Annexure-2.1

Nomenclature and Characteristic of Soils in the Study Area.

(After NBSS & LUP, 1994)

Map Symbol	Description	Taxonomy
027	Very deep, well drained, fine loamy, soils on gently slopping quartzitic, folded ridges and furrows with sever erosion; associated with very deep, well drained, calcareous, fine loamy soils on very gently slopping lands with moderate erosion.	Fineloamy, mixed hyperthermic fluventic ustochrepts Fine loamy, mixed (calc) hyperthermic, typic, ustocherpts.
037	Shallow, well drained, clayey soils on moderately slopimg basaltic hills and ridges with severe erosion & moderate stoniness assocciated with shallow, well drained, loamy soils with severe erosion & moderate stoniness.	Clayey, mixed hyperthermic lithic Ustochreprts Fine mixed, hyperthermic vertic Ustochrepts
038	Shallow, well drained, clayey soils on gently sloping basaltic hills and ridges with severe erosional & moderately deep, well drained, fine soils on very gently sloping lands with moderate erosion.	Clayey, mixed, hyperthermic lithic Ustochrepts Fine mixed, hyperthermic vertic Ustochrepts
041	Moderately shallow, well drained, fine soils on very gently sloping basaltic hills & ridges with severe erosion and moderate stoniness, associated with very shallow, somewhat excessively drained loamy soils with severe erosion & moderate stoniness.	Fine, mixed, hyperthermic vertic Ustochrepts Loamy, mixed hyperthermic lithic Ustorthents
042	Rocks outcrops, associated with shallow well drained, loamy-skeletal soils on moderately steep sloping basaltic hills & ridges with severe erosion & moderate stoniness	Rocky outcrops loamy-skeletal, mixed, hyperthermic lithic ustorthents
058	Moderately deep, well drained, fine soils on very gently sloping granitic interfluves with moderate erosion, associated with deep, well drained, fine soils with slight erosion.	Fine, mixed, hyperthermic fluventic Ustochrepts Fine, mixed, hyperthermic Udic Ustochrepts
060	Shallow, well drained, clayey soils on gently sloping basaltic interfluves with moderate erosion, associated with moderately deep, well drained, fine soils on very sloping lands with moderate erosion.	Clayey, mixed, hyperthermic fluventic Ustochrepts Fine, mixed, hyperthermic Udic Ustochrepts
061	Very deep, well, drained, fine soil on very gently sloping quartzitic interfluves with moderate erosion associated with deep, well drained, calcareous fine loamy soils with slight erosion.	Fine, mixed, hyperthermic Udic, Ustochrepts Fine-loamy mixed (calcareous), hyperthermic Fluventic Ustochrepts

Map Symbol	Description	Taxonomy
063	Moderately deep, well drained, fine soils on very gently sloping basaltic interfluves with moderate erosion, associated with moderately deep, moderately well drained, fine soils with moderate erosion.	Fine, mixed, hyperthermic Udic, Ustochrepts Fine, montmorillonitic hyperthermic typic Chromusterts
067	Very deep, well drained, fine soils on very gently sloping basaltic interfluves with moderate erosion; associated with shallow, well drained, loamy soils with moderate erosion.	Fine, mixed, hyperthermic vertic Ustochrepts loamy, mixed, hyperthermic lithic Ustochrepts
070	Very deep, well drained, fine soils on nearly level basaltic interfluves with slight erosion, associated with very deep, well drained calcareous fine soils on gently sloping lands with slight erosion.	Fine montmorillonitic, isohyperthermic Typic chromusterts Fine, montmorillonitic (calcareous) isohyperthermic Vertic Ustropepts
075	Very deep, well drained, calcareous caorse-loamy soils on very gently sloping dissected plains very severe erosion; associated with very deep, well drained, calcareous fine loamy soils with moderate erosion.	Coarse loamy, mixed (calcareous), hyperthermic Typic Ustifluvents Fine-loamy, mixed), hyperthermic fluventic Ustochrepts
077	Very deep, well drained, calcareous, coarse-loamy soils on very gently sloping dissected flood plains with very severe erosion; association with very deep, well drained, calcareous, fine-loamy soils with severe erosion.	Coarse-loamy, mixed (calcareous) hyperthermic Typic Ustifluvents Fine loamy, mixed (calcareous) hyperthermic fluventic Ustochrepts
104	Deep, well drained, calcareous, fine soils on very gently sloping alluvial plains with slightly erosion & slighlty alksline, associated with very deep, imperfectly drained, calcareous, fine loamy soils with slightly erosion.	Fine, mixed (calcareous) hyperthermic, Fluventic Ustochrepts Fine-loamy, mixed (calcareous) hyperthermic, Udic Ustochrepts
