Chapter 8

ENVIRONMENT

8.1 Vision and Objectives

To make this gifted land an abode friendly to nature and salubrious to inhabitants through activities with community participation.

Objectives (Environment)

Educate and empower urban communities on the guardianship of environmental resource and make them an integral part of decision-making process in urban development.

8.2 Back ground and history of urbanization

8.2.1 Geology and Physiography

The Cochin City and the surrounding urbanizing area comprising of 330 Sq. km with varying shades of urbanization which fall within the geographical co-ordinates 9^0 49' to 10^0 14'N and 76^0 10' E to 76^0 31'E, are relevant in the present context.

The climate of the region, like the rest of costal Kerala is warm with gentle prevailing winds and daily temperatures varying in the range 23- 34 ^oC. Humidity ranges from 65% and 95% with diurnal and seasonal variations and the average annual rainfall is 2900 mm. There are two distinct periods of higher than average rainfall from June to August and October to November.

The Cochin Corporation, two municipalities and thirteen panchayaths fall in the present CDP. It is located on the southwestern coastal strip of India. Cochin is inseparably linked with the wetlands of Vembanad estuary.

The Vembanad Lake and the surrounding geological formation are the fruit of all the major rivers of central Kerala, namely Chalakkudy puzha, Periyar, Muvattupuzha River, Meenachilar, Manimalayar, Pampa River and Achancoil River and lesser rivers like Keecheri, Karuvannur and Puzhackal. The silt and sand washed down by these rivers from the Eastern highlands originally sculptured the landscape of the coastal belt on either side of Cochin. Also the hinterland of Cochin comprising of Ernakulam, Idukki, Kottayam and Pathanamthitta districts is watered and in a sense nurtured by these rivers. The oceanic wave action and the unimpeded discharge of sediment load before the debut of civilization resulted in the formation of a long sand bar from Arattupuzha to Kodungalloor along with a large network of deltaic islets and lowlands in between braided streams. There are reasons enough to conclude that the seashore began along the western fringe of the midlands well before the emergence of the Vembanad Lake. In Kuttanad region, thick layers of calcareous shells of extinct marine organisms are seen betraying a marine past of this region. Today the low lands and the catchments of the seven rivers aforesaid are economically the most important region of Kerala. And this part of the state, over the past one hundred years or so, has undergone sweeping anthropogenic transformations.

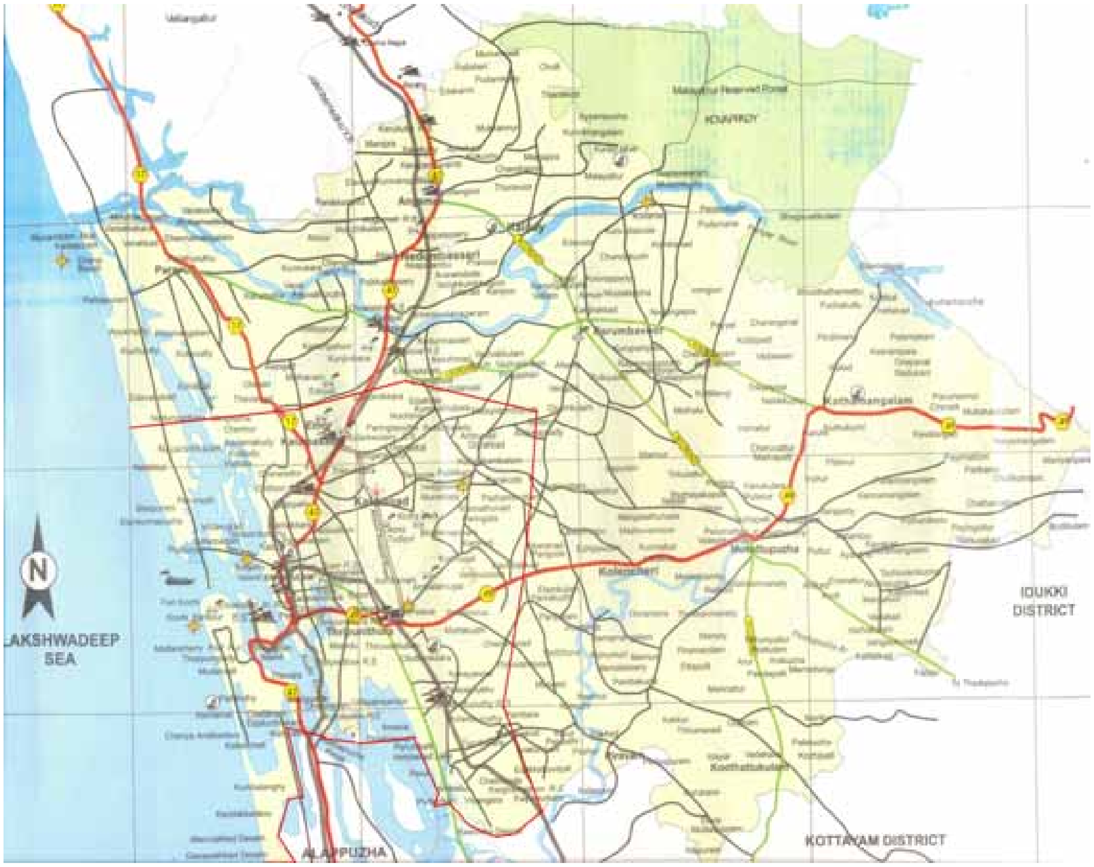
Cochin, unlike other urban centers of India, is a region interspersed with tidal water bodies and all developmental initiatives have to be streamlined giving due respect to the geological and ecological fingerprints of the region.

