CHAPTER 1

INTRODUCTION

1 INTRODUCTION

Water is life and access to safe and assured water is recognized as a universal human need and a fundamental human right.

The world wide scenario in terms of water availability is highly precarious. "We are in the midst of a water crisis that has many faces" cries out the United Nations report (2003). More than 1 billion people today are water poor and its incidences are too high. In the past few decades water has turned from an infinite to a finite renewable natural resource with a remarkably high degree of susceptibility to climate change and pollution because of the anthropocentric pressures. The alarming truth is that the water poverty is only going to worsen more and its relative scarcity is going to escalate further due to the non-commensurate inflation in its demand vis-à-vis growth in the population and various economic activities (United Nations report 2003).

It is projected that by 2025, an estimated 3.5 billion people (approximately 6.5 times the figure of 2000) will live in water-stressed countries (Asia-Pacific Forum for Environment and Development, 2002: 1) and by the middle of this century, at worst 7 billion people in 60 countries and at best 2 billion in 48 countries will be faced with the scourge of water scarcity. (United Nations report 2003:10)

1.1 Global Water Resources Scenario

About 71% of earth surface is covered with water. Total volume of water in hydrosphere is estimated to be 1.46 billion km^3 of which 97% is ocean water (not suited for human use due to high salt concentration) and rest 3% is available as fresh water. About 2.997% of it is locked up in ice cups or glaciers or is buried so deep that it costs too much to extract. Only

about 0.0035% of earth's total volume of water is easily available as soil moisture, exploitable ground water and rivers, lakes and streams (Patel A.S., 2008).

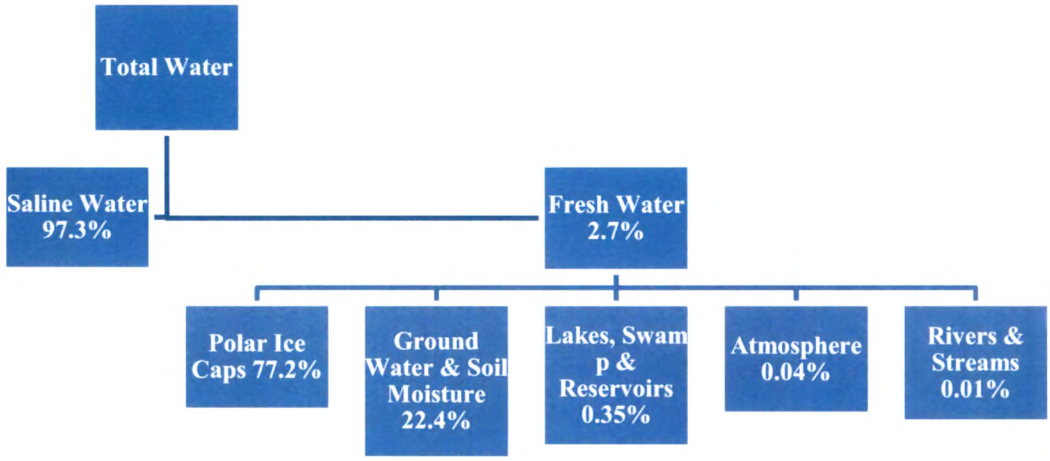

Figure 1.1 Distribution of Fresh Water Resources on Earth

(Source: Patel A.S., 2008)

1.2 Water Resources Scenario in India

The basic source of fresh water in India is the rainfall over the most part of the country and snowfall in the part of North India region. India, with a geographical area of nearly 3.3 million square kilometers experiences changes in climate. The rainfall varies from place to place and from year to year. Normal annual rainfall varies from 100 mm in Western India to over 1100 mm at Eastern India. Figure 1.2 shows the availability of fresh water resources in India (Patel A.S., 2008).

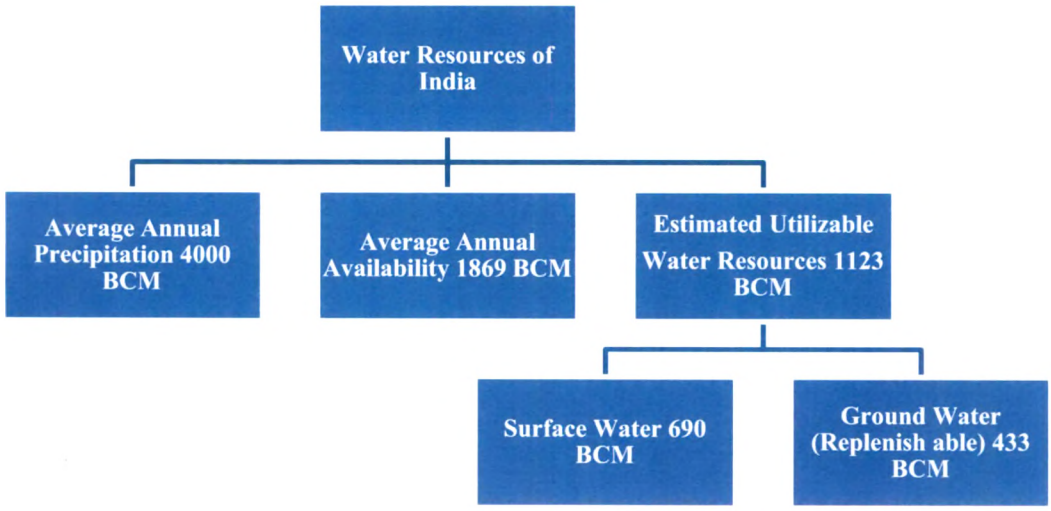

Figure 1.2 Availability of Fresh Water Resources in India (Source: Patel A.S., 2008)