105	Very deep, well drained, calcareous, fine loamy soils on gently sloping alluvial plain with moderate erosion; associated with deep, well drained, calcareous, fine-loamy soils on very gently sloping lands with moderate erosion.	Fine-loamy, mixed (calcareous), hyperthermic fluventic Ustochrepts Fine loamy, mixed (calcareous), hyperthermic Udic Ustochrepts
109	Very deep, well drained, fine loamy soils on very gently sloping alluvial plain with slight erosion, associated with very deep, well drained, fine soils on nearly level sands with slight erosion.	Fine-loamy, mixed, hyperthermic fluventic Ustochrepts Fine, mixed, hyperthermic, fluventic Ustochrepts

Map Symbol	Description	Taxonomy
114	Moderately deep, well drained, calcareous, fine soils on nearly level alluvial plain with slight erosion and slight salinity; associated with deep, moderately well drained, calcareous, fine soils with slight erosion	Fine, montmorillonitic (calcareous), hyperthermic, Vertic Ustochrepts Fine, montmorillonitic (calcareous), hyperthermic Typic Chromusterts
121	Very deep, moderately well drained, calcareous fine soils on very gently sloping alluvial plain with slight erosion; associated with very deep, moderately well drained, fine soils with slight erosion.	Fine, montmorillonitic (calcareous), hyperthermic, Typic chromusterts Fine, montmorillonitic hyperthermic Typic Chromusterts
122	Very deep, moderately well drained, calcareous fine soils on very gently sloping alluvial plain with slight erosion & moderate salinity; associated with very deep, moderately well drained, calcareous, fine soils with moderate erosion.	Fine, montmorillonitic (calcareous), hyperthermic, Typic chromusterts Fine, montmorillonitic (calcareous),hyperthermic Udic Chromusterts
127	Very deep, moderately well drained, fine soils on very gently sloping alluvial plain with moderate erosion; associated with very deep, moderately well drained fine soils on nearly level lands with slight erosion.	Fine, montmorillionitic, hyperthermic, Typic chromusterts Fine, montmorillonitic hyperthermic Vertic Ustochrepts
128	Very deep, moderately well drained, fine soils on nearly level alluvial plain with slight erosion; associated with very deep, moderately well drained, calcareous fine soils on gently sloping land with severe erosion.	Fine, montmorillionitic, hyperthermic, Typic Chromusterts Fine, montmorillonitic (calcareous) hyperthermic Typic Chromusterts
131	Very deep, moderately well drained, fine soils on very gently sloping alluvail plain with moderate erosion & moderate salinity; associated with very deep, moderately well drained calcareous, fine soils with moderate erosion.	Fine, montmorillonitic, hyperthermic Typic Chromusterts Fine, montmorillonitic (calcareous), hyperthermic Udic Chromusterts
135	Very deep, moderately well drained, calcareous, very fine soils on very gently sloping alluvial plain with slight erosion & moderate salinity; associated with very deep, moderately well drained, calcareous fine soils with slight erosion & slight salinity.	Very-fine, montmorillonitic (calcareous), hyperthermic Typic Chromusterts Fine, montmorillonitic (calcareous) hyperthermic Vertic Ustochrepts
137	Very deep, moderately well drained, very fine soils on very gently sloping alluvial plain with moderate erosion ; associated with very deep, moderately well drained, calcareous fine soils with slight erosion.	Very-fine, montmorillonitic, hyperthermic Typic Chromusterts Fine, montmorillonitic (calcareous) hyperthermic Tyic Chromusterts

Map Symbol	Description	Taxonomy
139	Very deep, moderately well drained, very fine soils on nearly level alluvial plain with slight erosion & slight salinity; associated with very deep, moderately well drained, calcareous, very fine soils with slight erosion.	Very-fine, montmorillonitic, hyperthermic Typic Chromusterts Very-Fine, montmorillonitic (calcareous) hyperthermic Udic Chromusterts
116	Moderately shallow, well drained, calcareous fine soils on very gently sloping alluvial plain with slight erosion & moderately well drained, calcareous, fine soils with moderate erosion	Fine montmorillonitic (calcareous), hyperthermic vertic Ustochrepts Fine montmorillonitic (calcareous) hyperthermic Typic Chromusterts
252	Moderately shallow well drained, calcareous fine soils on very gently sloping piedmont plains (with narrow valleys) with slight erosion & slight salinity; associated with moderately shallow, well drained, calcareous, fine soils with slight erosion and slight salinity	Fine montmorillonitic (calcareous), hyperthermic Vertic Ustochrepts Fine montmorillonitic (calcareous) hyperthermic Typic Chromusterts

Annexure-4.1

Detailed physical and chemical analysis of pre monsoon 2002 water samples.

