CHAPTER 3

OVERVIEW OF RRWSS UNDER STUDY

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The key measures taken on policy level to cater the demand of water in the Gujarat state include transfer of water from water surplus areas by Sardar Sarovar Project, interlinking of State's rivers and the development of Water Supply Grid for Gujarat, Sujalam Sufalam Yojana, construction of check dams and rainwater harvesting structures and the Regional Water Supply Schemes for rural-urban areas in last decade.

The State Wide Drinking Water Supply Grid (Figure 3.1) has been mooted as solution to the drinking water woes especially for the Saurashtra and Kachchh region of the state. It should also be noted that the water grid project involves a long gestation period and requires ample financial resources for building a network of effective water conveyance infrastructure.

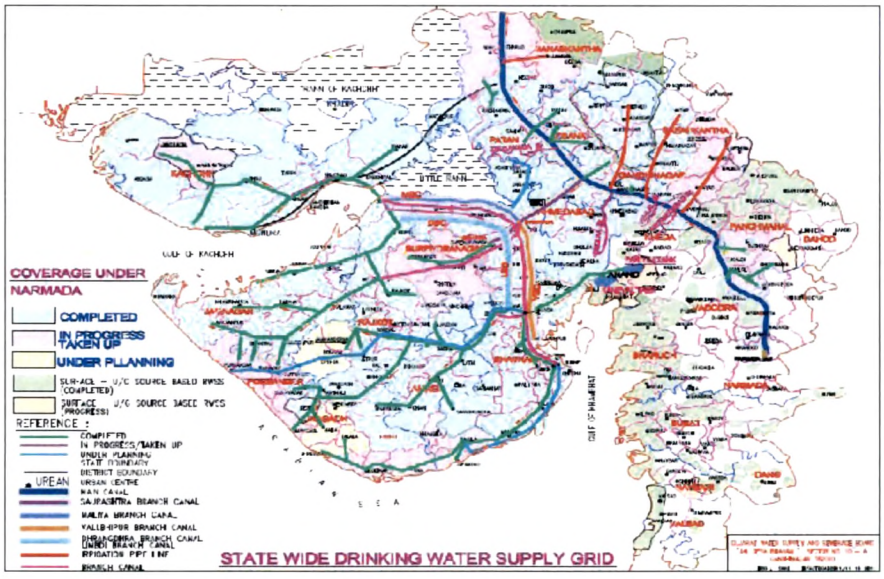

Figure 3.1 Map showing the Water Supply Grid of Gujarat

(Source: www.gwssb.org, July, 2012)

Gujarat state is having very wide diversities of population density, available water resources, rural and urban areas with and without industrialization, etc. Therefore, the mode of water supply in different

areas is also different and from time to time different types of water supply schemes were implemented with various objectives and scopes. For the present study four groups of RRWSS are selected covering detailed study. However, for evaluation of certain Performance Indicators, group schemes of South & Central Gujarat and Saurashtra group schemes based on Saurashtra pipe line project and Narmada bulk water supply are also undertaken for the study.

3.1 Criteria for the Selection of RRWSS for the Study Purpose

Source of the water, Population under coverage area, Geographical region (coastal, desert, water available and water scarce area), etc. are considered as selection criteria for the representation of various RRWSS implemented. Four groups of schemes are selected for detailed study and evaluation using Performance Indicators.

3.1.1 Variations in Hydrology

In terms of total quantity of rainfall, South and Central Gujarat receives the highest quantum of rainfall with mean annual precipitation of 51.95 km^3. Saurashtra follows with this 36.514 km^3 and North Gujarat with 24.53 km^3 and Kachchh receives a total of 17.21 km^3 of water as the mean and annual rainfall. Thus 40% of total rainfall that Gujarat receives falls in South and Central Gujarat. The Utilizable Ground water potential across the south and central region is also high about 36%.

3.1.2 Variations in Geology

The North Gujarat and Saurashtra region of Gujarat are consist of rocky strata with rich in minerals including Fluoride. The Saurashtra and

some part of South Gujarat is having long sea coast. This coastal segment is almost straight and trending NW-SE and characterized by uneven substrate of submerged miliolitics. Kachchh is falling in the desert part of the state. The South and the Central region of the Gujarat are having flat lands with good agriculture potential.