1.2.1 Ground water potential of India

The ground water resources of the country have been estimated for freshwater based on the guidelines and recommendations of the GEC-97. The total Annual replenishable ground water resources of the country have been estimated as 433 billion cubic meter (BCM). Keeping 34 BCM for natural discharge, the net annual ground water availability for the entire country is 399 BCM. The Annual ground water draft is 231 BCM out of which 213 BCM is for irrigation use and 18 BCM is for domestic & industrial use.

1.2.2 Surface water potential of India

The availability of surface water in different water basins of India is as shown in Table 1.1.

Table 1.1 Showing Available Fresh Water in Different Water Basins of India (Source: Ministry of Water Resources, India and reproduced in Nigam Navin C., 1999)

Sr. No.	Name of the River Basin	Average annual available water (km^3/Year)	Sr. No.	Name of the River Basin	Average annual available water (km^3/Year)
1.	Indus (up to Border)	73.31	11.	Subernarekha	12.37
2.	a) Ganga	525.02	12.	Sabarmati	3.81
	b) Brahmaputra ,Barak & Others	585.60			
3.	Godavari	110.54	13.	Mahi	11.02
4.	Krishna	78.12	14.	West Flowing Rivers of Kutch, Sabarmati including Luni	15.10
5.	Cauvery	21.36	15.	Narmada	45.64
6.	Pennar	6.32	16.	Tapi	14.88
7.	East Flowing Rivers Between Mahanadi & Pennar	22.52	17.	West Flowing Rivers from Tapi to Tadri	87.41
8.	East Flowing Rivers Between Pennar and Kanyakumari	16.46	18.	West Flowing Rivers from Tadri to Kanyakumari	113.53
9.	Mahanadi	66.88	19.	Area of Inland drainage in Rajasthan desert	Negligible
10.	Brahmani & Baitarni	28.48	20.	Minor River Basins Draining into Bangladesh & Burma	31.00
				Total	**1869.35**

1.3 Water Resources Scenario in Gujarat State

The state of Gujarat is located between 20^0 06' to 24^0 42' North Latitudes and 68^0 10' to 74^0 28' East Longitudes in the west of India covering about 1,95,984 km^2 geographical area. Out of the total area nearly 1,09,314 km^2 is covered by the rocky formation and 86,670 km^2 by alluvium soil, of which 34,625 km^2 is brackish. The state has the longest coastline in the country measuring about 1600 km along with western part of India. Gujarat state has common borders with Rajasthan, Madhya Pradesh and Maharashtra states in North, East and South respectively and with Pakistan in the North West. The population of the state was 50.67 millions, as per 2001 census. For administrative purpose state has been divided into 26 Districts and 225 Talukas. Based on various parameters, the state can be divided into the regions namely, North Gujarat, Central Gujarat, South Gujarat, Saurashtra and Kachchh.

1.3.1 Variations in Rainfall

The state suffers from geo-climatic variations and climate related adversities. In Gujarat, 95 percent of the rainfall occurs during few days of monsoon period, especially during June to September. The visible difference in the rainfall received by the regions leads to a marked disparity in the availability of water. Except South Gujarat, which is flood prone, the entire state is drought prone. (Government of Gujarat. 2000: 3) While Kachchh gets less than 400 mm of annual rainfall and is a water-starved desert. In the Saurashtra region, the annual rainfall ranges from 400 to 800 mm. North-South Gujarat is relatively blessed- it gets rainfall between 800 to 2000 mm. Figure 1.3 shows the Mean annual rainfall over the various zones of Gujarat. From the graph it is noted that about 40%

of the total rainfall ie.130.205 km^3, that Gujarat receives; fall in South and Central of Gujarat.