Taluka	Village	Well Type	Temp. °C	Well Depth 'm'	pH	EC (µS/cm)	TDS (mg/l)	Na (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Total Hardness as $CaCO_3$ mg/l	Calcium Hardness as $CaCO_3$ mg/l	Magnesium Hardness as $CaCO_3$ mg/l	Alkalinity HCO_3 (mg/l)	Chloride (mg/l)	Sulphate (mg/l)
Jambusar	Sindhav	BW	28.2	18	8.51	2550	1124	462.3	38.6	3.1	32	109	96	13	338	300	800
	Bhadkodara	BW	27.8	--	8.28	849	420	69.3	21	45	5.1	238	52	186	188	100	500
	Kora	BW	28.1	18	8.31	3560	1618	621.2	53.8	1.9	81.8	142	134	8	130	950	810
	Kora	HP	28.2	18	8.20	2580	1268	444.6	49.9	2.4	29.3	134	125	10	164	450	294
	Dabha	BW	28	35	8.32	3400	1400	504.6	38.6	1.1	2.0	101	96	4	178	450	720
Amod	Machhasara	BW	28.1	14	7.74	10400	5150	895.4	310.6	460	51.1	2667	776	1891	180	679	2640
	Dora	BW	28.1	91	8.10	4210	1940	357.1	90.2	73	5.6	525	225	300	152	850	730
	Dora	HP	28	--	8.04	6090	2762	334.9	77.5	254	1.9	1239	194	1045	198	65	340
Vagra	Keshwan	BW	28.1	--	8.07	13500	9542	2699	370.6	46	13.1	1113	925	188	300	3799	5600
	Mosam	BW	28.2	45	7.96	8450	4260	1060.4	224.6	185	11.9	1323	561	762	166	2349	1250
	Kothia	HP	28.4	--	7.88	10900	5010	1544	264.6	136	51.2	1220	661	559	176	800	5100
	Vilayat	BW	28.3	--	8.31	3440	1774	479.7	43.5	65	2.8	378	109	269	274	700	850
Bharuch	Manad	BW	28.5	--	8.10	4070	2542	480.8	52.7	136	30.6	693	132	561	120	900	1000
	Sarnar	BW	28.5	39	8.24	8590	4170	1194.6	115.5	175	17.1	1008	288	720	72.0	2549	800
	Vasdada	BW	28.6	33	7.93	6010	3532	967.2	84.6	173	48.8	924	211	713	128	1699	2050
	Paguthan	HP	28.6	--	8.21	1380	695	154	21.7	63	1.0	315	54	261	144	150	50
Padra	Masar	BW	28.6	--	8.07	8300	4150	619	56.3	88	60.5	504	141	363	236	700	1400
	Ambada	BW	28.8	--	8.87	1570	744	243.3	29.2	54	2.2	294	73	221	348	250	400
	Ambada	HP	28.9	--	8.23	3260	1674	635.4	52.8	31	2.4	258	132	126	258	450	1000
	Darapor	BW	28.7	98	7.91	2350	1622	1206.6	35.1	55	1.9	315	88	227	728	250	100
	Darapor	HP	28.5	--	8.43	2040	1076	445.8	28.1	71	2.3	363	70	293	268	150	350
Vadodara	Asoj	BW	28.7	61	8.11	1390	714	100.9	35.4	55	6.5	315	88	227	92.0	250	420
	Asoj	HP	28.4	61	8.19	1150	796	141.6	28.3	34	60.9	210	71	139	192	100	280
	Makarpura	BW	28.5	--	8.12	1660	1128	137.2	23	98	0.8	462	57	405	230	150	940
	Ankhi	BW	28.5	80	8.19	2430	1174	496.8	43.7	138	2.7	676	109	566	146	350	1660
Karjan	Kiya	BW	28.5	42	8.01	2260	1190	314.9	36.3	39	3.6	252	91	161	94.0	500	700
	Karamadi	BW	28.5	76	8.21	2250	928	399.8	56.8	44	3.9	324	142	182	72.0	850	1480
Savli	Gothada	BW	27.8	36	7.97	1650	758	96	21	92	0.6	431	52	378	102	200	640
	Gothada	HP	27.7	--	7.61	3100	1570	187.9	39.4	206	21.3	945	98	847	38.0	450	1480
	Manjusar	BW	28.4	61	8.10	1690	804	350.2	36.1	0.5	1.9	92	90	2	152	150	640
	Manjusar	HP	28.3	55	8.15	1820	874	390.9	36.6	47	2.5	284	91	192	192	150	660
