CHAPTER VII

H Y D R O G E O L O G Y

Water resources of Gujarat include both surface and subsurface water. The annual rainfall in the Saurashtra Peninsula normally varies from 400 to 700 mm. The rivers which become dry during low rainfall are flooded during heavy rains. Ground water resources of the study area form parts of the Gondwana Sedimentary and Deccan Trap Ground-water Provinces of Saurashtra Peninsula.

SURFACE WATER

It is available from ponds, swamps and rivers. Four major rivers of this area are the Machhu, the Maha, the Bhogavo-I and the Balal. Except the Balal, all rivers originate from the Chotila hills south of this area. The Machhu river and the Maha river flow towards the western boundary and the Bhogavo-I river flows towards the eastern boundary of this area. All these rivers are seasonal and influent. At a distance of 3 km SE of Jodhpur, a NW-SE dyke cuts across the Machhu river which forms a barrier giving rise to natural reservoir for surface water (Plate VII.1)

PLATE NO.VII.1

Deccan trap dyke cutting across the
Machhu river, SE of Jodhpur.

SUBSURFACE WATER

It is available from openwells dug-cum-borewells, and tubewells. Twentynine openwells near augerbore sites, 2 dug-cum borewells, near Vagadia and Bhasol (Kanpar) and 2 tubewells near Than and Sayla were observed. In the Gondwana Sedimentary Province, groundwater is located in the bed rock aquifers. The sandstones of Than Formation and Surajdeval Formation of lower and Middle Dhrangadhra Group are moderately permeable. In the zone of saturation these sandstones are the most productive aquifers (Fig. VII.1A), and the intercalated shale and coalseam are aquicludes. The movement of groundwater is controlled by the pore spaces, joints and bedding planes. The depth of water level in openwells varies from 3 to 15 m from the surfaces during dry season. The position of aquifers and aquicludes in the typical well sections NNE of Songadh and west of Shekhardi are as follows:

West of Shekhardi	Soil	
	Murrum	(Aquifer)
	Siltstone or Red Shale	(Aquiclude)
	Ferruginous sandstone	(Aquifer)
NNE of Songadh	Soil	
	Ferruginous sandstone	(Aquifer)
	Grey shale Coalseam Black shale	(Aquiclude)
	Sandstone	(Aquifer)

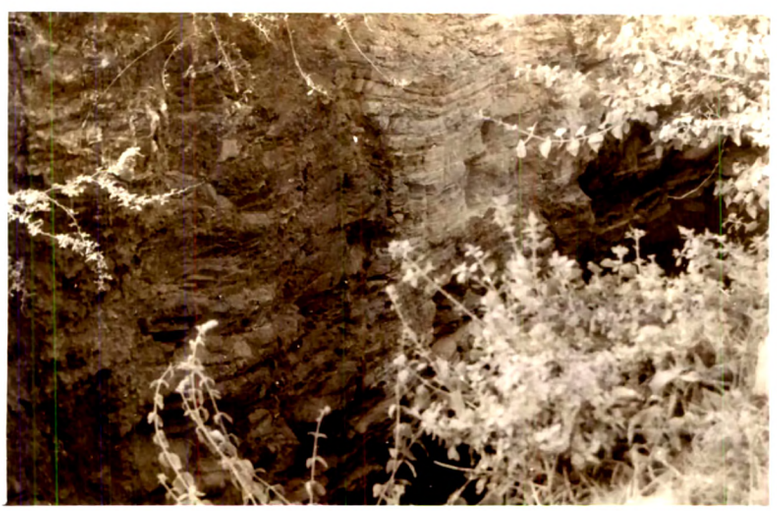
Dykes cut across the sandstone of Dhrangadhra Group at many places in this area. They act as barriers for ground water movement (Plates VII.2, VII.3, VII.4). Many openwells are located in these sandstones near the contact of dykes (Fig. VII.1B) e.g. SW of Aya Deriwala ($41\frac{N}{2 \& 6}$ E3/4), SW of Sarla ($41\frac{N}{2 \& 6}$ E1/1) and S of Shekhardi ($41\frac{N}{2 \& 6}$ A3/1).