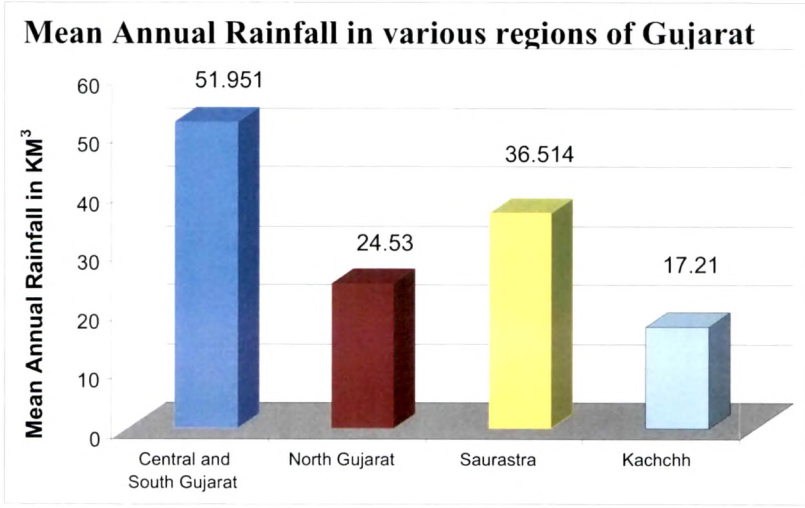

Figure 1.3 Graph Showing Rainfall Variations in the Various Zones of Gujarat

1.3.2 Potential Water Resources

Nature has endowed Gujarat with limited fresh water. The total renewable fresh water available, including the annual runoff from within the state and that allocated from the neighboring states, and all the natural recharge of ground water, is 54,593 MCM. This gives a per capita renewable fresh water availability of 1137 m^3 per annum for year 2001. Therefore, as per water stress index (Falkenmark and Widstrand, 1992), the state can be called 'Water Stressed'. But availability of water is heavily skewed towards south and central Gujarat, which has 69.5 % of the total renewable fresh water. At regional level per capita availability in other regions is much less, at 427 m^3 in North Gujarat, 734 m^3 in Saurashtra and 875 m^3 in Kachchh (IRMA 2001).

Water resources of Gujarat are divided into two distinct categories namely, a. Surface water resource and b. Ground water resource. Each of

these categories is a part of the earth's water circulatory system called the hydrologic cycle and is ultimately derived from precipitation. From the surface water resources point of view, the state can be divided into three major physiographic regions and total 185 river basins are located as under:

(1) South, Central and North Gujarat 17 Basins

(2) Saurashtra Region 71 Basins

(3) Kachchh Region 97 Basins

Figure 1.4 shows the surface water potential of the state and its sub division. This also indicates that the most available surface water resources are in the south and central Gujarat, whereas north Gujarat, Saurashtra and Kachchh water scarce for surface water availability.

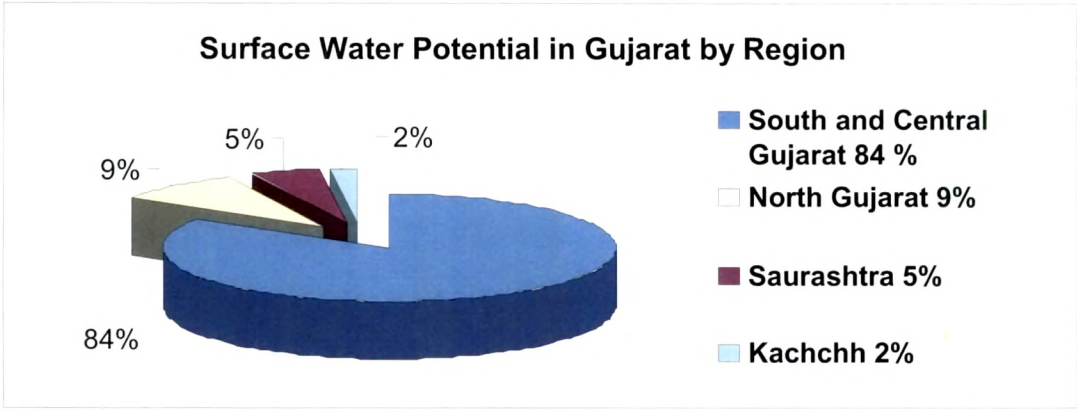

Figure 1.4 Graph Showing Surface Water Potential of Gujarat

The ground water potential of the state and its sub divisions are as shown in Figure 1.5. Ground water availability in the state is 7,465 MCM against the average annual draft of 6765 MCM (i.e 80%), which categorized the state into 'Over exploited'.

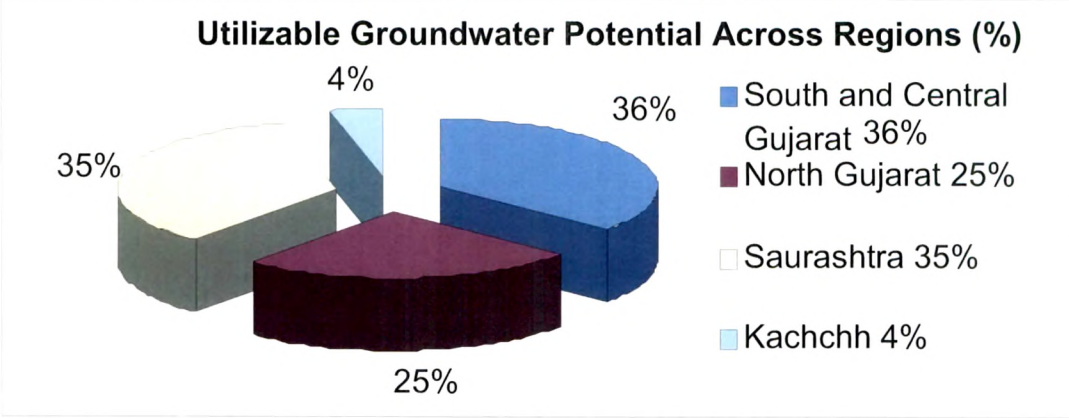

Figure 1.5 Graph Showing Ground Water Potential of Gujarat

1.4 Increases in Water Resource Demand

Since independence, India has witnessed an unprecedented increase in population. From a population of about 343 million in 1947, the population has grown at a rate of 2.04% to 1200 million in 2011. With an increasing number of mouths to feed, there has been an additional pressure on agriculture resulting in an increase in net sown area. High cropping intensity has also resulted in an increased demand for water resources. Domestic water need in the urban areas has also grown notably with the current urban population is about 31%. By the year 2050, the population is expected to reach around 1600 million, the per capita availability will drastically reduce and our country shall be water stressed in many river basins. The following Table 1.2 shows probable water availability against each year in India.