	Moti Bhadol	BW	27.7	73	8.12	2140	1110	105	21	106	0.7	487	52	435	94.0	250	660
	Moti Bhadol	HP	27.8	--	8.02	1610	822	89.5	22.8	60	0.3	302	57	245	118	350	700
	Garadiya	BW	26.7	27	8.42	1580	894	320.4	34	15	0.7	147	85	62	192	100	200
	Garadiya	HP	27..4	27	8.31	2060	862	375.7	18.5	11	0.8	92	46	46	80.0	300	600
Vaghodia	Kamrol	BW	28.2	24	8.35	1060	512	202.8	26.0	10	0.8	105	65	40	220	50	175
	Kamrol	HP	28.1	--	8.10	8100	5192	1390.2	87.7	266	2.8	1313	219	1094	260	1300	7800
	Navi Jambuvai	HP	28	21	8.34	2080	1004	470.1	31.6	13	1.0	132	79	53	184	200	820
	Abhrampura	BW	28.3	42	8.24	1800	882	309.4	32.2	16	1.0	147	80	67	170	200	245
	Abhrampura	HP	28.3	27	8.10	2020	862	338.9	35	20	1.0	168	87	81	250	250	300
	Nava Rampura	HP	28.1	36	7.69	2400	1172	216.4	57.7	108	2.4	588	144	444	150	500	920
	Felod	HP	28.1	27	8.05	5060	2530	1045	65.9	5.9	2.4	189	165	24	320	189	960
	Goraj	HP	28.1	52	8.11	4280	1804	174.3	51.2	51	57.9	336	128	208	188	400	1400
	Khervadi	BW	28.3	--	8.27	2630	1256	564.2	45.2	12	3.4	163	113	50	92.0	250	1390
Dabhoi	Dholar	HP	28.5	--	8.18	3260	1396	593.5	47.8	45	2.6	305	119	185	50.0	500	890
	Tarsana	BW	28.5	36	8.15	3200	1300	616.9	48.5	41	1.7	291	121	170	556	400	930
	Tarsana	HP	28.5	27	8.19	4320	2264	773.5	57.8	39	2.7	305	144	160	192	600	1340
	Tentalav	BW	28.3	--	8.14	1410	600	200.9	27.6	29	2.2	189	69	120	74.0	250	90.0
	Bhimpura	BW	29.7	--	8.21	958	504	158.2	23.9	29	1.3	179	60	119	138	100	90.0
Sinor	Mindhol	BW	29.1	36	8.03	2070	982	163.7	25.7	133	2.6	613	64	549	100	300	550
	Vaniad	BW	29.1	82	8.05	829	456	152.2	23.8	10	1.4	102	59	42	106	100	105
	Mota Fofaliya	BW	28.9	61	8.07	1500	728	129.7	22.3	73	2.3	357	56	301	132	200	135

Annexure 4.2

Table 1 Detailed physical and chemical analysis of post monsoon 2002 water samples

Sr. No.	Taluka	Village	Well Type	Depth (m)	Temp °C	pH	Ec (mS/cm)	TDS (mg/l)	Na (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Total Hardness as $CaCO_3$ mg/l	Calcium Hardness as $CaCO_3$ mg/l	Magnesium Hardness as $CaCO_3$ mg/l	Alkalinity (mg/l)		Chloride (mg/l)	Sulphate (mg/l)
																CO_3	HCO_3		
1		Kaliari	HP	12	29	8.14	1620	702	275.3	18.9	124.6	15.8	560	47.2	512.8	24.0	508	87	658
2		Sindhav	BW	14	28	7.4	2130	1086	210.7	31.9	41.4	35.9	250	79.7	170.3	Nil	424	185	556
3		Kora	BW	17	26	8.1	[illegible]	2540	706.8	[illegible]	67.9	115	[illegible]	200.5	[illegible]	Nil	216	260	1988
4		Kora	HP	--	28	8.3	[illegible]	166	197.1	23.2	0.0	24.5	58	57.9	0.1	72.0	172	77	212
5		Nadiad	BW	--	28	8.18	2270	820	209.5	35.4	20.6	121.1	173	88.4	84.6	Nil	470	146	356
6	Jambusar	Kalak	BW	8	31	8.6	2790	1116	369.2	37.5	16.1	1.1	160	93.6	66.4	48.0	648	[illegible]	260
7		Nadiad	OW	11	23	8.0	884	480	217.0	23.4	0.1	38.8	59	58.4	0.6	36.0	314	50	273
