CHAPTER VII

G R O U N D W A T E R

VII.1 INTRODUCTION

Very little geological and hydrogeological work is done on the northern coast of Saurashtra as compared to the coastal areas of the south. The northern coastline that runs practically in a east-west direction and is more indented consisting of creeks, nars and marked, with shoals and islands scattered in the off-shore zone. The rainfall which is the main source for recharge of groundwater is very scanty.

Groundwater along the coast is saline and unpotable and people have to depend on surface water collected in the reservoirs. The rivers flowing through the study area originate in the central hilly part of Saurashtra. Their lengths are short, and they are ephemeral, posing serious problems of fresh water supply in the dry season. Water wells especially along the western coast are very deep and contain insignificant quantity of water, and majority of them get dry in the summer.

The streams and rivers originating in the southern hilly region and draining the northern slopes empty their water in the Gulf of Kutch. They form 18 stream basins, but only in the large rivers like Sasoi and Ghi, their middle sections contain water even in the summer, the rest of the portions of these rivers usually remaining dry.

The area receives small rainfall, and it varies towards west from 500mm in the east to 200 mm in the west. The number of rainy days also decrease from east to west (Jamnagar 14 days, Dwarka 12 days/year).

VII.2 HYDROLOGICAL CONDITIONS

The trap is weathered and less compact near the surface. Amygdules, joints and mechanical weathering of the trap allows the surface water to percolate. In trap the water table is met at the depth of 10-12 m from the surface in the hilly terrain and in the gently sloping region at the depth of 5-10 m which become shallow near the coastal plain, with 3-5 m depth (Fig. VII.1). Average recharge of the area is 19.8×10^7 cu m while the discharge rate is 13.7×10^7 cu m per year. This water is available through dug wells and tube wells from joints, cracks, crevices and interconnected vesicles. On the basis of 1976 observations net groundwater potential of the trap area is about 72936 Ac ft/year out of which 17505 Ac ft/year is available from the hilly terrain, 35155 Ac ft/year from the gently sloping area and 20276 Ac ft/year from the coastal plain of about 10-15 km wide. These values vary depending upon the recharge which in turn depends on the rainfall in the area (Table VII.1)

Around Jamnagar where industries have rapidly come up, the demand for fresh water has almost exceeded the total recharge, and this problem may become quite acute in near future.