3.1.3 Variations in Source of Water & Availability of Water

The South Gujarat and the Central Gujarat is having the maximum surface water resources of the state. Also, most rivers flowing through are perennial and the availability of surface as well as the ground water is high compare to the rest part of the state. Due to rocky area in Saurashtra, most water resources are in the form of ground water and that too either from the unconfined aquifers or if alluvial area then the water is tapped by tube wells. Most of the rivers flowing through North Gujarat and Saurashtra are non-perennial. Kachchh being a desert area, availability of water resources are very scarce.

3.1.4 Variations in Population and Type of Coverage

Few of the RRWSS are covering the population of urban area, though their main objective is to provide water supply to the rural regions. In some of the RRWSS the water is made available to cope up the needs of Irrigation and/or Industries along with domestic water supply. However, most of the RRWSS are implemented with a objective of supplying the water for domestic needs of rural region, especially where no or limited local water resources are available.

Based on the above selection criteria, the RRWSS selected for the study are listed in Table 3.1.

Table 3.1 List of Selected RRWSS Under Study (Source: GWSSB)

Name of the Scheme	Main Source of Water	Population under coverage as per census 2001	No. of Villages/towns covered	Average Rainfall of region	Geo hydrology of Region
Variav Group, Surat-South Gujarat	Tapi river (perennial river)	6,11,795	156/0	>1500 mm/Annum	Alluvial soil, Rich in surface water and ground water resources
Gadhada Group, Bhavnagar-Saurashtra Region	Bulk water supply from Saurashtra pipe line project based on Mahi-pariej Yojna	1,43,471 (Year: 1991)	67/1	<600 mm/ Annum	Rocky area, taping water from unconfined aquifer
Ishwariya group, Amreli-Saurashtra Region	Bulk water supply from Saurashtra pipe line project based on Mahi-pariej Yojna	93,498	49/1	<600 mm/ Annum	Rocky area, taping water from unconfined aquifer & High fluoride content in ground water
Mandvi Group, Kachchh-Partly Desert Region	NC 11 & NL 22 from Maliya Branch of Narmada canal	72,261	71/0	<300 mm/ Annum	Desert area, saline ground water & scare surface water

3.2 Population Forecast and Water Demand

3.2.1 RRWSS Variav Group, Surat

This RRWSS covers 156 villages of three talukas namely Choryasi, Olpad and Kamrej of Surat district. Most of these villages are located on the periphery of Surat city. The total population of group area from year 1971 to 2001 as listed in Table 3.2.

Table 3.2 Population under RRWSS Variav Group, Surat, as per Census of India

Year	Population, as per Census of India
1971	1,77,253
1981	2,40,599
1991	3,39,001
2001	5,44,260

While working out the population projection by various methods of demographic projection, it was observed that due to 36% rise in Year 1981-1991 decade and 47 % rise in Year 1991-2001 decade.

Further in this RRWSS, 29 villages of Choryasi taluka are now included in Surat Municipal Corporation (SMC) area due to expansion of Surat city limits owing to urbanization. Therefore, to calculate the water demand for rural area was considered as 60 lpcd instead of semi urban area category and for SMC area it was considered as 135 lpcd. This RRWSS also covers the water demand of 55 MLD of Surat Urban Development Authority (SUDA) and 5 MLD for Special Economic Zone (SEZ). Therefore, the Ultimate design water demand considerations include 24.72 MLD (21%) of rural water requirement and 93.16 MLD (79%) of urban and industrial water requirement.

Table 3.3 Projected Population and Water Demand, RRWSS Variav Group, Surat

Village/Town covered	Population				
	1991	2001	2004 (Base Year-25% increase per 15 year)	2019	2034
Choryasi, Kmarej, Olpad,	333892	544260	611795	764750	917703

3.2.2 RRWSS Gadhada Group, Bhavnagar

Government of Gujarat spared 275 MLD of water for the Saurashtra pipe line project from Mahi-Pariej project and Kanewal storage pond which include the Bhavnagar, Rajkot, Amreli, Pipavav Industry & Bhal area of Ahmedabad. In Gadhada group mainly 67 villages and 1 town Gadhada are covered. Further, Gadhada group water distribution system is divided into four sub groups based on topography and ease of hydraulic flow conditions. Table 3.4 shows the projected population and water demand for the design. Against the present water demand, 250 MLD of water is available for Bhavnagar, Amreli district and Jasdan Taluka of Rajkot district & hence 46 LPCD water is considered for supply, but on completion of Narmada canal based project, 70 LPCD water can be supplied into the scheme.