8		Dabha	BW	36	28	7.80	7140	3440	1082.7	86.2	127.5	7.4	740	215.2	524.8	6.0	314	1728	2946
9		Dabha	BW	52	28	8.2	2440	1120	359.7	35.6	16.1	1.8	155	88.9	66.1	26.0	279	415	889
10		Dabha	BW	73	28	7.67	12600	7824	2652.0	371.1	153.9	12.2	1560	926.6	633.4	Nil	225	4349	4922
11		Jambusar city	BW	39	28	7.64	6620	[illegible]	536.4	77.3	181.5	692.8	940	193.0	747.0	6.0	654	1060	3874
12		Machhhesara	BW	15	28	8	3180	1182	400.5	42.5	30.1	5.7	230	106.1	123.9	16.0	272	541	626
13		Dadapor	BW	36	28	7.1	1190	842	196.5	26.6	73.8	[illegible]	370	66.4	303.6	16.0	444	[illegible]	360
14	Amod	Dadapor	HP	42	30	7.9	2540	1226	436.1	39.4	2.8	18.6	110	98.4	11.6	16.0	444	350	568
15		Asnera	HP	--	28	7.85	5360	2368	774.2	62.0	34.1	3.8	295	154.8	140.2	6.0	229	1430	902
16		Dora	BW	73	29	7.6	3430	1646	269.4	75.1	129.4	5.1	720	187.5	532.5	Nil	180	890	838
17		"	HP	45	28	7.8	825	462	252.2	10.1	81.4	17.8	360	25.2	334.8	6.0	329	61	182
18		Keshwan	BW	18	28	7.3	13200	8870	2798.0	335.9	82.9	12.0	1180	838.7	341.3	16.0	549	3499	10770
19		"	HP	8	28	8.20	5900	3314	657.1	75.7	226.2	46.4	1120	189.0	931.0	Nil	248	1485	1947
20		Janiadara	HP	24	29	8.6	5820	2632	1225.2	66.3	0.1	19.5	166	165.6	0.4	48.0	536	995	2672
21	Vagra	"	OW	12	24	8.2	795	426	218.1	20.5	20.4	19.7	135	51.2	83.8	Nil	320	53	99
22		Kakam	BW	33	25	7.6	4890	3064	681.2	176.4	101.9	26.8	860	440.5	419.5	Nil	290	1410	1119
23		"	HP	--	27	7.9	9690	6710	1976.0	370.3	178.7	10.9	1660	924.6	735.4	Nil	112	1110	1676
24		Saran	BW	27	29	7.4	1500	928	335.4	33.6	2.7	4.6	95	83.9	11.1	64.0	492	485	322
25		Manad	HP	24	28	7.1	5590	3400	460.0	76.9	174.5	937.6	910	192.0	718.0	16.0	712	1014	2840
26		"	HP	24	28	7.20	1630	934	285.7	24.3	99.5	118.2	470	60.7	409.3	8.0	400	304	632
27		Samar	BW	39	29	7.6	7690	4870	2161.0	80.6	252.4	12.5	1240	201.3	1038.7	Nil	220	2473	2369
28		Vasdada	BW	20	26	8	591	486	117.0	12.4	47.2	12.3	225	31.0	194.0	Nil	116	105	206
29	Bharuch	Paguthan	BW	--	28	7.7	3010	1760	348.3	44.7	138.1	5.3	680	111.6	568.4	16.0	228	782	1002
30		"	HP	--	28	7.7	1130	600	181.5	17.8	82.8	0.4	385	44.4	340.6	Nil	356	154	83
31		Uparali	BW	45	28	7.1	3790	2742	277.1	81.3	198.5	7.7	1020	203.0	817.0	Nil	268	1012	896
32		"	HP	36	28	7.6	773	428	46.4	13.4	55.0	1.1	260	33.5	226.5	Nil	240	106	190
33		Kavitha	BW	39	28	7.4	2720	1946	214.5	43.2	175.5	1.4	830	107.9	722.1	Nil	284	762	434
34		Masar	BW	39	28	7.5	3490	2100	445.6	48.5	155.3	2.6	760	121.1	638.9	8.0	430	890	1276
35		"	HP	12	28	7.1	3310	2720	170.6	132.2	230.8	27	1280	330.1	949.9	Nil	380	905	1438
36		Dhobikuva	BW	45	29	8	1490	1000	185.1	16.2	153.0	0.6	670	40.5	629.5	Nil	488	816	1600
37		"	BW	91	28	8.2	1730	1032	353.9	39.2	2.9	2.7	110	97.9	12.1	16.0	428	258	1216
