding the urban growth of the city beyond the year 2000.

5 Revenue and Expenditure Base of the Corporation of Cochin

Local revenue from various taxes, fees, and rentals is insufficient to meet the growing needs of municipalities for recurrent expenditures and the demand for capital investment. Central and state government resources alone cannot cover the shortfall for implementing comprehensive proposals at the local administration level. The comprehensive development schemes proposed by the Corporation of Cochin under Janakiyasootranam identified many additional resources to balance this deficit as follows:

- innovative approaches to the current system to improve revenue collection,
- loan facilities from various national¹⁶ and international¹⁷ financial aid agencies,
- loan facilities from various national banking institutions,
- investments of non-resident Indians, mainly from the Gulf States,
- increased property taxes from an appreciating real estate market,

¹⁶ Life Insurance Corporation (LIC) Urban Development Corporation (UDC) Housing and Urban Development Corporation (HUDCO) Cooperative Societies etc

¹⁷ Agencies like USAID the Department for International Development CIDA the World Bank the Asian Development Bank etc



- use of in-kind manpower resources in implementation of appropriate development schemes,
- local sponsorships to financially supported schemes, and
- revenue resources of “Indira Vikas Pathra ”¹⁸

In Cochin Corporation’s first budget following its formation in 1967, income was 53 67 lacs versus an expenditure of 35 58 lacs of rupees. In 1995, projected income grew to 1,823 64 lacs (Table 9) and expenditures to 3336 15 (333,615,926) lacs of rupees (Table 10). The shortfall was made up by various government grants and loans, as well as other sources (Table 11)

Table 9
Projected Income/Collection for Cochin Corporation, 1993-96 (lacs)

Income Source	Demanded Income (Projected)			Collected Income			Pending Balance		
	(a)			(b)			(a-b)		
Period	93-94	94-95	95-96	93-94	94-95	95-96	93-94	94-95	95-96
Property Tax	889 28	1 600 00	1 250 00	800 21	879 52	773 62	89 07	720 48	476 38
Employment Tax	73 02	112 52	125 00	65 15	104 27	110 58	7 87	8 25	14 42
Tourism Tax	161 20	177 02	212 62	161 20	177 02	212 62	—	—	—
Additional Tourism Tax	97 86	106 21	129 54	97 86	106 21	129 54	—	—	—
Advertisement Tax	7 37	15 00	6 87	7 37	8 65	7 59	—	6 35	—
Exhibition Tax	0 78	0 77	2 12	0 78	0 77	2 12	—	—	—
Building Rent	54 15	70 00	80 00	53 29	56 56	78 48	0 86	13 44	1 52
D&O Fee	8 67	15 00	16 48	6 64	13 95	5 59	2 03	1 05	10 89
PFA Fee	0 62	1 00	1 00	0 46	0 67	0 23	0 16	0 33	0 77
Total	1,292 95	2 097 52	1,823 64	1 192 96	1 347 62	1 320 38	99 99	749 90	503 98

¹⁸ Government has decided to invest 40 percent of the Indira Vikas Pathra deposits in the respective local regions



Table 10
Expenditures for Cochin Corporation, 1994-96

Item	Annual Total Expenditure (lacs)		Expenditure per Day		Expenditure per Person		Expenditure per Family	
	94 95	95 96	94 95	95-96	94 95	95 96	94 95	95 96
Administration	313 49	348 26	85 887	95 415	54	59	269	296
Public Works	864 73	1 237 48	236 913	339 036	148	210	743	1 053
Education	20 55	22 95	5 629	6 286	4	4	18	20
Water Supply/Drainage/Public Health Services	692 37	982 67	189 690	269 244	119	167	595	836
Street Lighting	59 79	59 79	16 382	16 382	10	10	51	51
Miscellaneous	370 66	685 00	101 550	187 620	63	116	319	552
Total	2,321 59	3,336 15	636,051	914,033	398	566	1,995	2,838

The Corporation's annual budget is set according to the needs of various development targets and the total availability of revenue sources. In the 1998-99 budget plan, the five main development areas were Production, Service, Environmental Infrastructure, Poverty Alleviation, and Social Development. The revenue sources for these main areas are described in Table 11 and the allocation of these resources to the five development areas is detailed in Table 12. The Corporation has prepared a detailed development proposal for 1998-99 according to available resources and to the needs and opinions raised in the division and neighborhood conventions conducted by the Janakiyasootranam committee. Cochin Corporation has published a brief guide that describes the various projects proposed and the respective budgetary allocation.

Table 11
Estimated Revenue Sources for Cochin Corporation, 1998-99

No	Source	Amount in Lac Rupee	Percentage
1	Grant in Aid - General	1,303 38	41 29
2	Grant in Aid - Special Projects	108 51	
3	Grant in Aid - Tribal Sub-Plan	9 31	
4	Own Fund	1 205 15	35 02
5	State Government Fund	93 23	11 86
6	Central Government Fund	171 15	
7	Financial Institution	143 90	
8	Voluntary Donation	110 44	3 21
9	Beneficiary	202 36	5 88
10	Other	94 12	2 74
	Total	3,441 55	100 00



Table 12
Annual Budget Allocation by Sector for Cochin Corporation, 1998-99
 (lac rupees)

No	Sector	%	Subsector	%	Financial Resources							Total Outlay	
					Grant in Aid	Own Fund	State Fund	National Fund	Financial Institution	Donation	Bene-ficiary		Other
1	Produc-tion	30	(a) Agriculture	11	44 40						21 70		66 10
			(b) Fishing	11	41 25						15 62		56 87
			(c) Animal Husbandry	18	70 76	68 72		25 00	25 00		21 92		211 40
			(d) Industry	60	234 60			1 34		10 00	35 50		281 44
			Total	100	391 01	68 72		26 34	25 00	10 00	94 74		615 81
2	Services	39	(a) Health Environment	28	144 80	75 50	5 73			44 00	5 00		275 03
			(b) Education	17	85 24	0 10	70 45				4 45		160 14
			(c) Housing	18	91 25	9 00		3 50			25 00	46 50	166 35
			(d) Drinking Water	8	39 50	3 00					2 75		51 25
			(e) Culture Heritage	5	24 10					2 75			29 85
			(f) Mother & Child Care	14	71 56		17 00			2 00			90 56
			(g) Cooperative Marketing	2	9 12		0 05			0 92	31 50	36 00	77 59
			(h) Market	8	39 00								39 00
			Total	100	504 57	87 60	93 23	3 50			49 67	68 70	82 50
3	Environ-ment	26	(a) Transport	57	195 52	639 20							834 72
			(b) Energy	20	69 03	22 50				50 77	5 45		147 75
			(c) Drainage	23	78 08	361 38							439 46
			Total	100	342 60	1,023 08				50 77	5 45		1,421 90
4	Poverty Allevia-tion	5	Slum Improvement	100	65 17	25 50		141 31	118 90				380 20
			Total	100	1,303 38	1,204 90	93 23	171 15	143 90	110 44	198 21	82 50	3,307 70
5	Scheduled Caste Development				108 51	0 25					4 15	11 62	124 53
	Scheduled Tribe Development				9 31								9 31
	Women s Welfare				130 97								130 97
Total amount					1,421 00	1,205 00	93 23	171 20	143 90	110 44	202 36	94 12	3,442 00



6 Ongoing and/or Proposed Infrastructure Projects for Cochin

Cochin's local institutions and nongovernmental organizations (NGOs), as well as many multi- and bilateral organizations, are developing various projects for Cochin's infrastructure sector. Interestingly, most of these efforts are still in the pipeline or very early stages of implementation. This section briefly describes these ongoing and proposed infrastructure projects for Cochin Corporation.

6.1 Local Initiatives

6.1.1 Water Supply and Distribution

Various short-term proposals have been put forward by HUDCO, the Department for International Development (DFID), the Manjummal¹⁹ Project, the Expansion Project of Chowara Plant, etc. to meet increased demand for water in Cochin. All these schemes have been in the pipeline now for a few years, but the KWA has so far been unable to initiate and implement any of these projects.