In the Deccan Trap Province, the groundwater is located in the bedrock aquifer. Basaltic lavaflows are flat lying covering the rocks of Dhrangadhra and Wadhwan Groups. The groundwater is available in the weathered Trap or in the joints and openings in the Trap, enlarged by wealthering (Fig. VII.2) e.g. near Jodhpur ($41\frac{N}{2 \& 6}$ A3/2), Sadharka ($41\frac{N}{2 \& 6}$ A2/2), Gosal ($41\frac{N}{2 \& 6}$ E3/5) and Sayla ($41\frac{N}{2 \& 6}$ F3/4).

GROUNDWATER CONDITIONS

The groundwater study was carried out by taking observations of openwells in this area. The location, and the static water levels of the openwells are shown in well inventary chart (Table VII.1). The locations and depth to water levels of all observed openwells are shown on Map VII.1. The controus of depth to water level at 5 m intervals from the ground surface were drawn on the basis of static level in each openwell. The area between these contours are indicated by different colours (Map VII.1).

PLATE NO. VII.2

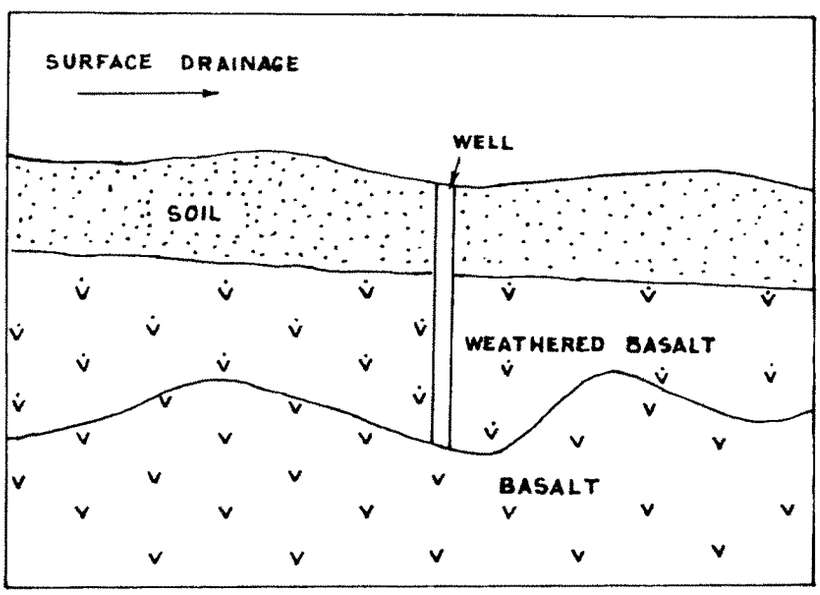


Contact between Deccan trap dyke and Dhrangadhra sandstone near Daldi.

PLATE NO. VII.3

Contact between Deccan trap dyke and Dhrangadhra Sandstone near Dholia.

PLATE NO. VII.4 Contact between Dhrangadhra sandstone and Deccan trap dyke, S of Navagam.



OCCURRENCE OF GROUNDWATER IN DECCAN TRAP PROVINCE

TABLE VII.1

FIELD OBSERVATIONS WELL INVENTORY CHART

Sr. No.	International number		Well Location	Taluka	District	Static water level depth (meters) in open wells
1	$41\frac{N}{2\ \&\ 6}$	A1/1	SE of Makhtanpur	Wankaner	Rajkot	6.00
2	$41\frac{N}{2\ \&\ 6}$	A2/1	S of Jali	"	"	11.00
3	$41\frac{N}{2\ \&\ 6}$	A2/2	S of Sadharka	"	"	11.50
4	$41\frac{N}{2\ \&\ 6}$	A3/1	SW of Shekhardi	"	"	7.90
5	$41\frac{N}{2\ \&\ 6}$	A3/2	NE of Jodhpur	"	"	3.90
6	$41\frac{N}{2\ \&\ 6}$	B1/1	SE of Rajgad	"	"	11.00
7	$41\frac{N}{2\ \&\ 6}$	B1/2	NE of Chitarkhada	"	"	8.00
8	$41\frac{N}{2\ \&\ 6}$	B2/1	SE of Lunsar	"	"	8.10
9	$41\frac{N}{2\ \&\ 6}$	B2/2	N of Sarsana	Chotila	Surendranagar	10.00

contd...

TABLE VII.1 (contd.)