Vembanad wetland system is the largest of its kind on the west coast. Nearly half of the population of Kerala depends directly or indirectly on this wetland or its drainage basins. The wetland system with its drainage basins cover an area of about 16,200 km^2, which is about 40% of the area of Kerala. It is expected that about 30% of the population of Kerala will gravitate to the periphery of Cochin City in the years to come given the magnitude and dimension of projects on the anvil in the region. Already there are 411 slums in the urban region where people are tied to squalor and penury.

A major portion of Periyar water is diverted to Tamilnad from Mullaperiyar Dam. Another major human intervention on the Periyar is the Idukki dam, which diverts water to the Muvattupuzha River after power generation. It appears that the greatest river of Kerala has been slighted and degraded by inter-basin and inter-state water transfers. The transfer of the Periyar river water to Muvattupuzha basin has unleashed a phalanx of environmental and industrial problems.

The most industrialized zone of Periyar lies between Angamaly and Cochin, with over 50 large and medium scale industries. The Edayar branch of Periyar, which caters to the needs of these industries, is estimated to have a lean season flow of 80-100 m^3/sec while the monsoon flow is around 150-250 m^3/sec (KSSP Report, 2002). The lower stretch of the river becomes slack at the onset of the dry season and salinity intrusion occurs in tune with the tidal pendulum. The industries of Edayar-Eloor area are estimated to consume about 189 million litre water per day and discharge 75 percent of this as wastewater along with a variety of pollutants (KSSP, 2002). The incursion of salinity upstream during the lean months has crippled many economic activities on several occasions. Drinking water shortages became a problem in Greater Cochin region.

Figure 8.1 **The project area**



Barrages were laid across the river to contain migration of salinity and the trapped water bodies upstream became heavily polluted with acidic industrial effluents and fish kills became regular. The inter-governmental panel for climate change (IPCC) has predicted in 1990 a 31cm rise in sea level (Lower scenario) induced by green house warming by the year 2100. In that case the sea would move several meters inland, permanently flooding a large part of the highly urbanized coastal fringe of the city. The city, in any case will have to inch eastwards in the decades to follow.

8.2.3 Cochin watershed

Cochin, for all practical purposes, is the gift of the water bodies it is braided with. Protection conservation and sustainable environmental practices are the essential part of a desirable integrated urban management approach.

Cochin is a coastal settlement interspersed with backwater system and fringed on the eastern side by laterite capped low hills from which a number of streams originate and drain into the backwater system. The western part of the study area is a flat coastal zone, which forms a part of the coastal plains of Kerala, and the eastern low hills are part of the midland region.