6.1.2 Solid Waste Collection and Disposal

Cochin Corporation has tried various schemes to improve solid waste collection and disposal.²⁰ Recently, EXNORA, a Chennai-based NGO, has proposed improving waste management through a partnership effort between the city and the affected communities. With RUDO/South Asia assistance, EXNORA initiated program activities through a technical workshop entitled "People's Program for a Clean Cochin." EXNORA's program envisages solid waste collection and disposal via a decentralized system that makes use of the Corporation's existing labor and equipment resources. Collection and disposal efforts will be managed by the Janakiyasootranam committee at the division level with technical support from EXNORA and USAID. Organic waste collection will be organized at the division level of the Corporation. From its own resources, the Corporation will purchase Rs. 25 lacs worth of manure for its own farming purposes. This amount is expected to cover the costs of the composting. Pilot efforts in four selected divisions were started in September 1998. Cochin's Rotary Club has donated tricycle carts for collection of the separated garbage in these divisions. A Christian nonprofit organization has come forward offering land for implementing this pilot garbage composting scheme.

6.1.3 Stormwater Drainage

As part of the 1997-98 Janakiyasootranam, the Corporation undertook an extensive cleaning of the Corporation's drains and canals. This was effective in reducing the usual monsoon flooding of the city. As part of municipal development projects carried out through Janakiyasootranam during 1996-97, many new drains were constructed.

¹⁹ The KWA has proposed the construction of a filtration/pumping station at Manjummal which is located on the Periyar River at the Corporation's periphery.

²⁰ The Corporation has introduced specially designed waste bins to assist collection and haulage which is done by Dumber Placer trucks. The Corporation has also opened a landfill to dispose of the waste collected.



6 1 4 Transport and Communications

- A new international airport was completed during 1998 at Nedumbasserry in Cochin. It will shortly be inaugurated. The development of the new airport was a public-private partnership, the first of its kind in India in terms of conceptualization and financing. It was designed and executed with technical assistance provided by the National Airports Authority of India. The cost of the project was 162 crores of rupees.
- CPT has plans to develop a trans-shipment terminal at Vallarpadam Island and an LPG station at Puthu Vypin.
- Cochin's Marine Drive was constructed into the backwaters along the western edge of Ernakulam city by reclaiming and expanding the foreshore along Shanmugham Road to a width of 150 to 300 feet. The scheme extends from Rajendra Maidan in the south to the High Court buildings in the north. Initiated by CTPT, this scheme was planned and implemented by GCDA.
- A Janakiyasootranam project, jointly organized by GCDA and Cochin Corporation, is currently under way to widen and develop Sahodaran Ayyappan (SA) Road, which is one of the three main approach roads to the inner city of Cochin. GCDA has been quite successful in gaining access to land on either side of SA Road in exchange for permitting additional building FAR (floor area ratio) on the remaining land. Once completed, this project is expected to go a long way toward resolving the traffic delays into and out of the city during peak hours.

6 1 5 Health and Sanitation

Mosquito eradication programs have been carried out, including street fumigation in the evenings, flushing drains with sea water, etc.

6 1 6 Technical Assistance

- The Kerala Institute of Local Administration (KILA) is providing technical training for municipal planning and administration in Cochin Corporation.
- NEERI is coordinating a comprehensive carrying capacity study of the Greater Cochin area as part of a state-wide survey initiated by the CMEF. NEERI will associate with KPCB, the Center for Earth Science Studies (CESS), the Center for Water Resource Development and Management, the National Institute of Oceanography, Kerala Sastra Sahitya Parishad (KSSP), and CUST in conducting the mentioned survey.
- Rail India Technical and Economic Services Ltd (RITES) is currently undertaking a feasibility study for a ring-rail rapid transport network for the central city area of Cochin.
- KSSP has recently completed a survey of 140 large-scale industries in Ernakulam District. KSSP is now conducting a socioeconomic survey of 5 percent of the households in 20 percent of the divisions of each of the District's panchayats.
- Kirloskar Consultants Pvt. Ltd. has prepared a preliminary assessment on drainage issues in Cochin.



6 2 Interventions of Multi-/Bilateral Organizations

6 2 1 Water Supply and Distribution

- DFID has recently proposed short-term assistance to Cochin's water distribution network. This scheme will relocate existing water lines that are found in drains and canals to improve sanitary conditions.
- The Japanese International Cooperation Agency has proposed a long-term water supply and distribution program for Cochin City.
- Tata Consultancy has prepared a detailed assessment for the World Bank on water supply requirements for Cochin.

6 2 2 Solid Waste Collection and Disposal

- USAID has recently initiated a program to support solid waste management (SWM) in Cochin in partnership with EXNORA and the Corporation's Janakiyasootranam.
- DFID has included SWM in its current year program in the amount of 5 crore rupees to fund engineering works.

6 2 3 Stormwater Drainage

DFID has included stormwater drainage in its current year budget and has allocated 66 lac rupees for city-wide flood protection.

6 2 4 Transport and Communications

The European Community (EC) has recently provided the Corporation and GCDA with assistance in relocating the city's wholesale markets along the newly developed bypass on the city's periphery at Maradu and Kalamassery. The EC support included the provision of truck terminals and warehouses. The concept is that commodities will be brought to this new market area by bigger trucks, which in turn will be distributed to suburban retailers in smaller vehicles.

6 2 5 Health and Sanitation

DFID is supporting a city-wide Slum Improvement Project (SIP) and a Poverty Alleviation Program in Cochin. Under DFID's SIP, about 280 slum pockets in the city are slated for intervention in the areas of community development, health, education, physical infrastructure, and employment support. DFID assistance will amount to 60 crore rupees over a span of five years. Mim Colony, one of the six pilot settlements under the SIP, received Rs 2,000 per house toward the provision of latrines during 1996.

During the current year, DFID has proposed a comprehensive upgrading package for West Cochin divisions 2, 3, 4, 5, 17, 20, 25, and parts of 19 and 21, which will include basic drainage and sanitation infrastructure, self-employment and job training schemes, and an awareness program. The total budget allocated for this current program is 5 crore 45 lac rupees.



6 2 6 Technical Assistance

- USAID initiated a year-long Historic Conservation Program entitled “Cochin Heritage Zone Conservation and Development Program,” whose principal objectives were the preparation of a walking tour brochure for the historic Fort Cochin, the formation of a bylaw and guidelines for the comprehensive conservation of Fort Cochin, and the development of a strategic plan for environmental infrastructure for Cochin Corporation. With the completion of this initiative, the Cochin Chapter of the Indian National Trust for Art and Cultural Heritage (INTACH) has offered to carry forward with the formulation of a conservation bylaw and guidelines for Fort Cochin with other resources.
- The Netherlands government, with support from its national universities, is providing financial aid and technical cooperation aimed at upgrading the educational infrastructure of CUST.
- The Netherlands consulting firm Frederick R. Harris carried out a feasibility study for CPT on the development of an international trans-shipment terminal at Cochin Port.

Part II Recommendations for the Provision of Environmental Infrastructure

The aim of the following recommendations is twofold (1) to address the issues and constraints set forth in the previous sections regarding Cochin Corporation's administrative, regulatory, and physical structure, and (2) to strengthen the Corporation's Janakiyasootranam functions with respect to the coordination of the decentralized (i.e., division- and neighborhood-based) planning and budgeting of infrastructure projects, specifically environmental infrastructure projects

1 Institutional Strengthening

The municipal administrative mechanism of Janakiyasootranam is weak in planning, budgeting, and execution of infrastructure provision as per the decentralization policy called for in the new 1994 KMA

1.1 Issues

- Infrastructure projects identified and proposed as part of Janakiyasootranam during the last two years were often prioritized on nonsubstantive grounds, were disproportionate in budget allocation between East and West Cochin,²¹ and were poorly conceived in terms of city-wide comprehensive planning
- Coordination is weak in the planning and implementation of infrastructure services among the involved government and NGOs (Cochin Corporation, the Town Planning Department, CPT, the Water Authority, the Electricity Board, HUDCO, GCDA, GIDA, the Planning Board, etc.), which causes inefficiencies in service delivery

1.2 Recommendations

- The administrative mechanism of Janakiyasootranam needs to be simplified to ensure access to appropriate technical inputs, particularly at the project identification stage. Sufficient technical skills must be available and brought to bear on proper prioritization and design of projects, on equitable allocation of budget, and on ensuring that individual projects fit within the overall comprehensive planning for the Corporation
- A participatory process involving the appropriate organizations and citizen groups is essential to coordinate efforts, as well as resources, in the identification of projects to ensure implementability, access to adequate capital funding, effective coordination of implementation, and ultimately sustainability of the completed projects
- Steps need to be introduced to incorporate corrective measures from feedback received at the end of the Corporation's fiscal year in order to improve project identification, planning, and budgeting for the next year

²¹ East and West Cochin consist of 27 and 23 municipal divisions respectively. East and West Cochin have respective populations of 307,021 and 257,568. However, five of six of the Corporation's Standing Committee Chairmen are from East Cochin. The recent municipal budgeting and projectization exercise was criticized due to a disproportionate allocation of funds to East Cochin.



