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GROWTH AND DEVELOPMENT OF AHMEDABAD-GANDHINAGAR URBAN COMPLEX

INTRODUCTION

Environment has long been neglected and maltreated. However, the awareness for conserving environment is picking up among the common people. The main emphasis is on the moderate utilization and conservation of renewable resources such as air, water and soil as well as the non-renewable mineral resources. Most environmental problems are due to the excessive concentration of human related activities, like urbanization and industrialization. Agglomeration of population is becoming increasingly susceptible. But the nature imposes limits on the process of human kind's over use of environmental factors. Adequate planning, technology and methodology of proper and conjunctive use of the environmental factors are essential requirements of maintaining the balance between the nature and human development. Thus the benefit of geo scientific approach to the environmental studies is in the proper planning of various resources. As the environment has given innumerable potential for the development and growth in the area, it is for the benefit of man to utilize such potentials at optimum.

Through the construction practices and the disposal of wastes, areas with important raw materials have been destroyed. The study area is densely populated with a large number of various industries. This has brought the notable changes in the quality of nature. The damage has been caused by the emission of industrial gases and poisonous waste. Such toxic waste is contaminating surface and groundwater storage.

POPULATION

The population study of the AMC and AUDA areas shows a very high population growth of 228 % i.e. almost four and half times during the period of forty years (1951-1991). The share of the urban population in the area for the year 1996 stands at 93 %, compared to state's urban share of 34.5 % and India's share of 25.7 %. The rate of population growth in the area has been 40.34 % during 1971-81 and 34.38 % during 1981-91.

The population distribution of the area has been studied and based on 1971, 1981, and 1991 census figures, the population for the years 1996, 2001 and 2011 have been projected and presented in the table 9.1. The area has seen an increase in population by 40.34 % during the period 1971-81 and an increase of 34.38 % during 1981-91 in the AUDA area. The share of urban population in the area stands at 93% compared to state's urban share of 35% and India's share of 26% for the period of 1981 to 1991.

Table 9.1: Population and Growth Rate for AMC, AUC and AUDA.

Year	1931	1941	1951	1961	1971	1981	1991	1996	2001	2011
Population in AMC (lakhs)	3.14	5.96	8.77	12.06	15.85	21.59	28.76	33.23	36.93	46.16
Population in AUC (lakhs)	-	-	-	-	17.73	25.15	34.37	-	-	-
Population in AUDA (lakhs)	-	-	17.20	20.60	22.30	28.88	38.81	47.12	53.26	70.75
Decennial growth in AMC (%)	-	90	47	37.5	30	36	33	16 (5 yrs)	28	24
Decennial growth in AUDA (%)	-	-	-	20	9	40	34	21 (5 yrs)	-	-

(Source: District Census Hand Book, 1994 and Development plan of AUDA, 1997).

From the above table, a very high growth rate is observed in the AUC (Ahmedabad Urban Complex) with that of AMC, suggesting that the fringe areas of AMC in the AUDA region showed four times (200 %) growth from 1971 to '81. This phenomenon is expected to continue further and the growth of AMC is expected to fall as the area has reached to a saturation level. It has also been observed that the decennial (1971-'81) percent increase of Ahmedabad city is relatively much less (36 %) compared to the other cities of Gujarat, viz. Surat, (110 %), Vadodara (64 %) and Rajkot (52 %) (Development plan of AUDA, 1997).

POPULATION DENSITY

The net population density in AUDA is 35.18 persons/ha. The net available areas remaining for the development is very less. Four growth centres identified in the area have different population densities. Kalol has the highest density of 29.86 persons/ha,

while the lowest is in the Sanand at almost 7 persons/ha. The rural area in the AUDA area has the population density of 4 persons/ha. The total built up area in AUDA is 130 sq km out of which 25 sq km is built up area and the area available for built up is 105 sq km. The estimated area required in AUDA by 2011 is approximately 18 sq km. Approximately an area of 20 sq km for a population of 24 lakh persons shall be required to develop in the next 15 years to accommodate the population. The areas like AMC and the villages of Chandlodiya, Ghatlodia, Memnagar, Ranip, Vastrapur, Kali and Vejalpur which are on the western side of the AMC are going to fall short of its required carrying capacity for the increased population.