Table 1.2 Water Availability in India (Source: Patel A. S., 2008; Water Management)

Year	Available Water (KL/Year/Capita)
1000	70,000
1850	10,000
1950	5,177
2000	1,820
2025	1,400 (likely population 1300 million)
2050	1,140 (likely population 1600 million)

The demand for fresh water has been identified, as the quantity of water required to be supplied for specific use and includes consumptive as well as necessary non-consumptive water requirements for the user sector. The total water withdrawal/utilization for all used in 1990 was about 518 BCM or 609 m^3/capita/year. Estimates for total national level water requirements, through an iterative and building block approach, have been made for the year 2025 and 2050 as shown in Table 1.3, based on a 4.5% growth in expenditure and median variant population projections of the United Nations. The country's total water requirement by the year 2050 will become 1,422 BCM which will be much in excess of the total utilizable average water resources of 1,086 BCM.

Table 1.3 Showing Projected Water Requirements in BCM for Different Uses in India (Source: National Commission for Integrated Water Resources Development Plan, 1999)

Category of Water Use	**Year 2025**	**Year 2050**
Irrigation	688	1008
Domestic	52	67
Industries	67	81
Energy	13	40
Inland Navigation	4	7
Flood Control	-	-
Forestation	67	134
Ecology	10	20
Evaporation	42	65
Total	**942**	**1422** (all values in BCM)

Viz. a viz. the demand for water in Gujarat state has also increased due to the growth of population, industrialization, urbanization and improved sanitation facilities. The population of the state has increased from 20.6 million in 1961 to 50.67 million in 2001. It has also been

observed that the per capita use of water has increased from 40 lpcd in years 1960's to 70-100 lpcd in year 2000.

1.5 Water Quality Management

Water Quality is a major environmental concern in developing countries. Pollution of waters of rivers, streams and lakes is mainly the fallout of rapid urbanization, industrialization and inadequate storage of flood flows for meeting the needs of water supply and sanitation sectors. The main sources of water pollution are discharge of domestic sewage and industrial effluents, which contain organic pollutants, chemicals and heavy metals, and runoff from land based activities such as agriculture and mining. Further, bathing of animals, washing of clothes and dumping of garbage into the water bodies also contribute to water pollution. All these factors have led to pollution of rivers, lakes, coastal areas and groundwater seriously damaging the eco-systems. The rapid urbanization, industrialization and increasing use of chemical fertilizers and pesticides etc. have made our rivers and water bodies highly polluted. Water Quality Assessment Authority (WQAA) has been setup to effectively coordinate and improve the work of water quality monitoring by various organizations.

In Gujarat, about 78 % of the drinking water supply is based on ground water resources (GWSSB 2005). But the quality of available ground water is not fit for consumption in many regions owing to excessive salinity, fluoride and/or nitrate. The state having the longest coastline of 1600 km in the country and excessive withdrawal of ground water from coastal aquifers has lead to ingress of seawater in the coastal aquifers rendering many thousands of drinking water and irrigation wells useless in coastal areas of Kachchh and Saurashtra (Bhatia, 1992; Kumar 1995). Every year on an average 0.5 to 1.0 km distance from the coastline is affected by salinity ingress (Barot, 1996). Also, in the state many of the

habitants are suffering from more than one quality problem. Central Ground Water Board (CGWB) in 2005 in its annual report shown that out of 26 districts of the state, 20 are suffering partly by salinity problem, 18 are suffering partly by fluoride problem, 17 are partly affected by chloride and 22 are partly affected by nitrate. In addition to above, there are problems of contamination arising from solid and liquid waste disposal from industries and human settlements. The regions around the major industrial centers like Ahmedabad, Vadodara, Bharuch, Ankleshwar, Surat, Navsari, Valsad and Vapi have polluted water sources, which have adversely affected their drinking water sources. Figure 1.6 shows the percentage villages of various districts of Gujarat suffering from the various water quality problems (Source: GWSSB 2003).