2 Infrastructure Provision

As set forth above, it is obvious that the provision of infrastructure services, such as water supply and distribution, SWM, stormwater drainage, transport, and power conservation, needs immediate attention in Cochin Corporation. The specific issues and corresponding recommendations for each subsector are described below.

2.1 Water Supply and Distribution

2.1.1 Issues

- The KWA continues to supply and distribute potable water in the city, even though, according to Section 30-1 of the 1994 Municipal Act, this service is now the responsibility of Cochin Corporation.
- Currently, about 90 MLD is supplied to the Corporation versus a total requirement of 184 MLD. Considering the rapid growth in the demand for water, there will be a projected shortage of water of 113 MLD in the city by the year 2010.
- Of a total length of 635 kilometers of pipe, about 190 kilometers need replacement, about 215 kilometers of pipe are required to extend the system.
- About one-third of the city's households have independent water connections and the rest depend on about 7,000 public water taps. (It is observed that considerable wastage occurs through misuse at public taps.)
- The various short-term HUDCO, Manjummal, and DFID proposals and the expansion project at the Chowara Plant are under way, but their completion is delayed by persistent inefficiencies in coordination.

2.1.2 Recommendations

- Because the 1994 Municipal Act calls for responsibility for water provision to pass to the Corporation, systems, procedures, and adequate staff should begin to be put in place for this transfer.
- Priority should be given to replacement of public water taps, since, in addition to causing wastage, they contaminate the entire water system.
- The Water Authority, with support from Cochin Corporation, should execute the short-term water supply proposals of HUDCO, Manjummal, and DFID without further delay, additional support and financial resources should be sought from other aid agencies to ensure smooth and fast completion of these projects.

2.2 Solid Waste Management

2.2.1 Issues

- It is estimated that out of a total 250 tons of garbage generated daily in the Corporation, only about 70 percent is collected. Many times garbage is seen spilling out of the collection bins, causing an unhealthy public environment.
- Manpower and vehicles, as well as other equipment, are inadequate for effective collection and disposal of different types of garbage.



- The current system of sanitary land filling is uneconomical, as it necessitates large tracts of land for filling, requires heavy and long-distance transportation, and uses large quantities of earth for covering. The whole process is energy intensive and ecological damaging.
- The current system does not generate any income, rather, it takes a major part of the annual municipal budget.
- Solid, liquid, organic, inorganic, and recyclable materials are currently not being separated at source.
- The Corporation by itself cannot effectively manage the collection and disposal of the total urban waste generated in its service area.

2.2.2 Recommendations

The collection and disposal of SWM needs to be put on a participatory, collective basis, rather than one where the Corporation has exclusive responsibility. Janakiyasootranam and EXNORA's recently initiated participatory SWM program should continue and find ways through trial and error to achieve an appropriate model. This model, which should ultimately be implemented in the Corporation's 50 divisions, has the following advantages:

- generation of income and additional employment,
- use of decentralized collection, separation, and disposal and assurance of eco-friendly waste management,
- avoidance of the costs of long haulage and heavy equipment, and
- no requirement for large tracts for landfill.

2.3 Drainage

2.3.1 Issues

- Inadequate slopes and high water tables are the main geological reasons for Cochin's drainage problems.
- Other reasons for the city's poor drainage are (1) clogging of drains due to dumping of solid waste, (2) erosion of the side walls of deteriorated drains, (3) lack of legislation to ensure provision of stormwater drainage in new subdivisions, and (4) illegal reclamation of wetlands within the city limits.
- In certain areas, drains also serve as sewers, since septic tanks often overflow, which ultimately contaminates the backwaters.
- Culverts along railways and roadways are often obstructed by water lines and electric cables of the KWA, the Kerala State Electricity Board (KSEB), and the Telecommunications Department.
- No major assessments have been carried out to study the city's drainage problems, even though drainage issues are a major concern of Cochin today.



2 3 2 Recommendations

- Planning the city's drainage network and implementing the construction and maintenance of new drains must be closely coordinated among the KWA, KSEB, the Telecommunication Department, Southern Railway (SR), and Cochin Corporation
- A comprehensive environmental plan, including improvements to the stormwater drainage system, which makes use of modern database and mapping aids, such as geographic information systems (GIS) and remote sensing, should be prepared for the city
- Upon completion of a comprehensive drainage plan for East and West Cochin, the financial resources and coordinating role of Janakiyasootranam could be effectively used for its incremental implementation
- Use of prefabricated modular drains, drain covers, and drain joints could accelerate effective incremental implementation
- Contaminated overflow from the city's septic tanks should, to the extent possible, be kept away from open drains
- Legislative controls should ensure that all new subdivisions provide proper surface drainage and should preclude the illegal reclamation of backwaters for new development

2 4 Transport

2 4 1 Issues

The east and west parts of Cochin present a different set of problems and therefore demand distinct solutions in the area of transport as follows

- West Cochin and GIDA Areas The population of West Cochin and the adjacent GIDA areas must cross the backwaters to travel to East Cochin The major problem for overland travel from West to East Cochin is the bottlenecks created at the two narrow bridges across the backwaters at Willingdon Island In addition, the public and private water transport services plying between West and East Cochin and the GIDA areas are inefficient
- East Cochin Area Road traffic is congested at peak hours on all three access arteries to center-city — SA Road, Banerji Road to Alwaye, and MG Road to Thopumpady There are inadequate pedestrian walkways, facilities for the aged and physically handicapped, litter bins, signs, traffic signals, bus bays, etc Trees with large trunks are often observed to occupy many sidewalks, obstructing easy pedestrian movement and maintenance of the drains and electric and telephone cables

2 4 2 Recommendations

- Realignment of the main access artery of SA Road is expected to solve much of East Cochin's transport problems An effective mass transport system serving the city center, however, is worth exploring RITES is currently conducting a feasibility study for an elevated rapid railway system A water mass transport system should also be considered A mass rapid transport (MRT) system and backwater ferry transport network could be alternative solutions to the inner-city transport problems The proposed ring roads and relocation of the wholesale markets is also expected to lower the volume of heavy and light commercial vehicles in the city center



- Improvements to the road network, the two airports, the port and new berthing facilities, proposed boat jetties, MRT stations, and bus terminals should be planned comprehensively to ensure the efficient transport of different types of passengers, goods, and vehicles
- Improvements to road signs, street lighting, signaling system, provision of conveniences for pedestrians, and the handicapped are required
- Specially designed bus stops, boat jetties, bus-boat interchanges with comfort facilities, bicycle parking, etc need to be provided
- Initiation of campaigns and awareness programs for making streets litter-free need to be designed and implemented
- Regulation of city greening in terms of the type and kind of vegetation appropriate to an urban environment need to be considered (Ideally, smaller trees would be planted on narrow sidewalks to provide a certain amount of shade for pedestrians. Larger trees would be reserved for public parks, open spaces, and boulevards)
- Proper traffic management needs to be introduced

2.5 Power Conservation

2.5.1 Issues

- The shortage of power is acute, since the total required electrical power in the Corporation is 300 MVA and only 130.5 MVA is being supplied. It is expected that in the next 10 years demand will grow to 600 MVA. About 5,000 applicants await electrical connections in the Corporation.
- Loss of power during transmission and household and industrial use of high-energy-consuming electrical systems for street lighting, water pumps and motors need to be dealt with.