It is also noticed that Out of 67 villages only 49 villages are taking water at present. These villages reduced to nearly 30 in monsoon. The villages not taking water depend on local source and thus at present in the scheme actually 1,19,358 souls taking water though it cover 1,53,764 souls.

Table 3.4 Projected Population and Water Demand Estimate of Water Distribution Groups among RRWSS Gadhada Group, Bhavnagar

Sr. No	Name of Sub group	No. of Villages/Town	Population in Year 1991, As Per Census	Population Projected in Year 2011 (Water Demand in MLD@ 46 LPCD)	Population Projected in Year 2031 (Water Demand in MLD@ 70 LPCD)
1	Holaya	13	20793	27447 (1.26)	42983 (3.0)
2	Viravadi	21	33341	44011 (2.03)	68773 (4.82)
3	Raliyana	24	46017	60743 (2.79)	94921 (6.65)
4	Adtala	9/1	43320	57183 (4.20)	89351 (7.62)
	Total	**67/1**	**143471**	**189384 (10.28)**	**295938 (22.09)**

3.2.3 RRWSS Ishwaria Group, Amreli

In this RRWSS also the water is made available at present from Saurashtra pipe line project based on Mahi-Pariej project at present. Hence, at present 46 LPCD water is considered for supply, but on completion of Narmada canal based project, 70 LPCD water can be supplied into the scheme. Table 3.5 shows the population forecast and the water demand for Ishwaria group.

Table 3.5 Projected Population & Water Demand Estimate for the RRWSS Ishwaria Group, Amreli

No.Of Villages/Town Covered	Population in Year 1991, As Per Census	Population Projected in Year 2011 (Water Demand in MLD@ 70 LPCD)	Population Projected in Year 2021 (Water Demand in MLD@ 70 LPCD)	Population Projected in Year 2031 (Water Demand in MLD@ 70 LPCD)
49- Villages	79665	105156 (7.36)	131449 (9.2)	164314 (11.5)

It is also noticed that Out of 49 villages, 12 villages are not taking water at present as they depend on the local water sources.

3.2.4 RRWSS Mandvi Group, Kachchh

The RRWSS Mandvi group is mainly divided in two sub groups. One which is completed covering 40 villages of Mandvi and the other cover Mau region having 31 villages. Prior to the water supply made available through Narmada Bulk Water Supply pipe line project, the scheme relied upon 6 tube wells. At present Mandvi region is mainly served from Bulk water supply pipe line project via sub head works at Madanpura and Bidada. The population for the base Year 2001 is considered as 72,261 (as per the census). Based on this the projected populations are considered for design as 85,648 (Year 2011), 90,331 (Year 2016-Intermediate) and 1,08,394 (Year 2031). The water demand assessment was planned at 70 LPCD. Based on this the estimated water demands are 5.93 MLD (Year 2011) and 8.10 MLD (Year 2031).

3.3 Details of Distribution Network for RRWSS Under Study

Various infrastructure facilities for the distribution network in different RRWSS under study & its salient features are listed as under.

3.3.1 RRWSS Variav Group, Surat

In this scheme the main source of water river Tapi which is a perennial river. The water is drawn from the upstream of the weir at village Singanapore, constructed in 1995 on river Tapi to prevent sea water intrusion into the river and to create water body for ensuring safe water supply during lean periods. This weir has total storage capacity of 31 MCM which is found to be adequate to meet the water requirements of Surat city as well as surrounding villages.

An intake well of 8 meter inside diameter is constructed by sinking method, which is 15 meter deep from the river bed and a pump house of 12 meter diameter above it, is constructed. The intake well is jointed with embankment through 7.5 meter wide Mild Steel Approach Bridge. The intake well is ideally located in deep portion of the river so that due to high velocity of water weed growth can be avoided

Presently for the treatment of water 60 MLD water treatment plant is constructed and commissioned in the year 2003-04 (phase-I). The water treatment plant is consisting of conventional water treatment units such as pre aeration, flocculation, clarification, rapid sand filters and post chlorination units. During the visit, overall housekeeping and performance of the plant found satisfactory.