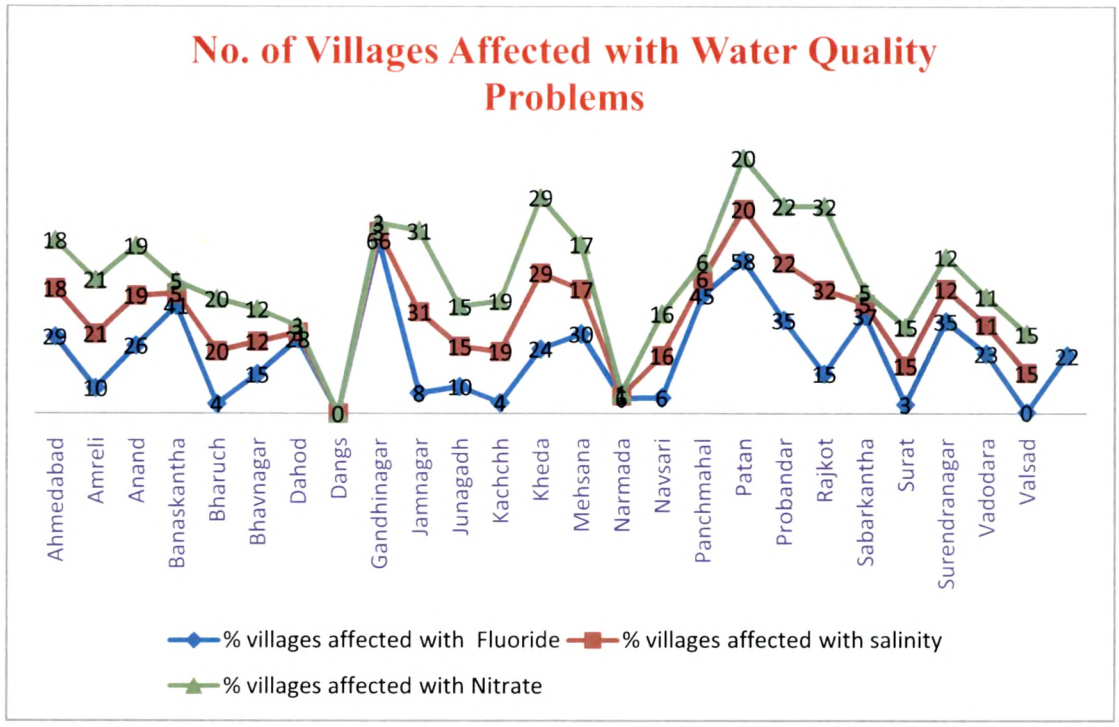

Figure 1.6 Graph Showing Villages of Gujarat Affected with Water Quality Problems (Source: CPCB)

1.6 Need of National Water Policy and Gujarat State Water Policy

In India, considering the availability and its variation in spatial and temporal dimensions it is found that the proper utilization of water is the most effective way for meeting the twin objectives of socio-economic development and environmental protection. Keeping this in consideration, the Government of India felt the need for the National Water Policy (NWP) for optimum utilization of the available water resources. Subsequently, India adopted its NWP in September, 1987. Since then, due to the emergence of a number of issues and challenges in the development and management of the water resources, the NWP (1987) was reviewed and updated in 2002. It clearly states that "As country has entered the 21st century, efforts to develop, conserve, utilize and manage this important resource in a sustainable manner, have to be guided by the national perspective". The issues of requirement for institutional mechanism for multi-sectoral, multi-disciplinary and participatory approach, participation of stakeholders and specially women community in policy decision are being strongly addressed by the NWP. Issues such as irrigation planning, resettlement and rehabilitation, financial and physical sustainability (water pricing), participatory approach to water resources management, encouraging private sector participation, monitoring the water quality (principle of 'Polluter Pay'), conservation of water, need for information system, watershed management, adequate safe drinking water facilities for the entire population in both urban rural areas are some of the amply stressed issues of NWP (2002).

With an ultimate goal of preserving and protecting the water resources of the state, Gujarat State Water Policy (2004) prioritize the utilization of water resources such as for 1. Drinking water 2. Irrigation 3. Hydro power 4. Ecology 5. Agro industries and other industries and 6. Other uses, Fisheries, Navigation, etc. Further, Adequate and safe drinking water facilities shall be provided to the entire population both in urban and in rural areas. Planning shall be done considering provision for drinking water as primary requisite in the irrigation and multi-purpose projects to come up in the future. Available water shall be provided on priority basis for use for human and livestock where there is no facility for assured drinking water supply at present. Following actions in state policy were noted to fulfill this necessity:

- Increase shall be made in the provisions in the budget for qualitative gradual improvements in the distribution of water for domestic and livestock uses in the urban and rural sectors
- Water tariff shall be increased gradually for self-reliant operations of pipeline projects in the urban and rural sectors. Standards/ criteria shall be decided for quality of water
- Strict control shall be exercised for discharged matters/ substances and harmful pollutants degrading water resources and deteriorating water quality
- Privatization of urban water distribution system shall be encouraged eg. To hand over work of reading of meters, etc.
- 8215 villages and 135 towns/ cities of Saurashtra, Kachchh and North Gujarat shall be covered under Narmada based projects
- Private sector shall be created for utilization of water. Panchayat institutions and domestic water user associations shall be involved

for participation in rural water supply system and taking proper decisions. Private and non Government sectors shall be encouraged

- Financial support (force) shall be provided to the rural water supply system

1.7 Scenario of Water Supply Sector and Water Supply Schemes Working in Gujarat State

As per Constitution of India 'Water is a subject matter of State'. Therefore, the responsibilities for the development of water supply sector are of concern to the state Governments. The State Governments on their part fulfill such responsibilities through state level functional authorities or the local bodies.

1.7.1 Water Supply Sector in Gujarat State

For the purposes of planning in the State of Gujarat, four different segments are considered separately for the water supply sector namely; Bulk water supply schemes, Water supply schemes for rural and smaller urban areas, Water supply schemes for larger urban areas, implemented by Municipal Corporations and Supply of water to large industrial users and industrial estates by GIDC.