2.5.2 Recommendations

- USAID's Sustainable Cities Initiative²² for Demand Side Management (DSM) can potentially assist in the resolution of Cochin's existing shortage of power through the development of

²² With the introduction of Demand Side Management in Ahmedabad in 1994 the Ahmedabad Electric Company (AEC) carried out the following power saving assessments

- High-Rise Buildings Water Pump Program — On the four tested sites the energy savings ranged from 22 percent to 60 percent and demand savings ranged from 5 percent to 48 percent. This indicated that a 25 percent savings in energy and a 20 percent savings in demand could be achieved when implemented in the 4,000 high-rise buildings in Ahmedabad. This translates into an energy savings of 1 million kWh and a demand savings of about 2 MW in the Ahmedabad Municipal Corporation (AMC).
- Flour Mill Program — Motor and mill maintenance achieved 2 percent to 5 percent savings in power. Capacitor installation improved the power factor from 0.75 to 0.92. Drive belt maintenance and conversion from v belt to flat belt achieved a savings of 1 percent to 12 percent. By installing energy-efficient motor power consumption was reduced from 5.9 kW to 5.3 kW and energy consumption was reduced from 2.75 kWh to 2.3 kWh per 50 kilograms of wheat. Reactive power demand was reduced by about 1,000 kVa by improving the power factor.



sustainable energy and environmental improvement programs USAID's initiative in Ahmedabad can serve as a model for Cochin Corporation

- Nonconventional energy systems, such as solar water heaters, street lights, and wind mill pumps, could provide energy-saving alternatives for most of the commercial buildings in Cochin (The Agency for Nonconventional Energy Research and Technology [ANERT] assists with installation and provides about a 30 percent subsidy on purchases of this type of equipment)
- Public education and awareness campaigns could help introduce power- and energy-conserving measures in all sectors of Cochin Corporation

3 Mapping and Documentation

Adequate data and information facilities are generally not available to assist with the proper planning and implementation of Corporation projects

3 1 Issues

As part of the devolution of roles and responsibilities to the municipal level, the Kerala State Government has initiated a comprehensive state-wide and detailed data collection, documentation, and mapping program Such programs usually take considerable time to complete, however, and the results are often less than satisfactory Insufficient data on existing issues, financial resources, and proposals for the different infrastructure subsectors are a few of the main reasons for the existing inefficiencies and shallowness in planning and implementation of municipal infrastructure projects at the local level

3 2 Recommendations

- Establish rapid assessment techniques for data collection and introduce comprehensive mapping, such as GIS databases and mapping, remote sensing, and aerial photography analyses
- Such documentation should be readily available to local bodies and periodically updated to ensure effective planning and implementation of municipal development activities

continued

- Motor Program — This program aimed at introducing energy efficient motors and effective motor specification and maintenance practices in Ahmedabad An annual savings of 800 000 kWh can be achieved if 5 percent of the AMC s 2 000 total motors are replaced by energy efficient models
- High-Tension (HT) Industrial Energy Audits — HT industries account for 25 percent of AEC s total peak demand Through the audit program it is estimated that with appropriate energy-efficiency measures 2 4 million kWh can be saved monthly and customer demand can be reduced by 8 MV
- Energy Conservation Program at the AMC — The AMC is AEC s largest customer in terms of water supply systems (79%) drainage systems (14%) and other uses such as street lighting, offices and schools and hospital buildings (6 9%) which account for a total energy demand that varies between 15 MW and 30 MW over a 24 hour period The adopted energy-efficiency measures achieved the following savings
 - ▶ Efficiency of an 85-HP bore well pump increased from 46 percent to 60 percent
 - ▶ Efficiency of a French well pump improved from 45 percent to 54 percent
 - ▶ Power factor improvements in 85 HP submersible bore well pumps achieved an annual saving of Rs 25 620 per pump while the power loss in the distribution cable was reduced from 6 kW to 4kW

Part III

Short-Term Action Plans for the Provision of Environmental Infrastructure in Cochin

The issues and recommendations discussed in Part II lead to the identification of five priority projects for Cochin Corporation. This section outlines these five projects, which are targeted to immediately address the strategic needs of the Corporation in the area of environmental infrastructure. Table 13 illustrates the linkages among the five priority short-term projects and the issues and recommendations set forth in Parts I and II of the Environmental Plan.

Table 13
Linkages between Priority Projects and Issues and Recommendations

Sector	Issues	Recommendations	Short-Term Action Plans
Institutional Strengthening	<ul style="list-style-type: none"> • Janakiyasootranam projects prioritized on nonsubstantive grounds disproportionate in budget allocation and poorly conceived in comprehensive planning • Coordination is weak in the planning and implementation of infrastructure services among the involved institutions which causes inefficient service delivery 	<ul style="list-style-type: none"> • Janakiyasootranam's administrative mechanism needs to be simplified to adequately access technical inputs for proper prioritization and design of projects on an equitable budgeting basis • Participatory process involving the appropriate organizations and citizens groups is essential • Steps needed to incorporate corrective measures from feedback on annual Janakiyasootranam programming activities 	Institutional capacity building of Cochin Corporation offices in project formulation, budgeting and delivery
Infrastructure Water Supply and Distribution	<ul style="list-style-type: none"> • The KWA continues to supply and distribute potable water in the city even though this is the responsibility of the Corporation • Shortage of 113 MLD of water in the city by year 2010 is estimated • Of a total length of 635 km of pipe, 190 km needs replacement and about 215 km is required to extend the system • Considerable wastage occurs through misuse of public taps • Short-term proposals are delayed by persistent inefficiencies in coordination 	<ul style="list-style-type: none"> • Since 1994 the Municipal Act calls for responsibility for water provision to pass to Corporation; action should begin to be put in place for this transfer • Priority to be given to replacement of public water taps since they cause wastage and contamination • The KWA with support from Cochin Corporation should execute the short-term water supply proposals of HUDCO, Manjummal and DFID without further delay 	Pilot environmental package plans for select divisions of Cochin Corporation



Sector	Issues	Recommendations	Short-Term Action Plans
Solid Waste Management	<ul style="list-style-type: none"> • Only 70 percent of the Corporation's total 250 tones of garbage is collected daily • Manpower/equipment are inadequate for effective collection and disposal of different types of garbage • Current system of sanitary land filling is uneconomical energy intensive and ecological damaging • Operation of the sanitary landfill does not generate any revenue • Garbage is not separated at source • Corporation by itself cannot effectively manage the collection and disposal of all solid waste 	<ul style="list-style-type: none"> • Collection and disposal of SWM needs to be put on a participatory collective basis rather than one where the Corporation has exclusive responsibility • Janakiyasootranam and EXNORA's recently initiated participatory SWM program should continue since it has the following advantages <ul style="list-style-type: none"> ▶ generation of income and additional employment ▶ use of decentralized collection separation and disposal ensures eco-friendly SWM ▶ costs of long haulage and heavy equipment are avoided and ▶ large tracts for land fill are not required 	
Drainage	<ul style="list-style-type: none"> • Inadequate slopes and high water tables clogging of drains due to dumping of solid waste erosion of the side walls of drains lack of legislation to ensure provision of stormwater drainage in new subdivisions and illegal reclamation of wetlands are the main reasons for Cochin's drainage problems • Drains often serve as sewers which leads to contamination of the backwaters • Culverts along railways and roadways are often obstructed by water lines and telephone and electric cables • No major assessments have been carried out to study the city's drainage problems even though drainage issues are a major concern of Cochin today 	<ul style="list-style-type: none"> • Planning implementation and maintenance of the drainage networks must be closely coordinated among the KWA KSEB the Telecommunication Department SR and Cochin Corporation • A comprehensive environmental plan including improvements to the stormwater drainage system that make use of modern database and mapping aids such as GIS and remote sensing should be prepared for the city • Janakiyasootranam resources and coordination role could be effectively used for the implementation of a comprehensive drainage plan for Cochin • Use of prefabricated modular drains could accelerate effective incremental implementation • Contaminated overflow from septic tanks should be kept away from open drains • Legislative controls should ensure proper surface drainage in all new subdivisions and should preclude illegal reclamation of backwaters 	Stormwater drainage schemes for East and West Cochin