In this project many varieties of pipes are used. The details of pipes from main head work to various sub head works are listed as in Table 3.6

Table 3.6 List of Pipes Used in RRWSS Variav Group, Surat

Type of pipe	Pipe diameter in mm	Length in M
M.S. pipe	1626 mm Ø, 8 mm thick	12750
	1118 mm Ø, 7 mm thick	13100
	914 mm Ø, 6 mm thick	150
	813 mm Ø, 6 mm thick	4800
	711 mm Ø, 6 mm thick	1450
	660 mm Ø, 6mm thick	2600
	610 mm Ø, 6mm thick	2070
	559 mm Ø, 6mm thick	7730
GRP pipe	600 mm Ø, 6 Kg/Cm^2	9750
	500 mm Ø, 6 Kg/Cm^2	500
DI pipe- Class K – 7	500 mm Ø	4030
	450 mm Ø	4255
	400 mm Ø	3724
	350 mm Ø	11755
	300 mm Ø	16792
	250 mm Ø	13190
	200 mm Ø	14012
	150 mm Ø	4887
	100 mm Ø	14629
	80 mm Ø	3665
Total Length of pipe used = 0.24 M/Capita (2001 census) Ø = Diameter		

The total pipes used for this RRWSS consists of DI-64 km, BWSE-25 km, MS-28 km, GRP-6 km, and PVC-93 km. It is also noted that the GRP, PVC & HDPE pipes have 'C' value more than 150, reduce the cost of electricity in water conveyance.

It also noticed that near the slum area of Surat & Surroundings, people play with the Air relief valves and results in losses & thefts. Also, the ownership issues are common where the pipeline supplying water in many part of the Surat city area is of GWSSB and the roads and storm water drains are under Surat Municipal Corporation. This leads to the repairs and maintenance problems.

3.3.2 RRWSS Gadhada Group, Bhavnagar

Gadhada regional water supply scheme is covered under Mahi pipe line project. The main source is from Pariej and Kanewal tank in Kheda district. The tanks are filled from the Limbassi branch of the Mahi irrigation project. The pipe line alignment is from Pariej to Indrana – Wataman – Piply – Wadheda – Botad - Gadhada. About 275 MLD of water from this is reserved for the Saurashtra pipe line project. And the main source of this RRWSS is Saurashtra pipe line project.

The design capacity of water treatment plant is 1385 m^3/hour (22 hrs. of run) where as the actual quantity of water pumped in to the system was observed during field visit about 5.5 MLD i.e. 250 m^3/hour. It is also noted that the plant was constructed and commissioned in 2006-07 and most units are performing well & overall house- keeping is good.

The pumping machineries are installed for transmitting water as well as lifting water from sump or filtration plant to overhead tanks. Table 3.7 shows the details of pumping machineries.

Table 3.7 Details of Pumping Machinery in RRWSS Gadhada Group, Bhavnagar

	Location	Hours of pumping	Capacity in LPS	Head in M	H.P.
Gadhada	Gadhada HW	16	23	40	20
Adtala	Adtala HW	12	51	35	40
Holaya	Gadhada	16	22	50	25
	Holaya	12	50	35	40
	Bhimdad	12	11	30	7.5
Raliyana	Gadhada	16	49	30	35
	Raliyana	12	111	40	95
	Dhasa	12	26	30	20
Viravadi	Gadhada	16	35	70	55
	Viravadi	12	80	30	50
	Itariya	12	5	30	5

During the studies, in Holaya group working hours for two pumps are calculated (from 1/6/2007 to 10/6/2007) as average to 11.30 hours, whereas per the population of 2007, working hours required are 10 hours only. This shows that the actual running hours of pump are more than calculated running hours for the period.

During visit in the Raliyana group few problems of the impeller in the pump are noticed and the actual discharge received is 22 LPS instead of 41 LPS as per design.

Table 3.8 shows the overall storage capacity in the scheme.

Table 3.8 Detail of Storage Facility for Each Group of RRWSS Gadhada Group, Bhavnagar

Sr. No.	Name of Group	Sump Capacity Lac Litres	R.C.C. E.S.R. at Group Head Works	R.C.C. E.S.R. 12 m. Height at Village level	R.C.C. Elevated Cistern 5.0 m height at Village level
1	Holaya-13 Villages	10.00	5.0 Lacs Lit Cap. & 20.0 m Height	3 Nos.	10 Nos.
2	Viravadi-21 Villages	16.00	8.0 Lacs Lit Cap. & 20.0 m Height	9 Nos.	12 Nos.
3	Raliyana-24 Villages	20.00	12 Lacs Lit Cap. & 25.0 m. Height	6 Nos.	18 Nos.
4	Adtala-9 Villages	10.00	5.0 Lacs Lit Cap. & 22.0 m. Height	5 Nos.	4 Nos.