38	Padra	"	BW	121	29	7.87	5300	3736	629.3	84.0	260.1	5.1	1280	209.7	1070.3	Nil	355	188	741
39		Ambada	BW	--	29	8.42	1480	776	267.7	33.2	26.0	2.9	190	82.9	107.1	8.0	508	175	314
40		"	HP	--	28	8.15	2780	1650	605.2	49.0	26.2	2.0	230	122.4	107.6	Nil	768	420	962
41		Darapura	BW	100	32	7.18	5320	3280	929.7	78.2	122.7	5.4	700	195.3	504.7	Nil	400	1140	4351
42		Sarsavani	BW	39	30	7.4	2410	1400	424.1	41.5	59.9	1.5	350	103.6	246.4	Nil	640	410	546
43		Choibhuj	BW	67	--	7.13	2660	1794	228.6	56.9	159.9	2.1	800	142.1	657.9	Nil	316	720	554
44		Karamadi	BW	73	30	7.1	3360	2316	330.6	42.7	207.4	3.2	960	106.6	853.4	Nil	412	895	1464
45		Kiya	BW	67	--	7.42	486	254	44.4	15.1	26.1	2.2	145	37.7	107.3	Nil	144	75	278
46	Karjan	Dhavat	BW	85	30	7.21	1970	1112	270.0	33.9	71.8	3.2	380	84.6	295.4	24.0	344	378	707
47		"	HP	--	--	7.40	1710	1024	215.3	29.4	72.1	2.5	370	73.4	296.6	Nil	344	256	520
48		Kanthariya	BW	76	--	7.43	1810	905	168.7	20.7	72.5	1.8	350	51.7	298.3	24.0	316	159	273
49		"	HP	52	--	7.51	1350	736	168.8	21.5	93.9	2.2	440	53.7	386.3	16.0	376	216	433

Sr. No.	Taluka	Village	Well Type	Depth (m)	Temp °C	pH	Ec (mS/cm)	TDS (mg/l)	Na (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Total Hardness as $CaCO_3$ mg/l	Calcium Hardness as $CaCO_3$ mg/l	Magnesium Hardness as $CaCO_3$ mg/l	Alkalinity (mg/l)		Chloride (mg/l)	Sulphate (mg/l)
																CO_3	HCO_3		
50		Shankarda	BW	73	29	7.1	3410	2420	324.2	76.3	189.4	4.4	970	190.5	779.5	Nil	330	923	910
51		Sewasi	BW	--	28	7.4	1620	878	289.9	33.9	23.2	2.3	180	84.6	95.4	Nil	520	186	366
52		"	HP	--	28	7.2	1390	820	172.0	18.9	101.5	2.1	465	47.2	417.8	Nil	405	143	1019
53	Vadodara	City	BW	36	--	7.1	2020	1542	366.8	39.6	14.9	1.0	160	98.9	61.1	Nil	680	167	519
54		"	BW	58	--	7.5	1480	900	277.3	33.9	45.0	0.7	270	84.6	185.4	Nil	470	187	725
55		Makarpura	BW	--	--	7.1	1770	960	192.4	29.6	106.0	0.5	510	73.9	436.1	Nil	390	246	824
56		"	HP	--	--	7.5	2370	1350	587.0	23.3	2.9	0.4	70	58.2	11.8	26.0	889	203	368
57		Ankhi	BW	76	--	7.1	3500	2000	601.5	66.4	69.1	3.1	450	165.8	284.2	Nil	350	772	4433
58		Amarapura	BW	76	--	7.35	993	600	155.1	20.9	123.4	0.4	560	52.2	507.8	36.0	394	41	71
59		"	HP	61	--	7.56	1110	674	183.2	25.4	40.5	0.4	230	63.4	166.6	36.0	444	45	92
60		Gothada	BW	61	--	7.21	6120	4988	454.8	203.6	445.1	94	2340	508.4	1831.6	Nil	615	1085	4549
61		"	HP	61	--	7.32	2150	1372	155.6	24.7	179.4	16.8	800	61.7	738.3	6.0	509	305	1382
62		Asoj	HP	--	--	7.28	918	516	145.0	21.7	33.0	33.2	190	54.2	135.8	Nil	350	77	242
63		Manjusar	BW	61	--	7.43	597	500	18.8	9.0	62.6	1.2	280	[illegible]	257.5	36.0	334	22	123
64	Savli	"	BW	45	--	7.27	766	474	148.9	21.3	21.1	2.8	140	53.2	86.8	Nil	280	39	78
65		Kadachhela	HP	58	--	7.07	1970	1400	147.3	31.8	102.2	1.0	500	79.4	420.6	Nil	280	336	1433