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1 Assistance to Cochin Corporation in Institutional Strengthening

Cochin Corporation needs to be supported with immediate and appropriate assistance to ensure that it can successfully carry out the new roles and responsibilities devolved under the 1994 KMA. Regarding the provision of environmental infrastructure, administrative and technical capabilities have to be built, particularly in project formulation, budgeting, and delivery. Priority should be given to build capacity in the Corporation to carry out the development initiatives of Janakiyasootranam Prastanam. The specific areas where the Corporation needs immediate assistance include

- project identification, prioritization, and formulation,
- revenue generation for infrastructure projects, including potential for private participation,
- annual budgeting process,
- introduction of modern accounting systems and procedures, and their appropriate automation,
- data collection and mapping and the creation of appropriate computerized databases, and
- manpower planning and training to ensure the effective delivery of the newly empowered municipal functions

2 Environmental Plan for Cochin Corporation/Pilot Plans for Divisions 6 and 31

Given the delicate balance existing between Cochin's built and natural environment, a comprehensive environmental assessment and plan is urgently required. Perhaps with state or donor agency funding, the Corporation should act quickly to commission an environmental plan that addresses the city's severe environmental problems and infrastructure deficiencies. Such a plan, which should be given the highest priority by city officials, would serve as the blueprint for the improvement/expansion of city-wide infrastructure networks and the framework within which division-level project identification and prioritization decisions are being taken under Janakiyasootranam. The city-wide environmental plan should encompass the areas of water supply and distribution, sanitation, stormwater drainage, and SWM. In conjunction with the preparation of a comprehensive environmental plan and ongoing activities under Janakiyasootranam, the following two illustrative pilot projects are proposed for East and West Cochin Divisions 6 and 31, respectively. These pilots are selected to demonstrate how improved infrastructure services can stimulate commercial activity and conserve and renovate the city's prime historical areas.

2.1 Division 6

Division 6 encompasses the historic Mattancherry area, which is home to many commercial activities and ethnic settlements, the famous heritage neighborhood of Jew Town, and the spice bazaar along the edge of the backwater. The development of the modern port at Willingdon Island led to the gradual shift of commercial activities to the mainland and to a decline in urban environmental services. The further tourism development of Mattancherry and the adjacent historic Fort Cochin is greatly dependent on the environmental quality of these areas. Within the



context of a comprehensive plan for the Corporation, a coordinated program for Mattancherry in upgrading stormwater drainage and SWM should be explored

2.2 Division 31

Division 31 forms the Central Business District (CBD) of Ernakulam. It is the location for the city's principal administrative, commercial, health, and educational institutions. Cochin Corporation, as well, is located in this division. It requires a comprehensive program of environmental upgrading, particularly with respect to stormwater drainage and SWM. Improvements in street lighting and comfort facilities are also required.

3 Stormwater Drainage Schemes for East and West Cochin

As part of the environmental plan proposed in the preceding point or as a separate undertaking, both East and West Cochin urgently require improvements to their stormwater drainage systems. The survey work carried out by Kirloskar Consultants could serve as the basis for a preliminary assessment. Assistance in rapid assessment techniques for mapping and data collection would be useful to further update and add required details for the preparation of a comprehensive drainage plan. The drainage schemes for East and West Cochin should include plans for the cleaning and maintenance of the canals and drainage networks. Community-based, participatory efforts need to be initiated to incorporate the ongoing Janakiyasootranam projects for flood prevention, mosquito control, and SWM. Detailed plans should be developed for the cleaning and desilting of canals and drains and for the further control of the dumping of solid waste. If properly phased and desegregated into manageable subprojects, a comprehensive drainage plan for Cochin could be executed incrementally through the Corporation's Janakiyasootranam program.

4 Cochin Backwater Cargo/Mass-Transport Plan

There is a large daily influx of individuals from the densely populated areas of West Cochin and adjacent islands to Ernakulam in East Cochin. These individuals commute daily for the employment, education, health, and entertainment opportunities offered in Ernakulam. Efficient mass transportation is of prime importance. The Corporation has not given proper attention to this issue in the past. Backwater transport is already a critical mode for the transporting of raw materials from Cochin Port to the industrial areas located on the city's periphery. The city's backwaters should be viewed as an asset to enhance the city's urban economic development.

Enhanced backwater transport in Cochin offers many opportunities for private participation. The Inland Water Ways Authority of India (IWWAI) has proposed the establishment of a passenger transport network between Kollam and Kodungallor, which will also connect with Cochin. The IWWAI is prepared to cover 50 percent of the cost of jetty development along the proposed route if municipalities and panchayats are able to put forward appropriate proposals on water transport schemes. IWWAI's plan envisages that the local authorities would license private boat operators from which they would collect a fee, as well as a user charge for the jetties. Cochin Corporation requires assistance in packaging these public-private ventures for passenger and cargo water transport. This proposal offers the potential for reducing traffic congestion and pollution in the center city and on the city's principal traffic arteries.



5 Tenement Upgrading in the Heritage Zone of Mattancherry

Occupants of the tenements of Mattancherry consider “housing” to be their top priority. They consider projects dealing with the overcrowding and dilapidated conditions of their structures to be of greater need than the sanitation, poverty alleviation, and job training projects presently funded by the Corporation and foreign donors. The effected communities believe that a housing component would appropriately complement the ongoing infrastructure programs being carried out in the historic sectors of Cochin. These communities are of the opinion that their housing problem is not being met by indigenous supply. The innovative partnership model of Mini Colony is seen as the ideal approach to address Mattancherry’s housing problem. The tenements of Mattancherry represent a complex set of issues, given their location in the historic district. The following is an illustrative case.

Valia Parambu tenement is located in the heart of Mattancherry. It is a two-story, dilapidated building that houses 14 extended families. The building and land are owned by a local landlord. This landlord owes the Corporation 3 lacs rupees in property tax arrears. Maintenance of the structure has been nil for years. The landlord has agreed to hand over the building to the Corporation to cover the owed taxes. In return, the Corporation is willing to provide the land for the construction of suitable housing for the 14 families. The old materials could be reused, and the families could contribute their labor and minimal financial contributions. Ongoing sanitation programs could potentially provide latrines, water taps, and minimal drainage. The innovative approach of Mini Colony could be applied to meet the requirements for additional financial and technical support.

The Mahajanaavaadi tenement near the Jain Temple and the Thashkand building at Nellukadavu, overlooking the Calvathy Canal, are two other similar cases of Mattancherry’s severe housing problem. Upgrading interventions for a few of these dilapidated tenements could serve as a model for filling the gap in the supply of housing in one of Cochin’s prime Heritage Zones.

Appendix 1
Household Demographic Profiles by Division for Cochin Corporation, 1991 Census