The western flat land comprises of 52 drainage units covering an area of 115 km^2 and islands in the backwater system with a total area of 56.4 km^2. The backwater extending to an area of 72.6 km^2 also comes within this zone. The eastern low hills, covering an area of 291 km^2, comprises of 21 stream basins or micro catchments, each with independent watershed area (Benjamin, 1998). These 21 major streams originating from the eastern low hills run mostly west in between the low hills and drain into the tidal canals with a linkage to the back water system. The drainage basins of these streams have laterite or lateritic soil with occasional rock outcrops. The tidal water canals of Chithrappuzha, Karingachirapuzha and Edappallythodu receive the waters from the east.

8.2.4 Cochin and the back water lagoon system

The estuary on the western parts of the city, stretching in the North South direction, has suffered large-scale siltation in the heydays of the Periyar. This has resulted in the formation of a number of mud bank islets, which are heavily populated. Overpopulation and industrial activities further north have degraded the quality of this sensitive marginal marine environment.

8.3 Growth of Cochin as an important urban center and its impact on the tidal canals - a historical perspective

Cochin originally developed as a converging point of water transport. Cochin had water transport connections with Alappuzha, Quilon, Kottayam, Changanassery, Ambalappuzha, Neelamperoor, Pulikeezhu, Mannar, Athirampuzha, Paippad and Neerettupuaram in the south and Arattukara Canal and the Edathuruthy canal constructed in 19th century made water transport possible between Cochin and Trissur. Mattancherry and Fort Cochin and the rest of the region were by far rural. In 1905, Ernakulam got connected to the rest of the country by railroads. Thereafter, the process of urbanization picked up momentum. The debut of Cochin as a major port on the west coast, triggered urbanization and industrialization in the modern lines, thus radically transforming the physiographic personality of this region. Road and rail traffic facilities pushed canal transport systems to a humble backseat and urbanization inched its way further east. Demography changed and traditional farming and fishing petered to near extinction. The land use pattern underwent a dramatic change. Armed with an all weather harbor, cheep electricity from Pallivasal, railroad connection to Indian mainland across the ghats and the availability of enough fresh water Cochin-Aluva belt turned all too ready to become a significant industrial nerve center. Pressure on land increased and in the same measure utility of the canals plummeted. Canals and wetlands were a casualty when greed for dry lands increased.

8.3.1 Development of urban Cochin

When road and rail traffic facilities improved, the center of gravity of the city shifted to the eastern mainland. Fortunately, the city is still gravitating further east with a nose for more fresh air. The tidal canals, which once served the purpose of modern roads, cannot be left to decline and decay as water is growing more precious and dear in Cochin and elsewhere.

8.3.2 Impact of urbanization on Environment

The domestic sewage from Cochin and its satellite towns ends up in the tidal canals and the estuary. Cochin City alone generates 255 million L/day of urban sewage that directly enters the estuary. In Cochin, the sewage treatment plant covers only 1 % of the population (KSPCB, 1982). It is estimated that nearly 260 million liters of trade effluents reach the Periyar estuary from the industrial belt daily. This discharge is fraught with heavy metals, nutrients and insecticides.

8.3.3 Population growth of Cochin and urbanization

In Kerala the rural-urban divide is not that sharp as far as basic amenities are concerned and hence there is not an appreciable flux of humanity into the city. In 1875, the population of Ernakulam town was 20,000. From 1875 to 1901, the demography remained more or less stalled. From the turn of 20th century an explosive growth of population was observed. This tendency persisted up to 1961 when the population reached 2,50,000 (Benjamin, 1998). Census of 2001 shows that the total population of Cochin Corporation is 5, 96,473, and the population of Greater Cochin Region, is around two million. A remarkable shoot up in population is expected in the years to come as the city is spreading itself thin to the east, transgressing the city limits. A floating population of around 4,00,000 commutes to the city from the suburbs (CUSAT and Oak Ridge National Laboratory Study, 2002).