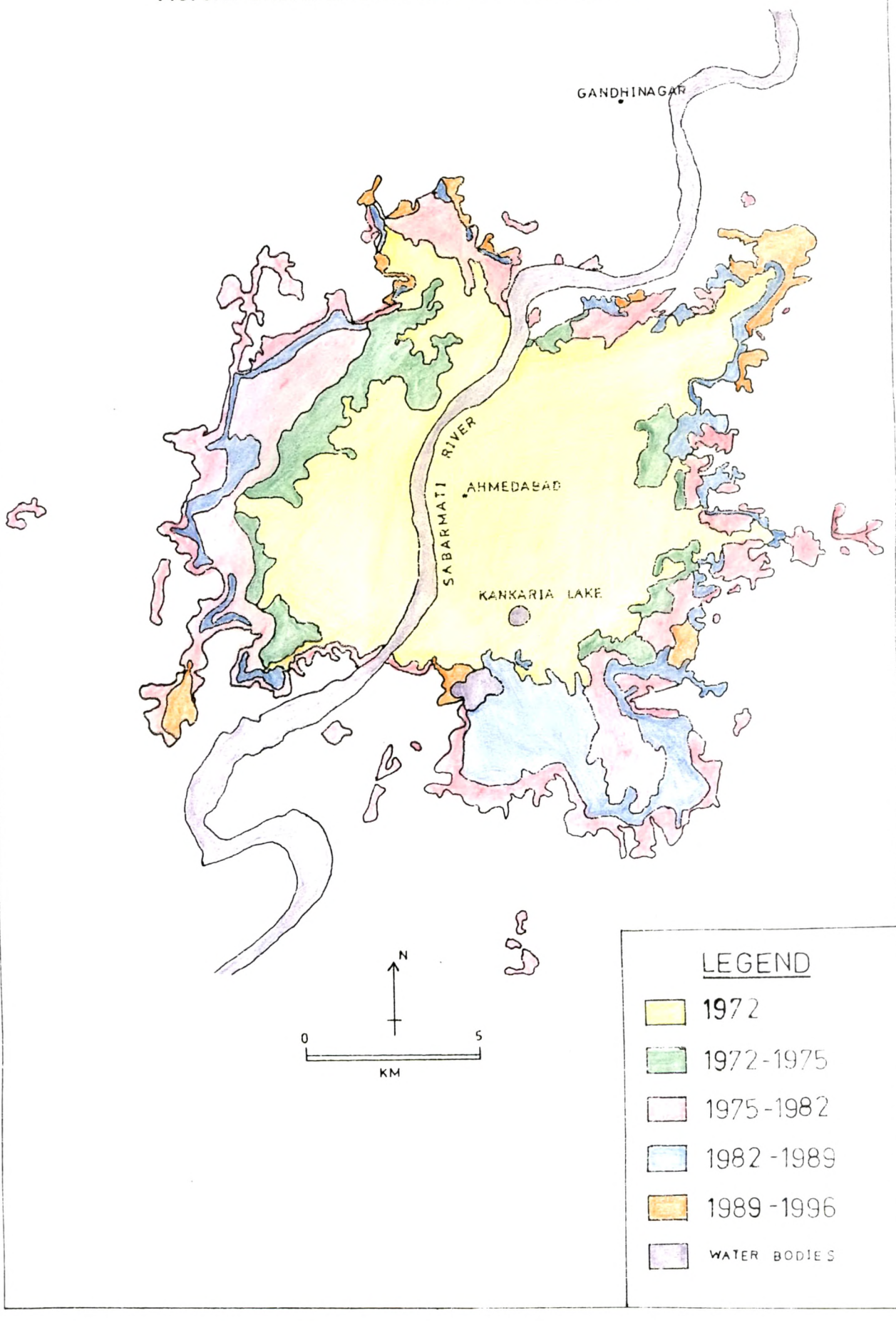
The history of expansion and the growth of the Ahmedabad city and the adjacent areas (fig. 9.1) which come under the city limits are given in the table 9.2. From the table it is clear that the rate of growth of the city was higher during the period 1982-89 compared to the growth rates between 1972-75. The average annual growth rate from 1972 to 1996 is 4.68%.

Table – 9.2: Areal growth rate of Ahmedabad city (1972-96).