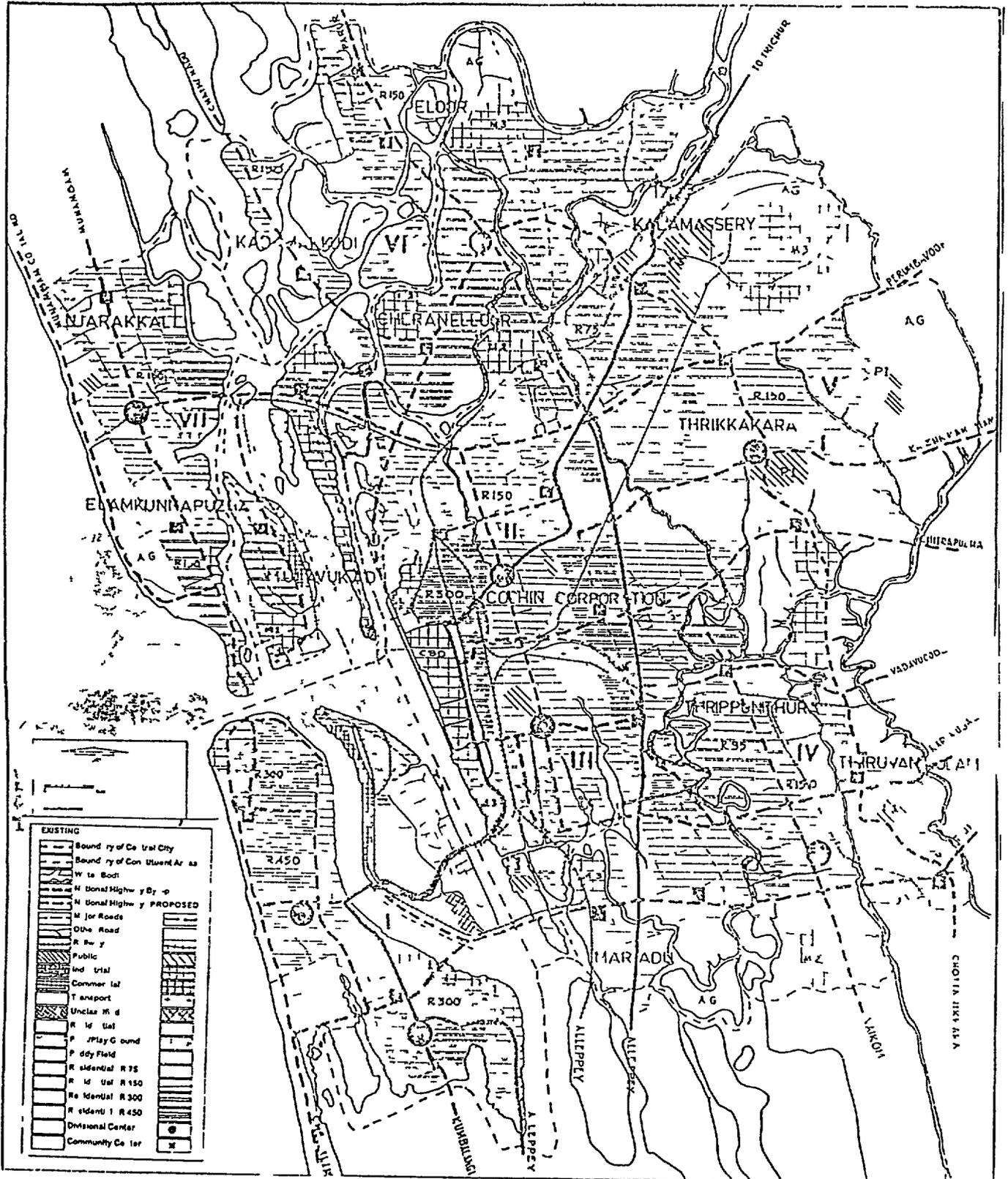
Division No	No of Occupied Residential Houses	Area in Square Kilometers, excluding Water Bodies	No of Households	Total Population (including institutional and homeless)			Net Density per Square Kilometer	Total Population in the Age Group (0 6)			Scheduled Caste		Scheduled Tribes		Literate	
				P	M	F		P	M	F	M	F	M	F	M	F
1	1 871	1 28	1 975	10 105	5 075	5 030	7 895	1 104	572	532	59	47		1	4 468	4 279
2	976	1 17	1 330	8 749	4 317	4 432	7 478	1 370	705	665	3	3		-	3 398	3 265
3	902	0 93	1 248	8 540	4 230	4 310	9 183	1 256	659	597			-	-	3 393	3 285
4	1 452	1 19	1 769	10 764	5 298	5 466	9 045	1 365	677	688	23	24	-	-	4 395	4 157
5	1 089	0 98	1 137	7 857	3 967	3 890	8 017	1 101	587	514	8	9	-		3 155	2 804
6	1 102	1 31	1 192	6 581	3 262	3 319	5 023	793	384	414	66	59	-	1	2 756	2 603
7	792	1 20	1 034	6 752	3 327	3 425	5 626	924	466	458	-	-	-	-	2 632	2 417
8	1 835	1 41	1 853	9 645	4 856	4 789	5 840	910	476	434	12	13	-	1	4 295	4 086
9	1 538	1 12	1 577	8 814	4 284	4 530	7 869	985	518	467	167	168	-	-	3 674	3 762
10	1 571	1 17	1 798	9 329	4 606	4 723	7 974	937	482	455	350	340	-	-	4 003	3 922
11	1 446	1 37	1 605	8 726	4 302	4 424	6 369	1 031	545	486	85	102		-	3 666	3 708
12	1 481	1 06	1 582	8 523	4 165	4 358	8 040	958	504	454	129	134		-	3 563	3 529
13	966	1 04	1 211	7 890	3 954	3 936	7 587	1 055	548	507	15	9	-		3 271	2 970
14	2 058	1 22	2 191	12 095	6 036	6 059	9 913	1 299	666	633	134	135	2	2	5 275	5 087
15	2 610	1 46	2 665	14 016	6 862	7 154	9 600	1 506	723	783	255	276		-	5 978	6 003
16	1 444	1 33	1 650	8 635	4 265	4 370	6 492	894	448	446	80	74		-	3 755	3 746
17	2 096	1 52	2 173	11 817	5 843	5 974	7 774	1 366	667	699	103	136	1	5	5 093	5 074
18	2 395	1 44	2 531	12 888	6 470	6 418	8 950	1 465	753	712	213	205	2	4	5 591	5 405
19	2 087	1 39	2 360	12 650	6 351	6 299	9 100	1 413	738	665	142	134	17	18	5 434	5 203

Division No	No of Occupied Residential Houses	Area in Square Kilometers, excluding Water Bodies	No of Households	Total Population (including institutional and homeless)			Net Density per Square Kilometer	Total Population in the Age Group (0-6)			Scheduled Caste		Scheduled Tribes		Literate	
				P	M	F		P	M	F	M	F	M	F	M	F
20	3 072	1 63	3 312	18 123	8 925	9 198	11 118	2 124	1 102	1 022	215	229	10	5	7 551	7 368
21	1 937	1 36	2 118	11 250	5 570	5 680	8 272	1 303	671	632	150	147		-	4 786	4 646
22	1 942	1 57	2 037	10 441	5 142	5 299	6 650	1 221	623	598	366	410	5	4	4 418	4 392
23	2 822	1 61	3 114	16 557	8 182	8 375	10 283	1 925	1 002	923	362	404	13	21	6 997	6 818
24	2 998	2 85	3 171	16 821	10 923	5 898	5 902	2 354	1 248	1 106	372	289	88	58	9 571	4 408
25	814	4 70	815	2 995	1 531	1 464	637	445	241	204	13	18	-	-	806	642
26	2 740	1 74	2 769	12 821	6 543	6 278	7 368	1 528	828	700	324	329	52	39	5 595	5 305
27	3 541	1 68	3 627	15 457	7 801	7 656	9 200	1 842	953	889	626	580	26	15	6 717	6 387
28	2 868	2 03	2 868	13 070	6 525	6 545	6 438	1 525	770	755	637	642	39	40	5 691	5 552
29	3 108	2 08	3 141	15 233	7 659	7 574	7 323	1 678	887	791	256	259	10	5	6 650	6 422
30	1 861	1 93	1 877	8 959	4 485	4 474	4 641	995	495	500	288	267	24	17	3 904	3 725
31	2 321	1 87	2 359	12 172	5 983	6 189	6 509	1 364	674	690	461	479	11	8	5 147	5 058
32	2 723	2 41	2 729	13 679	6 832	6 847	5 675	1 434	719	715	229	239	30	35	5 999	5 777
33	3 721	2 18	3 759	19 458	9 779	9 679	8 925	2 162	1 117	1 045	503	513	24	23	8 414	7 920
34	2 191	2 26	2 200	10 576	5 250	5 326	4 679	1 100	557	543	132	159	11	12	4 626	4 671
35	2 696	1 88	2 740	13 280	6 653	6 627	7 063	1 428	733	695	247	259	8	10	5 804	5 547
36	2 040	1 78	2 051	10 488	5 082	5 406	5 892	1 160	612	548	162	175	2	6	4,409	4 658
37	2 747	1 16	2 794	13 257	6 653	6 604	11 428	1 412	748	664	424	434	17	15	5 779	5 488
38	2 437	1 59	2 438	11 083	5 586	5 497	6 970	1 331	695	636	410	389	5	5	4 744	4 517
39	3 440	1 81	3 445	15 221	7 739	7 482	8 409	1 583	799	784	213	209	17	17	6 866	6 505
40	1 605	2 47	1 744	9 893	4 658	5 235	4 005	958	478	480	37	34		-	4 136	4 558
41	1 734	1 48	1 809	9 785	4 783	5 002	6 611	968	500	468	120	122	8	5	4 225	4 310
42	1 472	1 29	1 499	7 827	3 839	3 988	6 067	857	437	420	62	88		5	3 351	3 425
43	2 163	1 67	2 250	11 746	5 940	5 806	7 033	1 294	642	652	121	101	3	2	5 203	4 866