The implementing and administrative agencies of these segments are different. However, at planning and policy formulation stage entire water resource of the state and its management is considered in an integrated way while approaching real challenges and to set priorities. The institutional structure of water supply sector in Gujarat state is as shown in Table 1.4.

Table 1.4 Institutional Structure of Water Supply Sector in Gujarat State

Agency	Jurisdiction	Role
Administration and regulation		
Department of Narmada, Water Resources, & Water Supplies	State level	Regulatory oversight of the water sector in the State Oversight of State government owned corporations involved in the Implementation and operation of water schemes
Department of Urban Development	State level	Oversight of urban local bodies, excluding corporations, in matters of financial, planning and management issues. Regulation of political and administrative appointments in the local authorities
Municipal Corporations	Major cities	Provision of retail water supply services for domestic and industrial purposes in the area of their jurisdiction
Municipalities & Nagar Palikas	Smaller Cities	Provision of retail water supply services for domestic and industrial purposes in the area of their jurisdiction
Gram Panchayats	Villages	Provision of retail water supply services for domestic and industrial purposes in the area of their

Agency	Jurisdiction	Role
		jurisdiction
Gujarat Industrial Development Corporation	State level	Mainly Implementing water supply and sewerage schemes for urban local bodies
Implementation and Operation		
Gujarat Water Supply and Sewerage Board (GWSSB)	State level	Mainly Implementing water supply and sewerage schemes for urban local bodies. Operation of some schemes. Inspection of schemes where State government fund is provided.
Gujarat State Drinking Water Company Limited	State level	Bulk transmission and bulk supply of drinking water to local bodies, GWSSB, and Industrial estates
Sardar Sarovar and Narmada Nigam Limited	State level	Wholesale supply of water
Gujarat Water Infrastructure Limited	State level	Development & Maintenance of Water Infrastructure for Bulk transmission and bulk supply of drinking water
Department of Narmada, Water Resources, and Water Supplies	State level	Operation and maintenance of some river schemes like the Ukai Dam

1.7.2 Water Supply Schemes in Gujarat State

Gujarat Water Supply and Sewerage Board (GWSSB) is an organization which is involved in the overall supply and management of Drinking water to most rural areas of Gujarat. However, Table 1.5 shows the role and responsibilities for various water supply schemes in Gujarat state.

Table 1.5 Roles and Responsibilities in Various Water Supply Schemes of Gujarat State

Schemes	Implementation	Financing	Operations & Maintenance
Municipal Corporation Water supply projects	Municipal Corporation	Corporation finances	Municipal Corporation
Small & medium Urban Water S upply Projects	40% by Municipalities 60% by GWSSB	75% as grant released under state non plan for the period 1-4-08 to 31-01-09 (Yr. 2008-09)	Municipality
Rural Water Supply Projects	GWSSB	State Government grant	GWSSB
Bulk Water Supply Schemes	GWSSB	GWSSB	GWSSB

In rural water supply sector mainly two types of schemes are undertaken namely, 1. Individual water supply scheme, which involves the supply and management of water restricted to single village or habitation and 2. Regional or Multi-village water supply scheme, which

involves several villages and hamlets for the supply and management of water. Traditionally, the water supply schemes are planned based on local available source, however, during the summer season as local source get dry, scheme fail to supply water. However, Under Rural Water Supply Program, various schemes like Hand pumps, Mini pipe, Piped water supply schemes (Individual or Regional – Multi villages) are being taken up according to the technical feasibility of drinking water source under state budget from time to time:

(1) Hand Pump:

As the rural areas are characterized by hilly terrain, hand pump is the technically feasible source of drinking water. While considering one hand pump per 50 persons, total number of 1,11,543 hand pumps are installed in rural areas as on up to 2008 in the state of Gujarat.

(2) Mini Pipe:

This scheme consist of installation of single phased power pump on bore of 165mm dia., water will be stored in a storage tank of @ 10000 liters capacity and then distributed on stand post. Up to 2008, 1186 mini pipe schemes are completed in the state of Gujarat.

(3) Regional Water Supply Scheme:

Where individual water supply scheme is not feasible, Regional Water Supply Schemes are being implemented based on assured/ sustainable drinking water sources. Approximately 413 schemes were implemented in Gujarat benefiting 7,544 villages, 47 towns catering to approximately 1 crore people in the rural and urban area of Gujarat state. Local water utilities made significant investments to install, upgrade, or replace equipment in order to deliver safe drinking water and protect public health. However, most of these schemes are now shifted to reliable surface water source.

In RRWSS often source of water is common for several villages/towns, either based on ground water or surface water. Further, water conveyance system may include the common infrastructure like

intake structure, head works, pumping machineries, water treatment plant, bulk water storage at main head works. However, the in-village water distribution system in RRWSS may differ from village to village. Most of villages in RRWSS may contain common storage sumps for collection of water from RRWSS (in full need or part) and from local source, if any available (in full need or part). Thereafter water may be distributed in village by either of the systems namely; by ESR & SP system, Individual piped water supply system, Cluster Storage Tanks and/or the combination of above.