Year	Area sq km	Physical growth		Cummu. Growth		Population density (persons/ha)
		sq km	(%)	Sq km	(%)	
1972	93.67	-		-	-	172
1975	110.70	17.03	18.18	17.03	18.18	172
1982	134.40	23.70	21.40	40.76	43.48	161
1989	161.13	26.73	19.88	47.46	72.01	179
1996	196.03	34.90	21.65	102.36	109.28	194

(Source: Development plan of AUDA, AUDA, 1997)

FIG. 9.1: URBAN SPRAWL MAP OF AHMEDABAD CITY.



The history of expansion and growth of Ahmedabad city and the surrounding rural areas which have been incorporated during different periods of time within Ahmedabad Municipal Corporation is given in the table 9.3.

Table – 9.3: Growth in the area of Ahmedabad city- 1411 to 1960.

Period	Total area (sq km)	Areas incorporated
1411	5.3	Around Bhadra on eastern side of the river Sabarmati
1770	5.7	City walls, Saraspur
1873	23.6	Bhavanipur, Madhavpura, Bardolpura, Kazipura (in 1884), Asarva, Gomtipur, Dariyapur, Behrampura (in 1911)
1926	51.9	Shahwadi (1936), Rakhial, Old Wadaj, Usmanpura, Khanpur, Paldi and Fatehpura
1950	81.8	Areas of Navrangpura, part of Khokhra-Mehmadabad, part of Rakhial, Acher and Vasna, Vastrapur and Memnagar
1960	91.9	Danilimda

(Source: Town planning and valuation department, Govt. of Gujarat, 1968)

LAND USE PATTERN

The land use cover pattern of the AUDA is described below.

Built up land

The area under built up land includes urban agglomeration of AUDA area, the four growth centres of AUDA and the rural areas. The physical extent of the total built up land is about 343 sq km. Out of which the built up land in the Ahmedabad Urban Agglomeration is about 196 sq km.

An alluvial plain mostly covers the AUDA area. The soil is therefore either coarse or fine loamy with clayey content and with good to excellent drainability. The

soils in the study area are deep to very deep (soil depth more than 100 cm). However, there are no mineral deposits in the study area. Since there is lot of construction activity in the city during the last decade, the demand for bricks has gone up. As a result, a number of brick kilns have come up. The total area under this brick kiln is 14.09 sq km. Bricks manufactured in the kilns near Khodiyar are best. Bricks from Sanand, Sarkhej, Kanbha and Bareja stand next to Khodiyar in terms of quality.

Agriculture

Agriculture is the predominant land use out side the urban complex area. The area under agricultural land is 1441sq km and accounts for 74.16% of the total study area. It has been observed that more land is covered under agriculture on the eastern part than on the western part of the study area. It has also been observed from the satellite data that a large part of the eastern and southern part is under Rabi crops indicating the availability of water for irrigation. On the other hand, most of the agricultural land in the western part from Sanand to Ognaj is lying barren indicating lack of irrigation facilities. Another major problem associated with the area is salinity.

Wasteland

The area under the wasteland is about 133 sq km, which is about 4.3% of the total study area. It has been observed that most of the wasteland area is located on the banks of the rivers Sabarmati, Khari and Meshwo. These wastelands are mainly

gully or ravinous lands with scrubs. The large tracts of ravinous land are found around the villages of Koteshwar, Bhat and Chiloda in the north and the villages of Gyaspur, Vanzar in the south along the Sabarmati river.

The wastelands are also observed on the western part of the study area viz. Sanand, Shilaj, Jamiatpura etc. These are mostly salt affected areas where the vegetation cover is less. Some areas fall along the Khari cut canal, which are classified as wastelands because of water logging. The water logging is mainly because of waste water that is released through the canal from three industrial areas of Naroda, Vatva and Odhav (Plate 9.1).

Water bodies

The total area under water bodies is 38.54 sq km, which is 2.96% of the area. The prime surface water body in the area is the river Sabarmati, which flows from N to S and divides the city in to two parts. Two minor rivers pass through the eastern part of the city i.e. Khari and Meshwo, the tributaries of Sabarmati. A number of lakes/ponds have been observed in the entire study area, mostly on the western side of the river Sabarmati. Each village has its own tank or lake. Figure 9.2 depicts water bodies present in the study area.

Figure 9.3 shows the distribution of above described various land use patterns of the study area.

Urban land use pattern of the study area is given in table 9.4.

Plate 9.1: Untreated Industrial Affluent being Released in Khari Cut Canal near Odhav.