Division No	No of Occupied Residential Houses	Area in Square Kilometers, excluding Water Bodies	No of Households	Total Population (including institutional and homeless)			Net Density per Square Kilometer	Total Population in the Age Group (0-6)			Scheduled Caste		Scheduled Tribes		Literate	
				P	M	F		P	M	F	M	F	M	F	M	F
44	2 441	2 51	2 492	13 607	6 722	6 885	5 421	1 557	764	793	143	129	12	15	5 815	5 639
45	1 911	1 83	1 933	10 271	5 072	5 199	5 612	1 011	508	502	109	110	1	-	4 480	4 480
46	1 865	1 75	1 912	10 031	4 991	5 040	5 732	1 162	600	562	91	99	9	12	4 324	4 253
47	1 477	2 51	1 491	7 884	3 936	3 948	3 141	815	426	389	65	68	16	11	3 453	3 355
48	2 716	2 47	2 806	14 654	7 358	7 296	5 932	1 605	797	808	260	248	2	4	6 410	6 014
49	2 417	2 98	2 448	12 104	6 040	6 064	4 061	1 297	677	620	297	321	24	22	5 236	5 116
50	2 220	3 21	2 295	11 470	5 780	5 690	3 573	1 324	695	629	243	220	3	8	4 937	4 687
Total	103 751	87	108 924	564 589	283 432	281 157	NA	64 499	33 117	31 382	9 782	9 839	492	451	243 831	231 824

Appendix 2

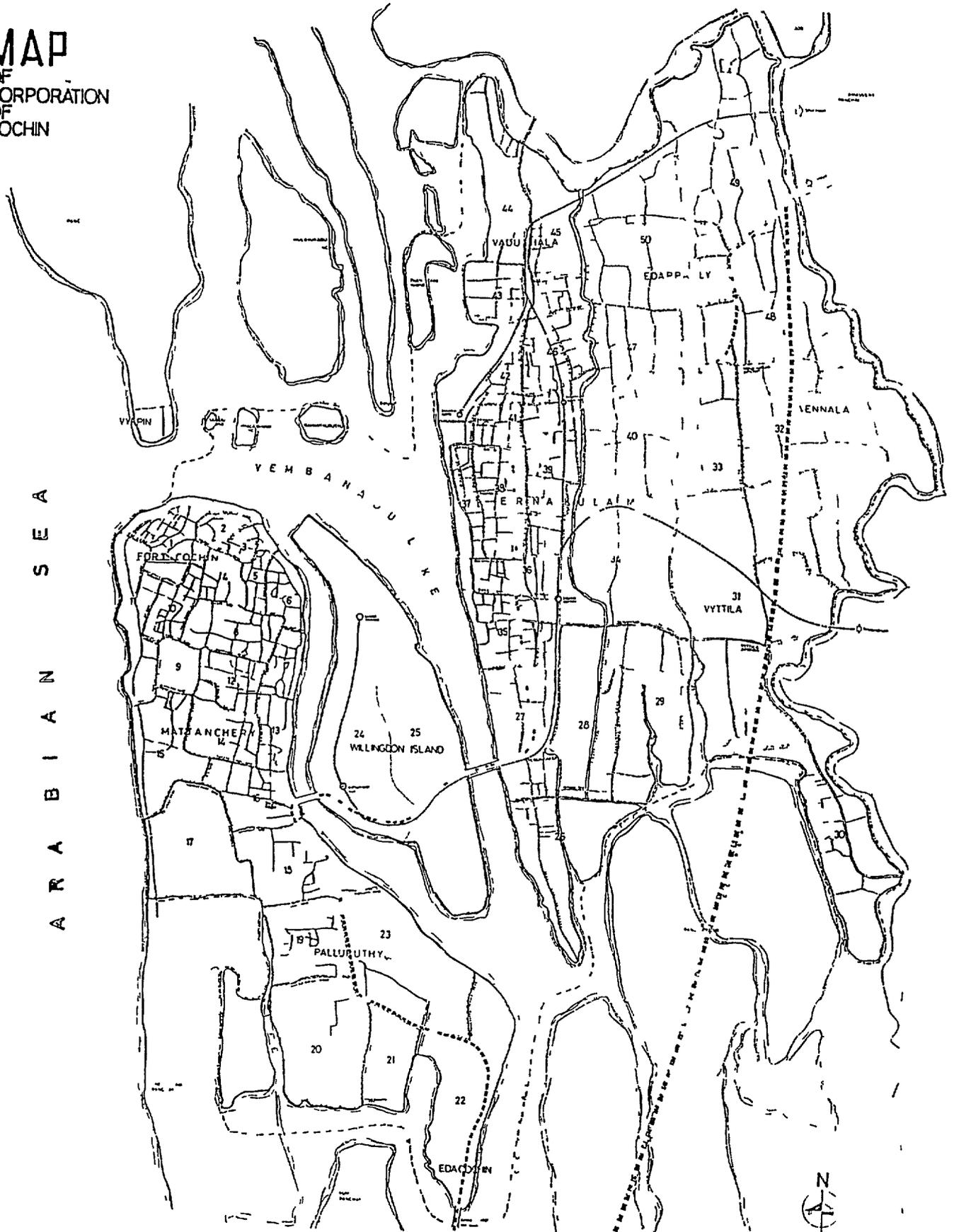
Map 1
The Central City Cochin Area as Defined by the Structure Plan for 1981-2001



CENTRAL CITY
STRUCTURE PLAN 2001

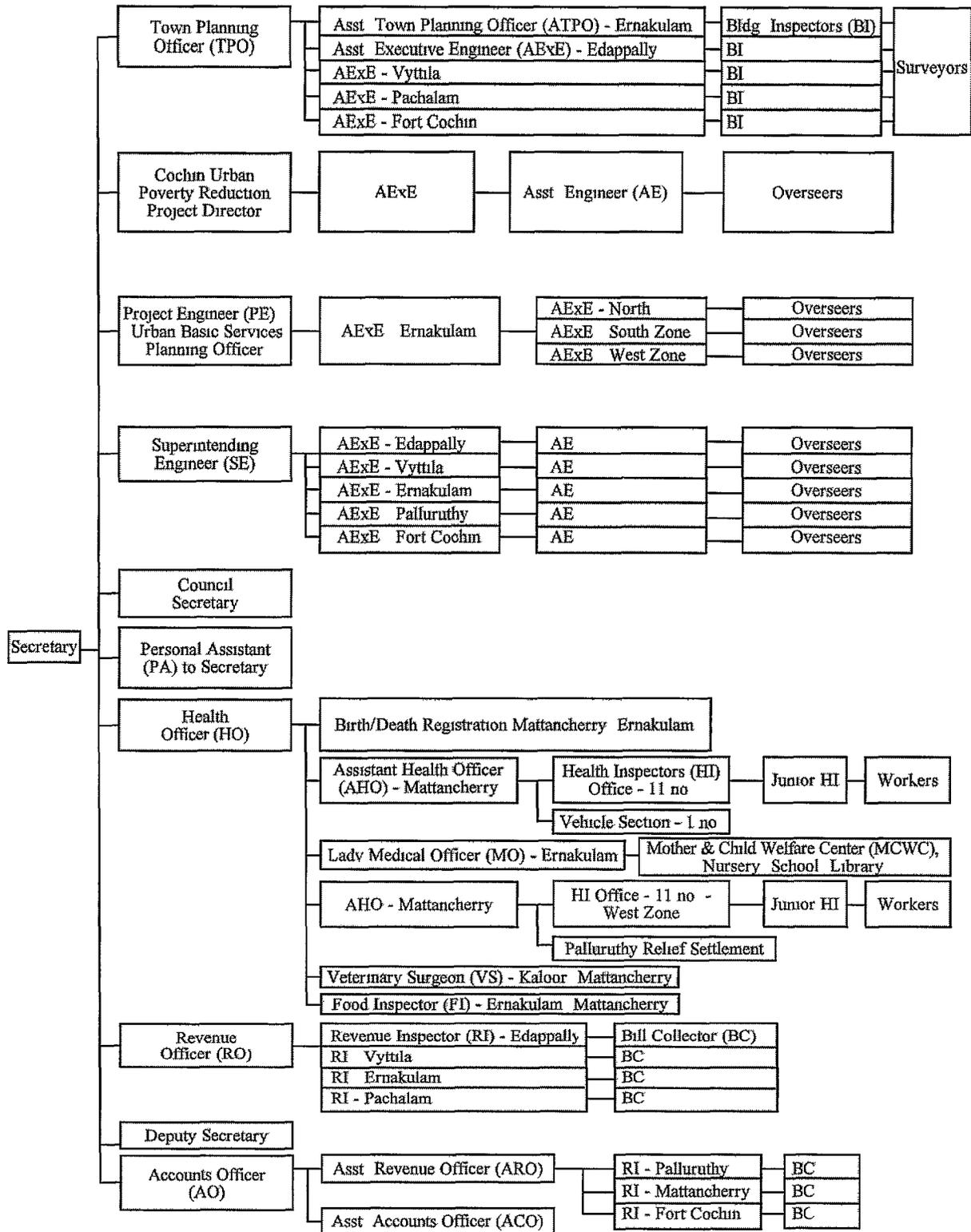
Map 2
Cochin Corporation Area with the Boundaries Showing its
50 Local Administrative Divisions