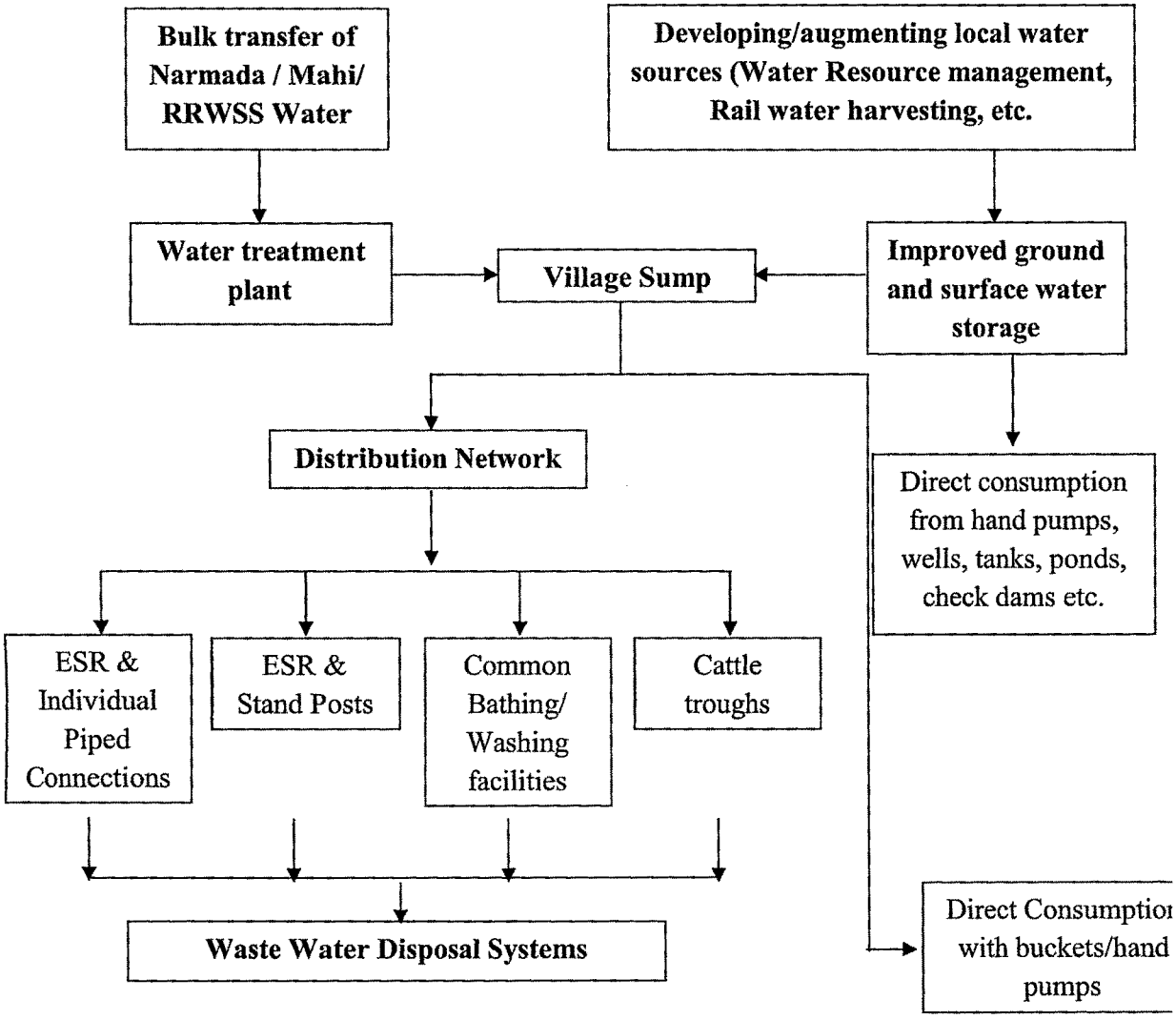

Figure - 1.7 Chart Showing Typical Water Supply Model Under Various RRWSS of Gujarat State

It is also noted that in RRWSS of Gujarat, various authorities or subsidiaries of state government are involved. For managing the supply of bulk water usually GWIL, SSNNL, Irrigation water department, various dam authorities and GWSSB are responsible. While mainly for in-village water distribution system often the local authorities such as Taluka/Gram Panchayats, Pani Samitis and/or WASMO and some NGO's are responsible.

(4) Sujalam Suphalam Yojana:

The State government has identified 10 worst water scare districts of North Gujarat, Central Gujarat, Saurashtra and Kachchh, which are being covered under the Sujalam Suphalam Yojana (SSY). These districts are Ahmedabad, Patan, Banaskantha, Gandhinagar, Mehsana, Sabarkantha, Dahod, Panchmahal, Surendranagar and Kachchh.

(5) Integrated Tribal Development Program:

Under this program, backward areas of tribal like, 25 villages of Vansada Taluka and 30 villages of Dharampur Taluka, 45 villages of Kaparada Taluka aggregating to 100 villages are taken up under community managed water supply and sanitation program.