Plate 9.2: GEB Power Station at Gandhinagar.

FIG. 9.2: WATER BODIES MAP.

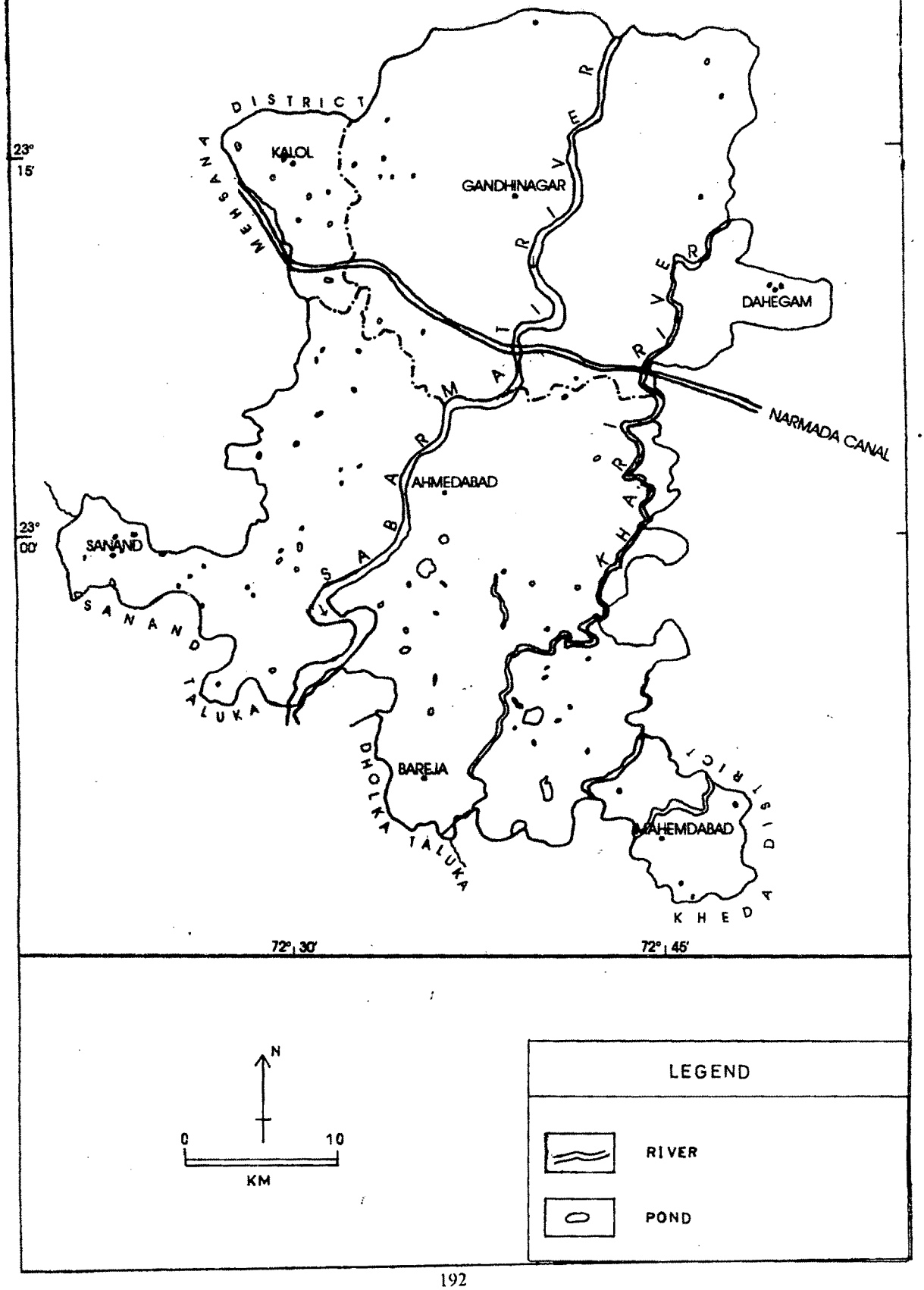


FIG. 9.3: LAND USE PATTERN OF THE STUDY AREA.