The city consists of islands and parts of the mainland linked by water transport and bridges. Cochin is dissected by numerous canals and backwaters. Managing the quality and quantity of the waters in these tidal canals is of utmost importance in so far as the quality of life is concerned. Insufficient drainage facilities and pressures of urbanization nag the city. Diffuse urban liquid and solid wastes naturally find their way to the nearest watercourses. The main threats from municipal sewage waste are anoxia and eutrophication. At present, the sanitary waste disposal system is limited to a small portion, with only one treatment plant at Elamkulam. The outlets of the septic tank and wash systems are directly connected to the public drains and, as a result, a wide spectrum of degradable and biodegradable pollutants is entering the drains and ultimately the water bodies. For most residents, the canals are the easiest option to get rid of their refuse. Urban run off is the single great source of water pollution and is an ecological problem threatening the long-term health of estuarine ecosystems and local economy.

Table 8.1 Kochi City: Common aspects

Name	Kochi City (CDP area)
Area	330.2 Sq.kms.
Population	11.38 Lakhs
Literacy Rate	92%
Population density	3448 / Sq.km.

When many of the arterial roads of the city emerged into prominence, many age-old canals and wetlands were a casualty. M.G Road, the flashy showpiece of the city, was once a fairly long wetland, so was

modern Banerji road as well. The costly strip of land west of Shanmugham road was the shallow edge of the estuary. The evolution of Cochin alluvial bars followed a regular pattern. Immediately west of the rolling hills, alternate rows of swales and sand bars with a north-south orientation existed before the onset of urbanization. Even today, a shadow of these regions' former self is discernible. Such a pattern had avoided flooding problems effectively as natural run off had a place to go. The situation was further confounded when railroads were laid giving rise to artificial ridgelines dividing natural watersheds. Numerous culverts *en route* choked or bottlenecked all the existing canals, partly impeding inland navigation and reducing flood-discharging capacity.
The land utilization pattern of Cochin City is indicated below:

Tableno. 8.2 Existing land utilization in Cochin Corporation Area

Gross Land Area	9488 Hect.
Water sheets	1878 Hect. (19.8 %)
Agricultural land	788 Hect (8.45 %)
Developed land	6822 Hect. (71.75 %)

Considering the vast area under water bodies, the development planning of Cochin has to be done giving due weightage to its extensive water bodies.

8.4 Status of Environmental Quality

(Status related to municipalities and panchayaths are given separately.)

The environmental quality of an area depends up on the ambient air quality and water quality which influence the quality of life of the inhabitants. The Central Pollution Control Board had undertaken a detailed study of the air quality in various cities in Kerala. (Furnished as annexure 8.1). The study has shown that Kochi exhibits a comparatively low level of ambient air quality with respect to the presence of SO2, No 2, & SPM

The noise levels of the samples collected from different location in the CDP area and Physico-Chemical characteristics of soil are given in Annexure 8.2.

8.4.1 Water Quality

8.4.2 Surface water

Periyar and Muvattupuzha rivers support the urban drinking and industrial water supply. Both the rivers have undergone substantial hydraulic modifications with impact on natural purification. The discharge of industrial and urban effluents makes the waters unacceptable in most of the stretches down stream the points of discharge. Absence of centralized sewage treatment facility forces builders to resort to onsite sewage disposal. There are no stipulated standards for onsite sewage disposal. Builders install septic tanks, which are unscientifically designed and maintained. Water samples collected from most of the urban wells and majority of suburban wells are unfit for drinking purpose due to biological contamination and organic loading.

Of late the land use alternation has become intense at the waterfront of the city and suburbs by reclaiming the estuary and wetlands, and in the eastern hillocks, slopes and wetlands. These areas fall under the panchayaths where building rules are virtually nonexistent. These hilly suburbs and slopes yielded high quality well water, which was extensively tapped for drinking purposes. It is estimated that 99% of the houses had own wells, which served as a perennial source of drinking water. Extensive reclamation of the wetlands (paddy fields) and leveling of the hillocks led to depletion of well water. Discharge of poorly treated sewage from septic tanks has contaminated the well water beyond repair.

The periurban region has been the venue of institutional development. These include industry parks, IT parks, health care facilities and institutions of higher education. These institutions where a considerable number of workers flock also lack black and grey water treatment facilities. This has led to increasing contamination of minor water sources like Kadamrayar and Chithrapuzha.

The topography of the city is in such a way that there are alternate sand bars with a swale in the middle. If the greed for land eats into the natural drains, the city will have to drown in its own liquid wastes since natural gradient is not conducive to a swift and efficient discharge of the runoff.