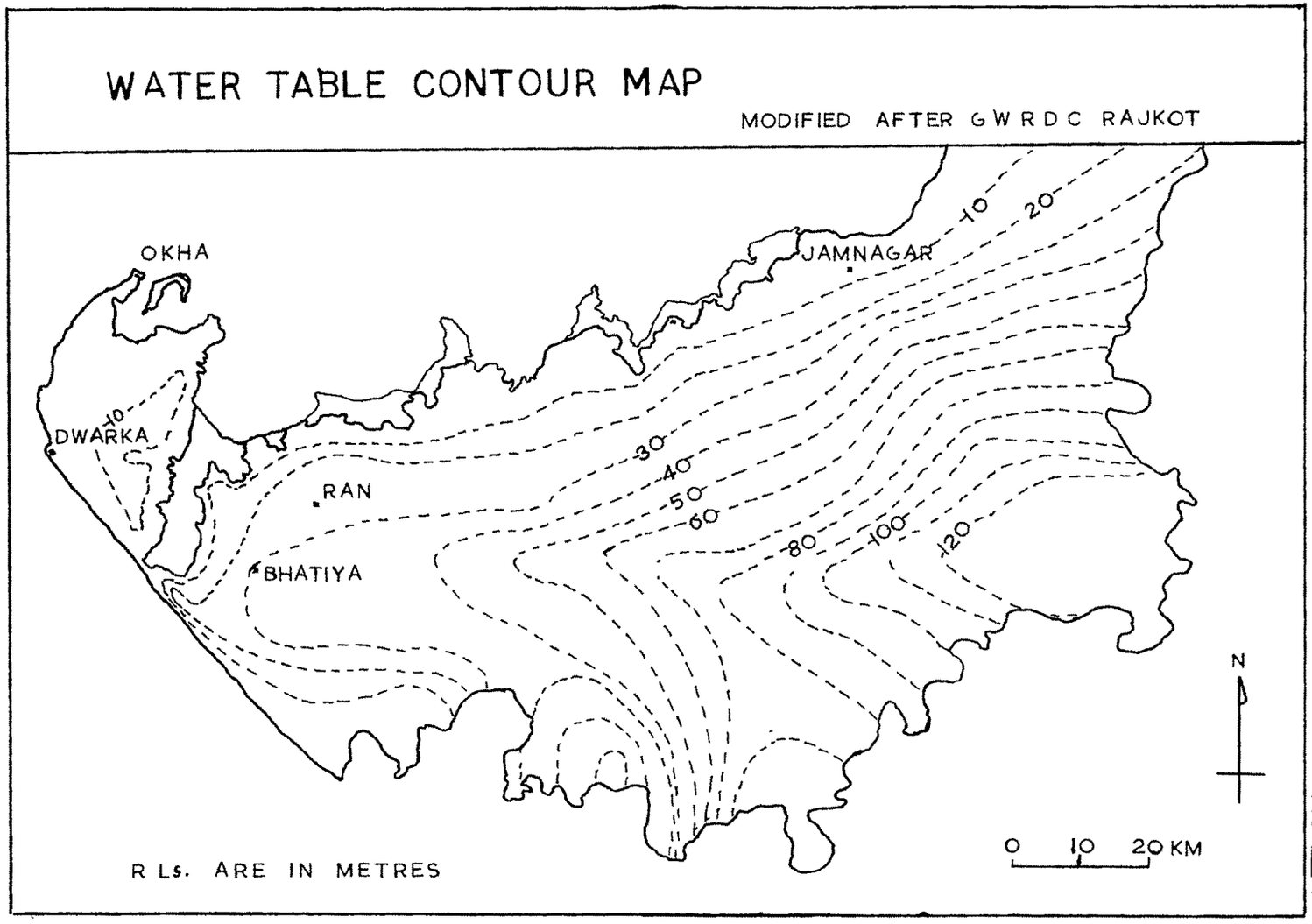
WATER TABLE CONTOUR MAP
MODIFIED AFTER G W R D C RAJKOT
OKHA
JAMNAGAR
DWARKA
RAN
BHATIYA
10
20
30
40
50
60
80
100
120
N
0 10 20 KM
R Ls. ARE IN METRES

FIG. VIII

Table No. VII.1 : Talukawise groundwater potential based on 1976 observations.

Sr. No.	Taluka	Average rain-fall mm	Geogra-phical area in acres	Saline area acres	Fresh water area acres	Total recharge Ac.ft. /year	Total draft Ac.ft. /year	Net G.W. potential Ac.ft./ year
1.	Kalvad	520.7	307512	Nil	307512	64068	57676	6392
2.	Jamjodhpur	584.2	267900	Nil	267900	60966	48096	12870
3.	Bhanvad	520.7	180866	Nil	180866	37745	34236	3509
4.	Lalpur	520.7	265709	11298	254411	48418	24781	23637
5.	Khambaliya	520.7	299887	38698	261189	47921	16509	31412
6.	Kalyanpur	520.7	348975	165613	183362	39418	40471	-1053
7.	Dhrol	520.7	140755	36000	104755	21450	17774	3676
8.	Jodiya	406.4	214640	160248	54392	8704	7263	1441
9.	Jamnagar	520.7	302984	38927	264057	57856	63738	-5882
10.	Okha Mandal	317.5	177078	130275	46803	5283	3287	1976

Groundwater conditions of Okha Mandal Block are somewhat different. Here the rocks are limestones with wide joints, solution cavities, solution openings, caverns and galleries and these provide the sites for groundwater accumulation. In this part of the area, the water table depth varies between 7 to 10 m. The total recharge of the area is about 5283 Ac ft/year and discharge about 3287 Ac ft/year (based on 1976 observations) excluding industrial requirement. The industrial requirement is much more than the potentiality of groundwater in this block, and to get sufficient freshwater numerous bore holes have been drilled. This has caused excess pumping resulting into sea water ingress along the coastal areas. This progressive decrease in the quality and potential of sweet water due to salt water contamination, has to be checked otherwise in very near future serious water supply problem will arise in the Okha Mandal Block. Some efforts have already been made to store fresh water and improve the recharge by surface storage of rainfall. Since last few years, construction of reservoirs have critically fullfilled their requirements.

The ISO-TDS map (Fig. VII.1) indicate that their values are gradually increasing towards the coast (Table Nos. VII.2 and VII.3).