3.3.3 RRWSS Ishwaria Group, Amreli

Ishwaria group RRWSS was design for 15 years-Intermediate and 30 years- Ultimate life. This RRWSS group is also a part of the Saurashtra pipe line project and taps the water from it which is originating from the source river Mahi. Out of 49 villages as per design,

about 37 villages demanding about 7.36 MLD (Year 2007) are receiving the water.

The water treatment plant consists of all conventional units such as Alum storage tanks, Flocculation and Clarification units, Rapid Sand Filters and Chlorinators with a total capacity of 10 MLD, commissioned in Year 2004-05.

To pump raw water from clear water sump at water treatment plant, two numbers of 65 HP capacity (Discharge capacity-102 LPS & 36 M Head) are provided, out of which one operate at a time and another acts as stand by. Also, at 19 villages, 38 numbers of pumps with 10 HP capacities are provided to lift the water from underground sump to Elevated Service Reservoir. It is also noted during the visits, some of the pumps at various villages including Kedichand group & Haripura are under repairs for long time and water supply relies on single pump without any stand by.

A clear water sump and ESR facilities are provided at some villages, as shown in the Table 3.9. However, at certain villages the elevated cisterns are provided with the underground sumps.

Table 3.9 Sump & ESR facilities in RRWSS Ishwaria Group, Amreli

Name of sub head work	Sump / ESR	Capacity in Lac Litres
Near village Toda	Sump	2.0
	ESR	1.0, 19 m. height
Akala village	Sump	2.0
	ESR	1.0, 13 m. height
Lalavader	Sump	50,000 lit
	ESR	50,000 lit,12 m. height
Haripura	Sump	5.0
	ESR	2.0, 12 m. height
Vitthalpur	ESR	2.7, 18 m. height

3.3.4 RRWSS Mandvi Group, Kachchh

This RRWSS mainly consists of two head works namely Bidada and Madanpura. For lifting the water and supply in distribution network, 50 HP (37 KW) capacity with 75 M head & discharge capacity of 92 LPS pump is fitted at Bidada head works and 100 HP (75 KW) capacity with 108 M head & discharge capacity of 35 LPS pump is fitted at Madanpura head works. For the treatment of water based on river Narmada, water treatment plant was constructed and commissioned in the year 2004 with a design capacity of 410 m^3/hr. Six number of storage reservoirs were constructed in the various distribution zones as per the following Table 3.10. It is noted during the field visits that the total storage including these six storage reservoir (60%) is about the 90% of total water requirement.

Table 3.10 Details of Storage Reservoirs in RRWSS Mandvi Group, Kachchh

Sr. No.	Type of Storage	Capacity	Location
1.	Open RCC Sump	50 Lac Litres – 1 No.	At Bidada HW Site
2.	RCC Sump	30 Lac Litres – 1 No.	At Bidada HW Site
3.	RCC Sump	20 Lac Litres – 1 No.	At Madanpura HW Site
4.	RCC ESR	13 Lac Litres 12 M height –1 No.	At Bidada HW Site
5.	RCC ESR	3.57 Lac Litres 12 M. height –1 No.	At Bidada Village
6.	RCC ESR	10 Lac Litres 12 M height –1 No.	At Bhadai Moti Village
Total Storage Capacity		126.57 Lac Litres	

Further, it is also noticed that the water received through Narmada Pipe line NC -11 is received at Bidada head works and after treatment it is conveyed to Bidada and Bhadai zones through separate lines with Valves fitted on it. The overall distribution comprises of the following type of pipes. (Table 3.11)

Table 3.11 Details of Pipes Used in RRWSS Mandvi Group, Kachchh

Type of pipe	Size in mm	class	Length in M
DI pipe	400	K-9	700
	350	K-9	8700
	300	K-9	6000
	250	K-9	29550
	200	K-9	15700
PVC pipe	160	6 Kg / sq cm	13500
	140	6 Kg / sq cm	28800
	110	6 Kg / sq cm	19700
	90	6 Kg / sq cm	32500
Total Length of pipe used = 0.47 M/Capita (2001 census)			