The urban modification of tidal canals can potentially have adverse environmental impact, which in particular circumstances may include

1. **Loss of wetland habitats and other sensitive aquatic systems, including the reduction in the sustainable values of estuaries as highly productive nursery areas necessary for fisheries.**
2. **Inadequate hydraulic functioning, which may reduce water quality through poor flushing, cause sedimentation or affect structural integrity.**
3. **Impact caused by storm water and urban runoff, including erosion and sedimentation away from the site.**
4. **Impacts associated with imported fill.**

5. **Problems caused by disturbing acid sulfate soils.**
6. **Pollution by wastes from vessels.**
7. **Ongoing impacts from maintenance including maintenance dredging.**
8. **Loss of wetland plants alters the chemistry of water. Wetland plants have the ability to release oxygen through the roots and could possibly increase the solubility of metals and arsenic.**

Most of the estuarine banks have already been urbanized and as a result the shores and the network of tidal canals have forfeited their original morphology. The pre-urban tidal canals were swales and braided rivulets in which interaction with the bottom sediment was unimpeded. The construction of bathtub canals substantially decreased the inter-tidal zone in the canals and sewage waste load denatured the quality of water. This is the general pattern of all the urban tidal canals of the world. There rare significant water management issues and areas of concern related to flow control measures in drainage basins in the inter tidal zone

The following observations indicate the alarming state of environmental deterioration.

- **Concentration of fecal Coliform bacteria commonly exceeded recommended standards for contact recreation**
- **Concentrations of total phosphorus is generally high in urban streams leading to nuisance plant growth**
- **Toxic compounds found in stream bed were also found in fish tissue**
- **Deteriorated water quality and sediment as well as habitat disturbances contribute to degraded biological communities in urban streams.**

Want of sufficient DO is the most crippling constraint in all of the tidal canals. At present, there is not any strategy whatsoever to check the discharge of oxygen demanding wastes into the water bodies of consequence. Industrial effluents play a very minor role in this connection. Urban liquid and solid wastes are primarily responsible for oxygen depletion in the canals. Again many of the canals have lost their dynamism that would otherwise have facilitated the re-aeration of the stagnant stretches. All the canals are at sea level and natural flow is sluggish or non- existent in non-rainy days. Tidal oscillation alone infuses some life into the system. But intervention by bunds, loss of depth by siltation and bottlenecks created in the channel by civil structures and dumping of solid waste isolate the canals into stagnant wet patches.

Table below shows the number of slums, the slum population and the total BPL population in Kochi.

8.3 Sources of water contamination

Location	No. of Slums	Slum population	Total BPL Population
Kochi	280	127872	213120
Urban out skirts	131	4548	276226
Total	**411**	**132420**	**489346**

The number and population are on the increase. Due to unhygienic conditions the slums are more prone to incidence of diseases. Most of the slums are located near water bodies. The people who live near the water bodies discharge waste and sullage in to the water bodies or open drains. A number of slums are located on the edge of the water bodies.

Analytical results of ground water samples collected from the different parts of the study area are given in annexure 8.3. It shows that the ground water is highly contaminated by the presence of Coliforms through out the study area.

8.5 Solid Waste Management

The target region of this CDP with produces about 650 tons of municipal solid waste per day. The region does not have a scientific management system for solid waste. Some isolated small-scale efforts have been made. Otherwise the solid waste is dumped (illegally) on roadside or in vacant plots and estuarine fringes. This unscientific practice leads to air and water contamination. Segregation can lead to reduction in treatable waste; This aspect has been dealt with in detail in another chapter of this report.

8.5.1 Health

With high humidity, air and water contamination air and water borne diseases are more common. Occurrence of contagious diseases in Cochin from 1995 to2001 is presented in annexure 8.4.

Disease statistics available from health care institutions are only partial and cannot establish the trend, which is needed to set health care goals.

- The industrial suburbs are reported to be the hotspots of environmental pollution, but the reports are not corroborated by reliable data.
- Cochin is listed as one of the cities unsafe to tourists with regard to water borne diseases.
- Typhoid, leptospirosis and cholera are reported at times.
- High ambient humidity and poor maintenance of schools make children a sensitive group to diseases caused by poor indoor air quality.