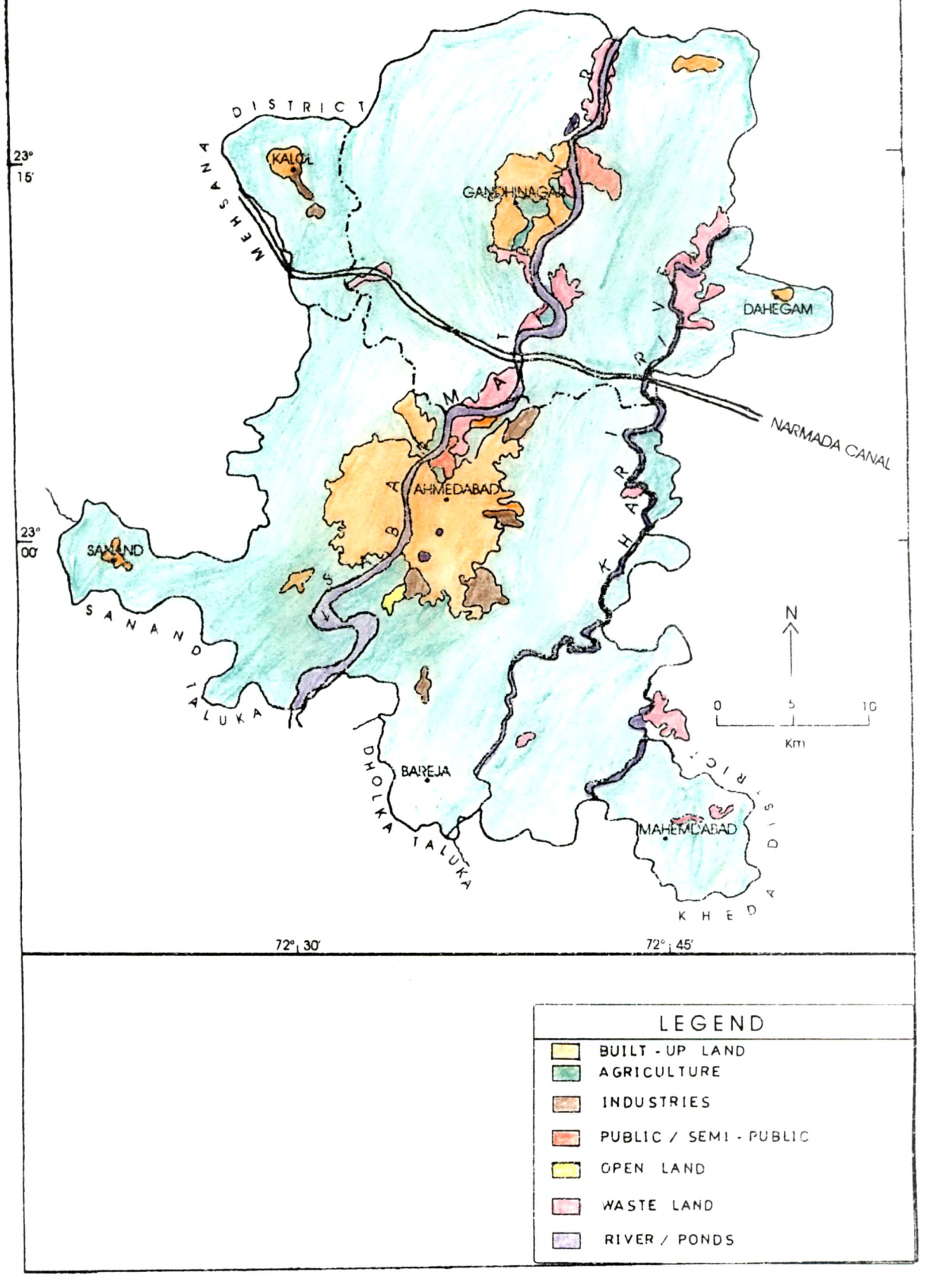


Table – 9.4: Urban land use pattern in the AUDA area.