FIG VII 2

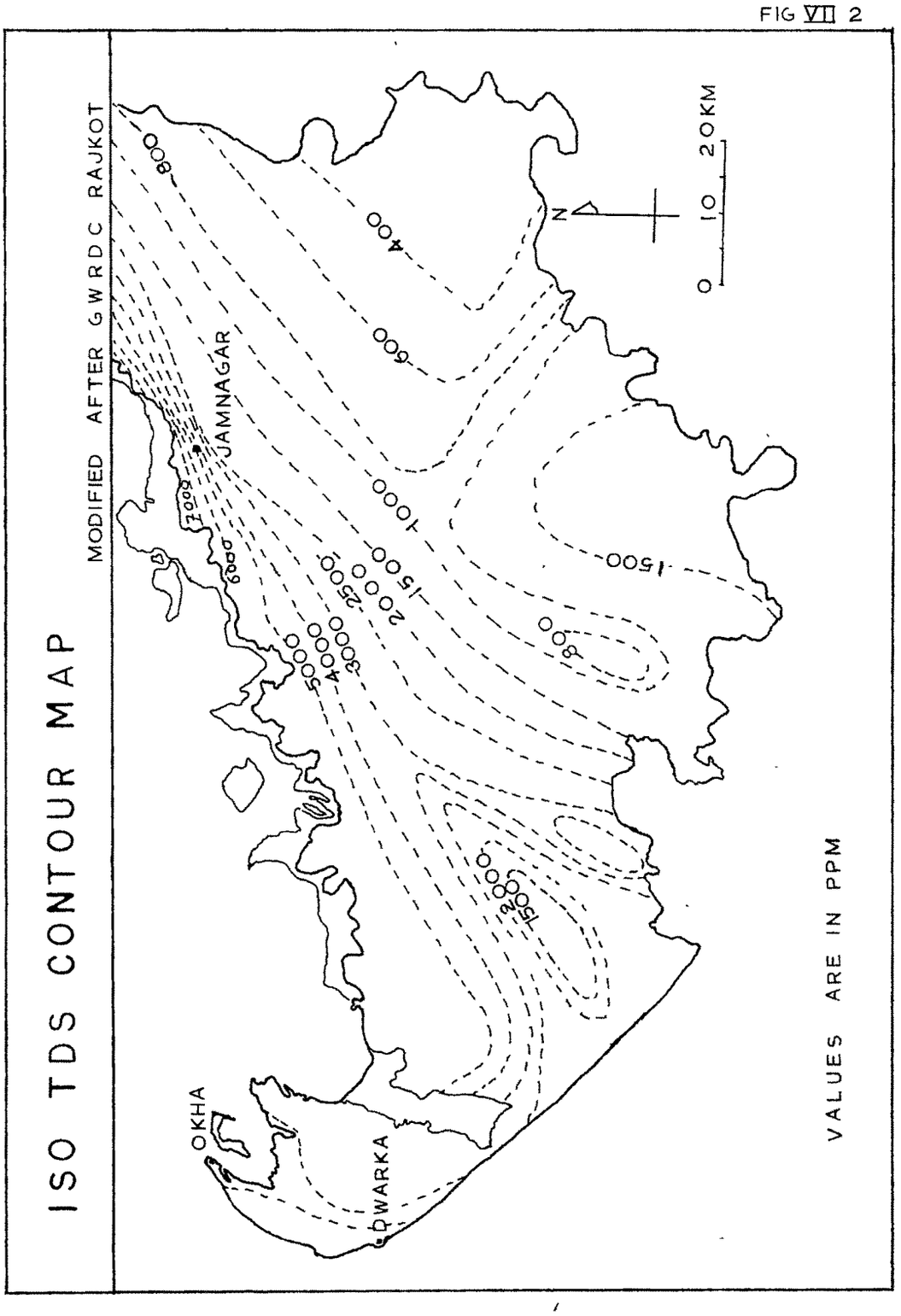
ISO TDS CONTOUR MAP
MODIFIED AFTER GWRDC RAJKOT
JAMNAGAR
OKHA
DWARKA
800
400
600
1000
1500
2000
2500
3000
4000
5000
7000
8000
N
0 10 20KM
VALUES ARE IN PPM