Adequate supply of safe drinking water is the prime requirement for human survival. Quality of infrastructure attracts industries and tourists. With its picturesque countryside and very comfortable climate, Cochin is an emerging tourist destination. Poor quality of the environment can off set all the advantages generated by better infrastructure, if we fail to project the visible and aesthetic aspects of the region.

Cochin has the rare distinction of being the hub of industrial activities in the state. Due to the contributions of industries and transport Cochin has become hotspot for environmental pollution. The scarce supply of fresh water has been contaminated by urban and industrial discharges. The **Common Hazardous Waste Disposal Facility** coming up at Cochin will receive all the hazardous waste generated in the state. In short *Cochin will be turning in to a dump yard of human as well as industrial wastes*. Type and quantity of waste generated in the industries in the region is given in Annexure 8.5. The impact of all these will be felt on the natural resources of the region. It becomes the onus of the local authorities and the resident communities to take proactive measures to curtail and contain activities that are detrimental to the environment and will reduce the sustainability of the region.

8.6 Disaster risks in Kochi

The geographical location and the developments have made Kochi one of the most disaster prone areas in the country. The risks involved are,

1. Geological
2. Water and Climate related
3. Chemical and Industry related
4. Biological
5. Accident related

8.6.1 Vulnerability

Cochin is considered to be in the seismic hazard zone (zone – 3) and prone to **earthquakes**. Amplification of seismic energy due to landfills and liquefaction of sub surface rocks are some of the major areas of concern. Cochin is located on a thick sedimentary pile consisting of alternating layers of sand and clay. Any seismic event can disturb these sediments. Moderate earthquakes are possibilities both on land and off shore sources. Earthquakes experienced at distant sources in Kerala can also damage the sedimentary piles leading to collapse of structures.

The terrain of Kochi with in the coastal wetland zone is highly fragile. In discriminate reclamation is permanently damaging the eco system. Cyclones and local severe storms have occurred in Cochin at 5 to 6 times during the last 100 years. **Coastal erosion** and storm surges are constant phenomena in Kochi. **Flooding** is another calamity occurring every year during Monsoon disrupting the activities of the region. The recent **Tsunami** affected the coastal areas of Cochin resulting in losses life and belongings. The location of the major **chemical industries and petroleum installations pose serious threats of disaster** related to this. The biological threats include mosquito **vector diseases**.

Proper hazard management programme relating to all the vulnerable conditions is essential in city development. Detailed study on this is going on as part of Master Plan for Cochin City which is under preparation.

8.7 Summary of Environmental Activities by various agencies

Parisththibhavan (Center for Environment Established in 2002).

Activities were limited due to lack of funding.

Meanwhile different agencies interested in infrastructure facilities conducted independent studies on the status of environment mainly as part of mandatory Environmental Impact Assessment. The studies conducted by various agencies have brought out the following facts.

Cochin Corporation entrusted Kerala Sastra Sahithya Parishad to compile a report on the status of environment. The report was submitted in 2002. Kerala Government entrusted Greater Cochin Development Authority to study the water sources of Greater Cochin area. GCDA in collaboration with Cochin University of Science and Technology submitted a detailed report supported by year round data. The three-part report deals with the water shed and water quality in various canals.

8.7.1 Outcome of the studies

1. Unplanned growth of the city and suburbs has led to bad land and waste management practices. The local water resources are contaminated by human activities, especially unscientific layout of buildings, inadequate sewage treatment and nutrient discharge in to the water bodies.
2. Community participation is minimal in environmental conservation
3. Natural wetlands, which were supporting the local ecosystem, are retained only marginally.
4. Local authorities (ULB) have no statutory control over many of the environmentally sensitive activities undertaken by private and governmental agencies. ULB has no a mechanism to assess the activities and make their learned decisions.

8.8 Gap Areas

The foregoing discussion brings out the **weakness of the ULB** in countering environmental degradation.