(6) Swajaldhara/ Sector Reform Program:

The in- village water supply facilities are provided through Water and Sanitation Management Organization (WASMO) under the principles of Swajaldhara and Sector Reform, in which 90% of estimated cost is borne by Government of India/ Government of Gujarat and rest 10% is taken from local body. The schemes are planned, implemented and maintained and operated by Pani Samities.

1.8 Role of Regional Water Supply Schemes (RWSS) in Gujarat- Development and Investments

In the late 1970's and the early 1980's the state government introduced large regional water supply schemes to transfer bulk water supply to problem villages. Important among these were the first in Banaskantha district started in 1978 (working in early 1980's) covering 102 villages of that district, which was supported by the Netherlands government and the World Bank. In the XIth plan the government spent Rs. 650 million on rural water supply and sanitation. In 1980-81 to 1990-91 at the cost of Rs. 5.72 billion regional water supply of transferring bulk water to problem villages and individual schemes based on local water resources were planned in state master plan.

The number of regional schemes was very small until about 1980 (nine in 1970 and 43 in 1980, each covering about three to seven villages). It jumped to 209 in 1990 and to 444 in 2000. It is also noted that the about 60% of the schemes were implemented in the Saurashtra and Kachchh, which corresponds to the problem of local water sources in these regions in terms of quality and quantity.

As per the record of GWSSB (Table 1.6), during the 1990-2000, the state government spent about Rs. 31.54 billion to supply water. Also, in 1990-2000, alone private expenditure on drinking water was about Rs. 4.94 billion. Of this 2.14 billion were spent on purchasing domestic water purifying equipments, Rs. 1.61 billion on buying unbranded purified water in small and big packages, Rs. 880 million on branded water bottles and packages and Rs. 300 million on private tankers (Hirway, 2002). It shows that even after huge expenses, the water supply problem in the state was persistent.

1.9 Importance of Monitoring and Evaluation

The monitoring and evaluation is traditionally being used as a part of management tool. These ascertain the program objectives and also serve as basis for the accountability in the use of program funds. The evaluation of the rural water supply program in India is being done mainly through periodic physical and financial progress reports, visits of area officers and other government officials, and evaluation studies and sample surveys conducted from time to time. Although, the outcomes of such evaluations reflect regarding fulfillment of the objectives or accountability of funds, the sustainability of schemes and the social impacts of the scheme need to be ensured. Therefore, in checking overall effectiveness of water supply schemes it is necessary to develop several Performance Indicators.

Table 1.6 Expenditure of Gujarat State on Drinking Water Supply During 1990-91 to 1999-2000 (at 1999-2000 prices & in Rs. Crores) (Source: GWSSB Reports, Master Plans of GWSSB for different years)

Year	Expenses on Regional Water Supply Schemes by GWSSB		Expenses on Water Tankers by GWSSB	Expenses on Reverse Osmosis/Desalination plants		Expenses on Defluoridation plants		Total Expenses
	Capital cost	Operation & Maintenance		Capital cost	Operation & Maintenance	Capital cost	Operation & Maintenance	
1990-91	295.62	11.39	5.08	0	0	0	0	312.09
1991-92	201.18	13.72	22.6	0	0	0	0	237.50
1992-93	219.83	12.57	2.93	0	0	0	0	235.33
1993-94	157.5	12.04	13.07	0	0	0	0	182.61
1994-95	155.67	12.31	0	0.53	0	4.7	0.47	173.68
1995-96	158.05	11.22	1.01	0.41	0	1.91	0.19	172.79
1996-97	281.29	11.17	0.2	0.93	0.61	4.58	0.46	299.24
1997-98	288.2	8.7	0.13	0.88	0.57	19.34	1.93	319.75
1998-99	347.63	9.12	7.23	0.83	0.55	32.33	3.23	400.92
1999-00	717.13	8.09	7.41	0	0	79.35	7.93	819.91
Total	2540.81	110.33	59.66	3.58	1.73	142.21	14.21	3153.82

1.10 Need of Performance Indicators

Performance Indicators (PIs) can be defined as variables, whose purpose is to measure change in process or function. They can be used to track the performance of the whole system or to a particular element of the system. These can be used to monitor the progress of process and also to evaluate the outcome of the process. The performance indicators may be quantitative or qualitative in nature. The main features of the performance indicators are Purpose, Visibility, Definition, Control Power, Computation, Consistency, Comparability, Aggregation and Integrity. Therefore, a PI may be a measurement that describes how well an entity is meeting its objectives. It is also to be noted that it may vary with time. For example, frequency and seriousness of leaks & length of time it takes to deal with those repairs are time dependant variable. Such time dependant variables are difficult to interpret meaningfully when view at and isolated point in time. However, in such cases 'how often it occurs?' may be determined and this requires continuous monitoring and benchmarking from time to time and from project to project may help in improving or achieving project objectives.

The factors which are essential to be taken into account while selecting the performance indicators are identification of area of control, relevance of measurement with respect to area of problem, magnitude of problem, acceptance, relation with other indicators and the users other than responsible for water supply schemes ie. The Administration, Operation and Maintenance personnel of water supply schemes. It may be extravagant to decide on PIs including all the features and incorporating all the factors mentioned above. The decision on PIs also depends on the availability and reliability of inputs for its estimation. Establishing threshold value or benchmarks are also the important in the process of development of PIs and evaluating performance of the project.