MAP
OF
CORPORATION
OF
COCHIN



Appendix 3

Manpower List of Cochin Corporation's Secretary's Office



Appendix 4

Power Consumption in the Cochin Corporation Area

Serial No	Name of Substation	Total Capacity in MVA	Name of Feeders	Peak Load in Ampere
1	66 KV at Ernakulam North	20	for TATA Company	< 50
			Power House	150
			Vaduthala	150
			Banerji Road	100
			Cheranelloor	220
			Kaloor	150
			Marine Drive	180
2	110 KV at Kaloor	25	Thammanam	100
			Mamangalam	140
			Janatha	180
			Edappally	180
			High way	100
			Elamakkara	180
			Kathrikadavu	180
			Girinagar	100
3	66 KV at Kakkanad CEPZ	10	Palarivattam	125
4	66 KV at Trkkakara NPOL	8	Temple	120
5	66KV at Perumanoor	32.5	Cochin Harbor	120
			Fore shore	100
			M G Road	180
			Ship Yard 1	40
			Ship Yard 2	60
			Thevara	150
			Willingdon Island	120
			T D Road	200
			Chittoor Road	160
			Kizhavana	100
			M E S	
6	110 KV at Vyttila	20	Thripunthura	180
			Kadavanthara	60
			Palarivattam	60
			Ernakulam	100
			Maradu	160
7	66 KV at Mattancherry	21	Mattancherry	180
			Thoppumpady	120
			Fort Cochin	150
			Palluruthy	100
			Koovapadam	140
			Kumbalangi	120
			Dronacharya	< 40
			Amaravathy	180
8	66 KV at Panampillynagar	10	Padiyath	150
			Gandhinagar	50
			Cochin No 2	120
9	110 KV at Arroor	10	Kumbalangi	120
			High way	180
			Edakochi	120

Appendix 5

List of Organizations with Interests in the Various Urban Issues in Cochin

Government and Quasi-Government Institutions

Agency for Nonconventional Energy Research and Technology (ANERT)
Archeological Department, Ph (0484) 369047
Archeological Survey of India (ASI), Ph (0484) 226085
Central Public Works Department (CPWD), Ph (0484) 361 088
Central Water Commission, Ph (0484) 342 586
Cochin Export Processing Zone (CEPZ), Ph (0484) 422545
Cochin Port Trust (CPT), Ph (0484) 666871
Cochin University of Science and Technology (CUST), Ph (0484) 555181
Collectorate, Ph (0484) 422 292
Council of Scientific and Industrial Research (CSIR), Ph (0484) 390 814
Corporation of Cochin, Ph (0484) 369007
District Tourism Promotion Council (DTPC), Ph (0484) 422998
Geological Survey of India (GSI), Ph (0484) 541302
Gosri Island Development Authority (GIDA)
Greater Cochin Development Authority (GCDA), (0484) 314461
Housing Development Finance Corporation (HDFC), Ph (0484) 373819
Housing and Urban Development Corporation (HUDCO), Ph (0484) 340490
Kerala Financial Corporation (KFC), (0484) 341645
Kerala Institute of Local Administration (KILA)
Kerala Industrial Infrastructure Development Corporation (KINFRA)
Kerala Shipping and Inland Navigation Corporation Ltd (KSINCO), Ph (0484) 360469
Kerala State Electricity Board (KSEB), (0484) 391435
Kerala State Housing Board (KSHB), Ph (0484) 319552
Kerala State Industrial Development Corporation (KSIDC)
Kerala State Pollution Control Board (KSPCB), Ph (0484) 318415
Kerala State Road Transport Corporation (KSRTC), (0484) 360531
Kerala State Water Transport Corporation (KSWTC), (0484) 352126
Kerala Tourism Development Corporation Ltd (KTDC), (0484) 355003
Kerala Urban Development Project (KUDP)
Kerala Water Authority (KWA), (0484) 361582
Military Engineering Service Cochin Zone (MES), Ph (0484) 666 851
National Environmental Engineering Research Institute (NEERI)
Panchayats Department, Ph (0484) 422219
Police Department, Ph (0484) 360800
Press Information Bureau (PIB), Ph (0484) 323583
Public Library, Ernakulam
Public Works Department (PWD), Ph (0484) 334708
Regional Archives Ernakulam, Ph (0484) 369 686
Regional Town Planning Department (RTPD), (0484) 315891
Southern Railway (SR), (0484) 367001
Telecommunications Department (0484) 322300
Vidhesh Sanchar Nigam Ltd (VSNL), (0484) 323918

Associations, Foundations, NGOs

Cochin Chamber of Commerce and Industry, (0484) 668349/668650
Eco Sensitive Development Center (ESDC)
Ernakulam Chamber of Commerce, (0484) 380 950/354 885
EXNORA Innovators Club of Cochin, Ph (0484) 350824
Gandhi Peace Foundation, Ph (0484) 351869
Greater Cochin Round Table, Ph (0484) 346835/362347
Indian Chamber of Commerce and Industry (ICCI), Ph (0484) 224 335
Indian Institute of Architects (IIA), Ph (0484) 366 054
Indian National Trust for Art and Cultural Heritage, Cochin Chapter (INTACH), Ph (0484) 228492
Indo-American Chamber of Commerce, (0484) 353834
Institute of Engineers India (IEI), Ph 225185
Kerala History Association (KHA), Ph (0484) 352452
Kerala Hotel and Restaurant Association (0484) 366602
Kerala Sastra Sahitya Parishad (KSSP), Ph (0484) 532675
Kerala Social Service Forum, (0484) 341110
Lions Club of Ernakulam, Ph (0484) 314214
Peoples Council for Social Justice, (0484) 361627
Rotary Club of Cochin, Ph (0484) 315 430
Social Action & Legal Aid Society, Ph (0484) 363693/341515
Y's Mens Club of Cochin Community Service Trust, (0484) 224 115

Media

All India Radio (AIR), Ph (0484) 422543
Deshabhimani daily newspaper (0484) 345739
Dooradarshan Television, (0484) 422266
Indian Express daily newspaper (0484) 341370
Kerala Kaumudi Kochi, (0484) 380817
Malayala Manorama daily newspaper, (0484) 316286
Mathrubhumi daily newspaper, (0484) 345708