These may be summarized as follows:

1. **Lack of environmental awareness among the public and decision makers**
2. **Lack of community participation in the conservation of environmental resources**
3. **Lack of technical capability to formulate and implement best management practices to minimize environmental degradation**
4. **Lack of reliable information on land use, water quality, air quality and environmental diseases.**
5. **Absence of a mechanism to monitor and predict trend in environmental quality**

8.9 Objectives (related to Environment Sector) of the CDP

An Environmental Management Centre (EMC) will be established with the definite objectives:

1. To promote environmental stewardship
2. To induce community participation in decision-making.
3. To establish an Environmental Management Centre that, among other things, will:
    a. Impart environmental awareness in the community targeting children, adults, businessmen, elected representatives and administrators. Its activities will include observation and dissemination of scientific information on land use, water resources, human activities which have bearing on the quality of life and ecology.
    b. Formulate guidelines for the operation of EMC
    c. Assess the baseline status of the environment, and predict trends
    d. Review environmental impact assessment reports referred to ULB and formulate submissions on the same
    e. Raise funds needed for its activities through projects
    f. Ensure community participation in decision making by providing reliable information

8.10 Methodology

The methodology ensures that the local community is a participant at all stages of developmental and conservational decision making. All the projects will lead to income generation in the weaker sections of the community, mainly at the non-technical level. This will benefit people below poverty level. The programs will generate a feeling of resource stewardship.

8.10.1 Schools

Local educational institutions right from the primary level and local NGO's are to be induced into the environmental education programmes. Green clubs will be instituted at local levels and in campuses. Students, teachers and the public will have an active role. Such clubs will be trained to observe and report the current environmental quality of the local resources and such grass root reports will eventually be brought to the notice of local administration.

Young generation is more susceptible to accepting challenges and changes. More resources will be spared to get educational institutions and students to actively participate in the programs

8.9.2 Institutions of higher education

There is one Science and Technology University and five engineering colleges in the jurisdiction of the ULB. There are two medical colleges and a number of nursing and paramedical institutions. These institutions of higher education will be invited to spare their expertise for the design of appropriate engineering projects, monitoring of health and environment, assessment of technologies, and to provide expert advise to the ULB.

8.9.3 NGOs

NGOs with specific objectives in the areas of concern for ULB will be invited to assist in awareness, and grass root technology development. This approach will ensure community participation in projects through the involvement of Residents Associations, and SHG.

8.10 Environmental Stewardship: Specific tasks

As part of community participation tasks will be assigned to community groups and agencies. They will be looking after public trust properties as virtual guardians.

8.10.1 Land use

There has been extensive encroachment and illegal occupation and conversion of land and water space. This was facilitated by the absence of a boundary demarcation system and lack of public guardianship. It is proposed to prepare a GIS based resource map with community participation.

8.10.2 Solid Waste

Individuals, households, trading centers, and institutions generate municipal solid waste. Only 15 % of the MSW produced is putreceable demanding immediate disposal. The practice of mixing bio degradable and non-biodegradable solid waste results in an unwieldy and fussy cocktail of solid waste. The people are to be trained to segregate the waste they generate for smooth and efficient disposal of MSW. Again the classic environmental panacea of reduction reuse and recycle strategy has to permeate the masses. All NGOs operating in the region can be inducted into this daunting mission bringing about a quantum shift in the waste generation and disposal philosophy of the city.

Cochin City generates 400 tonnes of solid waste every day. About 60% of the waste generated is collected by Cochin Corporation and dumped at selected dumpsites at Wellington Island, Cheranalloor and Brahmapuram and the rest is dumped on roadsides drains and canals. But the collection network miserably lacks the solid support of community.

8.10.3 Water and wastewater

Water supply is public concern, whereas the same public is unaware of the role of wastewater in contaminating water resources. Unscientific onsite sewage disposal by residential units and institutions are largely responsible for spoiling local groundwater and nearby tidal canals. Awareness drive and implementation of Best Management Practices will be done under the auspices of voluntary agencies.

8.10.4 Water resources

ULB recognizes that availability of fresh water is going to control sustainability of all activities. The local fresh water resources, conventional as well as non- conventional, are to be identified and protected. In the none-too-distant future water pumped in from the rivers will be out stripped by the burgeoning demand.