66		"	OW	20	--	7.46	988	582	142.4	23.2	66.1	3.0	330	57.9	272.1	Nil	360	100	258
67		Nahra	HP	67	--	8.04	879	572	204.0	23.7	2.6	0.6	70	59.2	10.8	51.0	344	36	130
68		Rani Bhadol	HP	--	--	7.45	1590	1096	142.5	17.2	113.5	0.3	510	42.9	467.1	36.0	339	405	504
69		Khakharia	BW	61	--	8.08	665	374	144.1	15.1	32.1	0.5	170	37.7	132.3	Nil	195	84	174
70		"	HP	24	--	7.43	592	324	218.7	12.9	31.1	0.5	160	32.2	127.8	6.0	184	65	141
71		Kamrol	BW	24	--	8.37	1020	556	192.5	23.1	26.1	0.8	165	57.7	107.3	Nil	445	61	136
72		"	HP	--	29	7.36	6380	3960	1133.0	80.1	75.3	2.7	510	200.0	310.0	16.0	424	1318	1100
73		Abhrampura	BW	48	30	7.5	1160	686	235.9	25.2	24.8	0.9	165	62.9	102.1	Nil	460	109	147
74		"	HP	41	--	7.56	1270	666	267.9	27.1	17.6	0.9	140	67.7	72.3	46.0	364	140	179
75	Waghodia	Nava Rampura	HP	--	30	7.75	415	212	35.7	10.1	34.0	1.3	165	25.2	139.8	Nil	190	20	63
76		Falod	BW	36	28	7.61	439	200	34.1	15.6	31.8	3.3	170	39.0	131.0	Nil	180	30	56
77		"	HP	27	--	7.13	19600	15094	3727.0	589.5	492.8	10.4	3500	1472.0	2028.0	Nil	475	6240	2376
78		Gorej	HP	61	29	7.29	2100	1188	275.2	38.6	98.1	70.0	500	96.4	403.6	6.0	479	382	961
79		"	OW	6	26	7.47	655	282	35.2	13.7	51.2	0.3	245	34.2	210.8	16.0	264	41	67
80		Rasulpura	HP	42	28	7.4	1240	728	159.6	28	45.0	1.3	255	69.9	185.1	6.0	444	156	228
81		Nariya	BW	91	29	7.8	2270	1370	485.4	48.9	21.4	1.6	210	122.1	87.9	16.0	859	187	936
82		Anguthan	HP	--	29	7.6	2970	1852	570.0	57.3	53.9	2.1	365	143.1	221.9	36.0	809	376	1620
83		Dholar	BW	30	28	7.5	418	200	33.4	12.6	28.8	9.8	150	31.5	118.5	Nil	150	34	60
84		"	HP	--	30	7.4	3470	1836	681.8	58.6	17.9	2.5	220	146.3	73.7	6.0	374	630	4130
85		Tarsana	BW	61	30	7.6	3470	2000	702.1	69.4	23.5	5.8	270	173.3	96.7	Nil	500	544	6246
86	Dabhoi	"	HP	21	28	7.4	3610	2170	765.5	66.4	3.5	4.0	180	165.8	14.2	570	0	585	2290
87		Bhimpura	BW	48	29	7.8	724	402	132.4	24.8	4.4	1.5	80	61.9	18.1	Nil	280	55	146
88		"	HP	--	29	7.6	3020	1750	723.6	51.7	0.2	0.7	130	129.1	0.9	36.0	1089	288	511
89		Asodara	BW	--	29	7.6	654	316	68.1	18.7	40.9	2.3	215	46.7	168.3	Nil	265	43	69
90		"	HP	--	29	7.8	636	458	184.2	17.1	33.4	1.5	180	42.7	137.3	Nil	230	45	114
91		Tentalav	HP	--	28	7.77	818	548	138.2	24.9	18.9	3.2	140	62.2	77.8	6.0	304	55	170
92		Nanahabipura	BW	91	29	7.6	1280	674	143.4	26.9	62.7	3.0	325	67.2	257.8	6.0	379	167	1181
93		Mindhol	BW	42	30	7.5	1660	800	120.1	25.4	124.3	2.8	575	63.4	511.6	6.0	434	273	880
94	Sinor	Vaniad	BW	82	26	7.8	794	480	259.3	23.7	17.2	1.4	130	59.2	70.8	Nil	315	58	68
95		Mota Fofaliya	BW	--	29	7.6	1060	530	230.9	22.8	61.5	2.3	310	56.9	253.1	Nil	400	101	107
96		"	BW	--	30	7.79	1160	668	120.8	23.1	69.8	3.2	345	57.7	287.3	Nil	355	154	301
97		Surasamal	BW	61	--	7.19	1340	600	145.3	26.0	76.6	3.1	380	64.9	315.1	6.0	384	196	265