Table No. VII.2 : Well test data January 1976

Sr. No.	Well location	Static water level (meter)	pH	Electric conductivity 10^{-6}	TDS ppm	Chloride content ppm
1.	Dhrol	6.35	7.6	896	560	80
2.	Jodiya	4.95	7.6	7634	4840	2720
3.	Jamnagar	6.8	7.4	1793	1120	384
4.	Sikka	4.1	7.6	7062	4420	2160
5.	Mungani	-	-	-	-	-
6.	Rampar	-	-	-	-	-
7.	Kalvad	2.6	8.0	2017	1260	336
8.	Jam Jodhpur	9.0	7.4	2914	1820	360
9.	Kalyanpur	5.2	7.8	1569	980	240
10.	Modpur	5.4	8.0	1345	960	224
11.	Gunda	-	-	-	-	-
12.	Khambhaliya	4.9	7.8	3517	2240	1280
13.	Bhatia	8.1	7.6	3811	2380	960
14.	Dwarka	4.8	7.6	4414	2800	1120
15.	Kuranga	-	-	-	-	-
16.	Goinj	5.6	7.6	6165	3860	1200
17.	Rawal	5.35	7.8	4822	3020	1600
18.	Bamangam	17.5	7.8	1121	700	88
19.	Okha	2.8	8.0	2802	2000	720
20.	Lalpur	5.1	7.4	2345	840	160
21.	Tin Patiya	6.35	8.0	672	420	80
22.	Toda	3.9	7.8	896	560	104

Table No. VII.3 : Well test data June 1976

Sr. No.	Well Location	Static water level (M)	pH	E.C. 10^{-6}	TDS ppm	Chloride content ppm
1.	Dhrol	7.8	7.6	1121	700	120
2.	Jodiya.	5.9	7.8	6389	7000	3800
3.	Jamnagar	7.7	7.4	2802	1740	488
4.	Sikka	4.8	7.6	9080	5680	2400
5.	Mungani	-	-	-	-	-
6.	Rampar	-	-	-	-	-
7.	Kalvad	2.8	7.8	672	420	72
8.	Jam Jodhpur	11.8	7.4	3138	1960	560
9.	Kalyanpur	8.85	7.6	1457	920	144
10.	Modpur	5.5	7.4	1793	1120	208
11.	Gunda	-	-	-	-	-
12.	Khambhaliya	6.9	7.6	4822	3000	1000
13.	Bhatia	8.1	7.6	7174	4480	1600
14.	Dwarka	4.7	7.8	4934	3060	1360
15.	Kuranga	4.4	7.8	4035	2520	800
16.	Goinj	6.7	8.0	8631	5400	1800
17.	Rawal	7.3	7.4	6053	3780	160
18.	Bamangam	6.4	7.8	560	340	80
19.	Okha	2.9	7.8	4593	2880	960
20.	Lalpur	7.6	8.2	1345	840	184
21.	Tin Patiya	9.5	7.8	1008	640	88
22.	Toda	-	-	-	-	-

The drainage density is high in the Deccan trap area as compared to that in the limestone area. In the former area, a number of rivers are dammed and surface water is made available. But the dams are uncommon in the limestone area.

VII.3 FUTURE DEVELOPMENT

Considering the rapidly growing water requirements for this part of Saurashtra, it is most essential that the existing groundwater resources are properly harnessed. The rainfall and geology are not very favourable, and as such one cannot hope to have unlimited supply of sweet water for industrial, agricultural and domestic purposes. The entire planning and future programming of groundwater development has to keep in mind the following aspects :

1) A systematic search for new sources in trap areas. The author, on the basis of the available data as well as his own studies would suggest following localities in the trap, where the water table contours are close to the surface for intensive groundwater search :

1)Area south of Jamnagar upto Pipartoda (10 km south of Ranjit sagar).

2) North of Sasoi Reservoir and Puna reservoir upto coastline

3) North of Ghi Dam, near Khambhaliya

4) Area around Pindara, Mewasa, Ran, Datrana, Bhatia, Kenedi, Gokalpar, Ranjitpur etc.

2)In the limestone country the problem is rather complex as the rainfall is less and recharge is accordingly less. Demand for ground water is more, therefore discharge is also more. Hence there is less scope for development of groundwater in this terrain. It is therefore advisable to tap all surface water. Sources of surface fresh water should be harnessed by constructing small dams on the rivers wherever feasible. These artificial reserviors will help to replenish the groundwater also.

Further, a very disciplined and judicious utilisation of the meagre groundwater supply should be embarked upon. It is most essential that not only the limited supply of sweet water is put to maximum use, but also the quality of the available water is preserved by prevailing the sea water ingress.