1	2		3	4	5	6
10	$41\frac{N}{2\ \&\ 6}$	B3/1	S of Hirana	Chotila	Surendranagar	4.70
11	$41\frac{N}{2\ \&\ 6}$	B3/2	N of Pandal(Vinaygadh)	Wankaner	Rajkot	4.00
12	$41\frac{N}{2\ \&\ 6}$	C1/1	SE of Sagadhra	Muli	Surendranagar	7.50
13	$41\frac{N}{2\ \&\ 6}$	C1/2	N of Ranipat	"	"	11.00
14	$41\frac{N}{2\ \&\ 6}$	C2/1	N of Tarnetar	Chotila	"	11.20
15	$41\frac{N}{2\ \&\ 6}$	C2/2	N of Songadh	"	"	8.00
16	$41\frac{N}{2\ \&\ 6}$	C3/1	W of Than	"	"	5.00
17	$41\frac{N}{2\ \&\ 6}$	C3/2	SW of Than (Tubewell)	"	"	6.50
18	$41\frac{N}{2\ \&\ 6}$	C3/3	S of Waori	"	"	6.00
19	$41\frac{N}{2\ \&\ 6}$	D1/1	S of Khampalia	Muli	"	9.50

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TABLE VII.1 (contd.)

1	2		3	4	5	6
20	$41\frac{N}{2\ \&\ 6}$	D2/1	S of Dholia	Muli	Surendranagar	9.50
21	$41\frac{N}{2\ \&\ 6}$	D2/2	S of Vagadia	"	"	16.00
22	$41\frac{N}{2\ \&\ 6}$	D3/1	W of Aya Dagdagia	Sayla	"	8.00
23	$41\frac{N}{2\ \&\ 6}$	D3/2	NW of Dharadungri	"	"	7.00
24	$41\frac{N}{2\ \&\ 6}$	E1/1	SW of Sarla	Muli	"	9.50
25	$41\frac{N}{2\ \&\ 6}$	E1/2	NW of Khatdi	"	"	8.50
26	$41\frac{N}{2\ \&\ 6}$	E2/1	S of Palsan	"	"	9.00
27	$41\frac{N}{2\ \&\ 6}$	E3/1	SE of Chorvira	Sayla	"	9.00
28	$41\frac{N}{2\ \&\ 6}$	E3/2	W of Bhaduka (Opp. to river from Bhaduka)	"	"	8.00
29	$41\frac{N}{2\ \&\ 6}$	E3/3	N of Vanalia	"	"	15.00

contd...

TABLE VII.1 (contd.)

1	2		3	4	5	6
30	$41\frac{N}{2 \& 6}$	E3/4	SW of Aya Deriwala	Sayla	Surendranagar	6.00
31	$41\frac{N}{2 \& 6}$	E3/5	W of Gosal	"	"	9.00
32	$41\frac{N}{2 \& 6}$	F1/1	W of Naika	Muli	"	3.00
33	$41\frac{N}{2 \& 6}$	F2/1	NW of Muli	"	"	8.70
34	$41\frac{N}{2 \& 6}$	F2/2	N of Muli	"	"	4.00
35	$41\frac{N}{2 \& 6}$	F2/3	N of Sidsar	"	"	10.00
36	$41\frac{N}{2 \& 6}$	F3/1	S of Sidsar	"	"	8.00
37	$41\frac{N}{2 \& 6}$	F3/2	S of Nava Sudamda	Sayla	"	6.00
38	$41\frac{N}{2 \& 6}$	F3/3	W of Sayla (Tube well)	"	"	9.00
39	$41\frac{N}{2 \& 6}$	F3/4	S of Sayla	"	"	9.00

PROBABLE RECHARGE

The rain water and surface water from reservoirs are the two main sources for the recharge of the groundwater in the study area. The area receives annual rainfall between 450 to 550 mm. The seepage of surface water, stored in the reservoirs, recharges the groundwater. The salient features of the two major irrigation schemes in this area are given in the following table:

Salient Features	Jalsikka Dam (Machhu-I dam)	Naika Dam
River	Machhu	Bhogavo-I
Location	SSE of Jodhpur	NE of Muli
Taluka	Wankaner	Muli
District	Rajkot	Surendranagar
Construction completed	1960-1961	1968-1969
Capacity	2570 mcft	641 mcft
PRL	444 mcft	324 mcft
Length	3090 feet	8800 feet
Max. height	90 feet	50 feet
Cultivation area	16,700 acres	8000 acres

Another minor irrigation scheme on the Balal river south of Ranipat is under construction. This stored water may be utilized to irrigate the Khakhrathal and Tarnetar areas. The height of earthen dam when completed will be 3 m.