Land use pattern	Sub-pattern	Area in ha.	Area (%)
Built up land	Urban complex	19602.97	
	Rural area	2915.00	
	Green belt	292.11	
	Others (Brick kilns)	1409.00	
	Total	*24219.08*	*18.58*
Agricultural land	Crop land	54039.00	
	Fallow land	42090.26	
	Plantations	550.04	
	Total	*96679.30*	*74.16*
Waste land	Ravines with scrubs	4992.93	
	Ravines without scrubs	602.44	
	Marshy land	10.04	
	Total	*5605.41*	*4.30*
Water bodies	Rivers and ponds	3854.51	2.96
	Grand Total	*130358.00*	*100*

The total area under residential category is about 129 sq km i.e. 65.8 % of the total Ahmedabad Urban Complex. The residential area is distributed equally on both sides of the river Sabarmati. However, it has been observed that the residential area in the east of the river is highly congested with many industries. This part is almost devoid of any vegetation. On the contrary the western part has the low density of buildings with good vegetation and better infrastructural facilities. The high rise structures that are zooming up in this part of the city may worsen the

quality of life in terms of transportation facility, power and water supply, sewage disposal as well as health.

Industrial Growth

Most of the industries in the area are located within the AMC limits. Three major industrial estates of Naroda, Odhav and Vatva have various types of industries ranging from chemicals, dyes and dyes stuff, engineering rolling mills, pharmaceuticals, plastics, electronics, ceramics, fabrications etc. The total area covered by these industries is approximately 25 sq km which is about 10 % of the total urban complex. Now, most of the new industries are coming up out side the AMC on the western part in Santej, Dhatraj and Sanand areas. Some major industries such as IFFCO, gas collecting centers of ONGC are present near Kalol.

Recreation parks and Gardens

The park and garden facilities and recreational areas are allotted in the out skirts of old walled city and surrounding areas on the eastern side of the Sabarmati river, which are insufficient and in majority of the cases not maintained properly except one or two i.e. Kankaria. On the other hand, the western part of the Sabarmati river the areas, which have been developed in the later seventies, the facility for open recreational land was provided in the AUDA town planning schemes. These facilities though ill utilized, has proved a step forward in maintaining good quality of environment. This type of positive development is recommended for the future planning.

Gandhinagar district consists of only one taluka also named as Gandhinagar. The taluka covers a total geographical area of 651.40 sq km and includes 75 villages and a township of Gandhinagar. About 101 sq km is covered by built up land and approx. 475 sq km is under agricultural land. The Gandhinagar is a well planned city and for the purpose of providing better infrastructural facilities, it has been divided into 30 sectors. All the state government offices are located here. The population largely includes the government employees. The population and land use pattern of Gandhinagar is given in table 9.5.

Table - 9.5: Population and Growth rate of Gandhinagar.

Year		1931	1941	1951	1961	1971	1981	1991
Rural		76000	97000	112000	137000	200000	226000	241000
Gandhinagar city		-	-	-	-	24000	62000	116000
Growth rate %	Rural	-	28	16	23	46	13	6
	City	-	-	-	-	-	158	87
Density persons/ha		-	118	184	211	309	400	630

Water Supply

Because of the phenomenal growth of the city at such a rapid rate and in view of the vagaries of rainfall affecting the availability of waters from Sabarmati river, the usage of groundwater for water supply is increasing year after year. The industries as well as private residences have also sunk tube wells for their requirement of water.

The total supply in 1951-52 by the Ahmedabad Municipal Corporation was 91 mld to a city population of 8 lakh in an area of about 52 sq km, thus providing 110 lit. of water per capita per day. After a decade, that is, in 1961-62 water supply increased to 150 mld. The use of groundwater by industries also increased from 10 mld during 1951-52 to 45 mld in 1961-62. In 1981, the total domestic water supply by the AMC was to the tune of about 380 – 400 mld. It is to be noted that the groundwater component of the water supply, which was a mere 23 mld in 1950-51, has increased to 250 mld in 1980-81. While at present the dependence on groundwater is almost 90%. Thus the development of groundwater has increased at a more accelerated pace than the river water. This has put considerable stress on the groundwater regime in this area. A scheme of water supply in Ahmedabad Urban Development Authority (AUDA) and in Ahmedabad Municipal Corporation (AMC) is given in the tables 9.6 and 9.7.

Table 9.6: Water distribution system in AUDA area

Details of tube wells	Unit	AUDA area
No. of tube wells	Nos.	44
Depth range	M	170 – 250
Discharge	m^3 / hr	24 – 100
Overhead tanks	Nos.	35
Direct distribution tanks	Nos.	9
Hours of pumping and supply		5 – 18
Total amount of water supply	Mld	2453

Table 9.7: Water supply scheme of AMC

Particulars	Available quantity (mld)	Supply (mld)	Supply from Dudheshwar water works (mld)
Surface water	Nil	Nil	-
Infiltration wells	30	54	54.31
French wells	94	135	26.32
Tube wells	273	226	3.30
Total	*397*	*415*	*83.93*

The average supply of water to the Ahmedabad city for the years 1986 to 1998 is given in the table 9.8.