CDP proposes to give special attention to conventional community water resources viz., open cut wells and ponds. These will be restored and maintained as alternate sources. Emergency disinfection procedures will be part of the awareness program.

Large-scale reclamation of inland wetland and tidal creeks affect the availability and quality of well water. It is proposed to develop wetland parks in newly developing areas, especially on the eastern side. This will help sustain the yield of wells, open space and recreational facilities.

8.10.5 Parks and open spaces

Per capita green areas and open spaces are a direct indicator of the *environmental quality* of the city. They will add to the aesthetic appeal of the urban environment. Vacant spaces owned by the state and currently not put to rational use can be transmuted to verdant cooling slots in the city. It is strongly suggested that the roads going to come up in the urban areas ought to have professionally planned green shoulders. Even on the existing roads, wherever spaces constraints do not imperiously stand in the way, such green strips can be incorporated.

8.10.6 Comfort stations for moving/floating population

Most of the people are thickly used to relieving themselves in the open quite oblivious of the environmental fallouts thereof. People confined by a nagging civic sense find it hard follow the way of the masses. And the city is not endowed with adequate facilities to meet the call of nature. No civilized society can permit or tolerate such a sate of affaires. And the existing facilities, as a general rule, are in a bad shape owing to design and management flaws, resulting in air and water pollution. ULB proposes to build scientific toilets at transit points and urban centers.

8.10.7 Improvement of crematoria

The crematoria in the Cochin Corporation area and in other areas requires more attention. The existing crematoria will be modified with electrical furnace and beautifully laid out gardens. These will be maintained with community participation.

8.10.8 Coastal line protection

The coastal line from Chellanam to Munambam is very sensitive to erosion. Conventional protection measures have proved to be ineffective in many stretches. Shoreline protection with geo-textiles and vegetation is proposed. This will be implemented with community participation. Coastal communities on community ownership basis will do maintenance.

8.10.9 Conservation of mangroves

The mangrove patches of Cochin estuarine fringes are in danger due to dredging, filling and waste dumping. These mangrove fringes support aquatic and amphibian species, which are of high economic value. Special attention is paid to conserve and protect the mangroves through community intervention.

8.10.7 Health

People cannot be better than their environment. A healthy environment supports a healthy people and vice versa. In the project area incidence of air and water borne diseases is an alarming indication of the state of the environment. Industrial hubs and congested urban areas like West Cochin call for particular attention on that score. Poor living conditions and social pressures of West Cochin are symptomatic of the vicious circle of poverty, population and pollution (P3) that this region is in the grip of. The tidal canals in this region do not any more carry out the natural functions expected of them because of the solid and liquid wastes ending up in these canals. If the tidal ministrations are allowed to sweep past the canals, they will remain clean and lively all through the year. The trend in the prevalence of environment related diseases could be identified only through scientific surveillances. Voluntary groups will be set up, trained and deployed to prepare disease statistics in industrial and residential areas. Yearly report of communicable diseases shows that the hidden cost in this sector is very high. International travel information providers list Cochin as a high-risk area with regard to water borne diseases. This sector deserves special attention

Conclusion:

Major hurdles in achieving the vision i.e., ‘to make the area an abode friendly to nature and salubrious to the inhabitants’ are undesirable waste management practices, both solid and liquid leading to contamination of air, water and land. Cochin is the gift of the water bodies and the protection, conservation and sustainable environmental practices, the concentration of fecal coliform bacteria, excess level of phosphorous and toxic compounds found in the water bodies necessitate urgent measures to be taken to protect our water resources. Geographical location of Kochi and the developments in Kochi have made Kochi one of the most disaster prone areas. Lack of environmental awareness, lack of community participation, lack of reliable data base on land use , water quality and air quality are the major lacunae in assessing the environmental quality trends. The strategy therefore includes creation of awareness among the people beginning with schools, community participation, and developmental decision-making, environmental stewardship (assigning specific tasks for protection water bodies, special environmental features etc.) Conservation of mangroves, coastal protection, setting up of crematoria, comfort stations and establishing and maintaining an environmental management center. The total estimated cost comes to 291crores.

Figure 8.4 Manually collecting drinking water

Polluted drinking water sources

Figure 8.5 Solid waste dumped everywhere