Table 9.8: Average water supply in AMC (1986-1998).

Year	86-87	87-88	89-90	91-92	93-94	94-95	95-96	96-97	97-98
Water Supply (mld)	400	324	430	420	411	423	422	415	382

The demand and supply of water is continuously increasing for domestic and industrial purposes in the city. This has generated overdrawal condition of groundwater resources. This has ultimately resulted in to the depletion of water levels in the municipal wells. The depth of water levels in the three zones of A.M.C. is given in the table 9.9.

Table 9.9: Depletion of groundwater levels in different zones of AMC (1960-99).

Year	Central zone (City)		Western zone (Sabarmati – Vasana)		Eastern zone (Bapunagar – Rakhial)	
	SWL (m)	Cummu. (m)	SWL (m)	Cummu. (m)	SWL (m)	Cummu. (m)
1960	26	-	18	-	25	-
1965	45	19	34	16	43	18
1970	59	33	49	31	58	33
1975	72	46	59	41	70	45
1980	84	58	71	53	79	54
1985	93	67	81	63	90	65
1990	101	75	89	71	98	68
1995	108	82	97	79	104	79
1999	121	95	112	94	119	95
Cummulative average 94.7 m in 35 years						

(Source: AMC yearly report, 1997 and Gujarat Samachar News Paper dt: 28-9-99)

River Water Quality

It has been observed that the Sabarmati river becomes highly polluted by contamination of industrial effluents and sewage water in Ahmedabad city. The Sabarmati has, over the past few decades, earned the dubious distinction of being the most polluted river in the country. The average water quality as determined by Dave et al. (1992) is given in table 9.10.

Table 9.10: Sabarmati river water quality.

Sampling station	Dissolved Oxygen mg/lit.	Biological Demand of Oxygen mg/lit.	Turbidity N.T.U.	Total Dissolved Solids mg/lit.	Total Coliform MPN/100ml.
Down-stream Dharoi dam	7.90	1.61	8.46	210	434×10^3
Indroda (Gandhinagar)	7.62	2.47	93.0	257	1444×10^3
Subhash bridge	5.58	1.67	13.13	320	417×10^3
Vasana barrage	0.37	62.25	24.93	1106	15000×10^3
Vautha	3.37	32.67	58.0	1580	8240×10^3

From the table, it is seen that turbidity has increased considerably near Indroda, which may be the result of effluent discharge from GEB thermal power station, mainly in form of ash in to the river. The river water quality depletes much faster when it enters in to the Ahmedabad City. This is evident from increase in BOD, turbidity and TDS at Vasna barrage. This is due to the industrial effluents in the

river at many places. Further the increase in number of coliform suggests very high discharge of untreated sewage water from Ahmedabad city in the river.

From this observation it can be concluded that the contamination of Sabarmati river water takes place from GEB-Gandhinagar (Plate 9.2), AEC-Ahmedabad, Sardar bridge etc. More than 30 outlets of drainage have been located in the river which create much of the pollution. The 13 km stretch of the river Sabarmati passing through Ahmedabad has been found by the NRAP (National River Action Plan) as the most polluted zone. It is worst than the Yamuna between Delhi and Agra, the Sutlej between Ludhiana and Haria, the Godawari between Nasik and Nanded or the Damodar between Dhanbad and Haldia.

The industrial untreated effluents are contributing about 35-40 % of the total 60,000 kg/day of BOD load in to the riverbed. In Delhi and many other cities, the industrial share is usually less than 10 %. The share of sewage is estimated to be 10,000 kg/day to 15,000 kg/day of BOD. On the other hand, the AMC and the capital project authority of Gandhinagar draw over 600 million liters of water per day through the french wells sunk on the river bed as well as tube wells in the peripheral areas.

The sewage treatment plants at Pirana and Vasna can treat hardly 400 million liters/day sewage water. Thus there is absolute increase in the pollution of river water at a very high rate. As a result, the river water within the city limits and after Vasna barrage becomes totally non-usable and unsafe for any purpose.