Sr. No.	Taluka	Village	Well Type	Depth (m)	Temp °C	pH	Ec (mS/cm)	TDS (mg/l)	Na (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Total Hardness as $CaCO_3$ mg/l	Calcium Hardness as $CaCO_3$ mg/l	Magnesium Hardness as $CaCO_3$ mg/l	Alkalinity (mg/l) CO_3	Alkalinity (mg/l) HCO_3	Chloride (mg/l)	Sulphate (mg/l)
98	Sankheda	Anandpura	BW	33	30	7.5	2220	1300	464.7	45.5	11.3	2.5	160	113.6	46.4	Nil	350	426	1488
99		"	HP	64	30	7.1	1100	638	177.7	27.6	27.0	2.5	180	68.9	111.1	6.0	439	102	106
100		Wandarda	BW	52	29	7.1	593	400	19.3	6.2	63.1	1.0	275	15.5	259.5	16.0	249	27	70
101		"	HP	15	28	7.3	896	660	34.2	9.0	91.7	1.3	400	22.5	377.5	Nil	365	70	186
102		Bhadrali	BW	--	29	7.3	1010	600	101.1	19.7	64.6	4.8	315	49.2	265.8	6.0	[illegible]	52	80
103		"	HP	14	29	7.2	813	408	84.8	19.5	46.5	1.5	240	48.7	191.3	Nil	375	58	192
104		Khunved	BW	45	--	7.4	2030	1146	399.4	40.9	40.8	1.8	270	102.1	167.9	26.0	574	322	112
105		"	HP	--	--	7.7	2560	1546	569.7	47.9	36.5	1.5	270	119.6	150.4	6.0	809	375	101
106		Ladhod	BW	36	29	7.1	1190	610	76.2	22.8	84.6	6	405	56.9	348.1	Nil	235	211	289
107		"	HP	--	--	7.69	418	222	16.6	7.8	41.0	1.5	188	19.5	168.5	6.0	189	22	30
108		Sardarpura	HP	--	--	7.3	1830	1060	311.9	36.1	65.6	1.1	360	90.1	269.9	Nil	585	385	177
109		Suryaghoda	HP	--	29	7.4	1240	706	292.6	35.4	10.1	2.3	130	88.4	41.6	26.0	444	95	444
110	Tilakwada	Vajirai	HP	--	28.5	7.7	693	428	16.8	6.6	71.3	1.4	310	16.5	293.5	Nil	298	44	76
111		Uchad	BW	150	30.1	7.7	1670	1084	396.8	41.8	15.9	1.8	170	104.4	65.6	Nil	738	172	463
112		"	BW	--	29	7.1	[illegible]	1182	363.1	39.9	31.7	1.4	230	99.6	130.4	16.0	649	84	361
113		Tarsal	BW	55	27	7.7	867	534	79.0	20.0	48.6	1.7	250	49.9	200.1	Nil	400	42	64
114		"	OW	--	26	7.8	925	626	98.0	16.4	70.2	2.1	330	41.0	289.0	Nil	428	58	69
115	Naswadi	Jitpur	HP	91	29.4	7.5	608	342	59.2	12.4	41.1	0.8	200	31.0	169.0	Nil	265	38	60
116		"	OW	--	28.4	7.3	945	468	108.8	18.7	47.0	0.8	240	46.7	193.3	Nil	420	56	86
117		Chandpura	HP	--	29	7.5	552	320	31.9	9.9	47.5	0.6	220	24.7	195.3	Nil	205	35	108
118		"	HP	--	29	7.5	1030	580	168.4	23.2	15.1	1.0	120	57.9	62.1	Nil	105	143	491
119		Ghatasa	HP	61	28.5	7.4	518	310	18.9	9.9	49.9	0.7	230	24.7	205.3	Nil	215	26	76
120		"	CW	--	26	7.4	486	248	17.9	6.2	44.8	1.1	200	15.5	184.5	Nil	200	27	73
121		Sengpur	HP	--	28	7.6	715	410	35.7	13.8	62.1	1.2	290	34.5	255.5	Nil	230	54	183
122		"	OW	9	26	7.1	639	400	22.3	7.6	65.9	0.6	290	19.0	271.0	Nil	325	24	77
123		Reliya Amba	HP	48	28	7.2	862	546	24.8	26.8	73.6	0.7	370	66.9	303.1	Nil	345	47	159
124		"	OW	--	26.5	7.5	529	265	17.4	8.7	55.5	0.5	250	21.7	228.3	Nil	255	21	65
125	Nandod	Ambada	BW	--	28	7.7	440	276	19.1	6.6	42.2	0.9	190	16.5	173.5	Nil	185	24	69
126		"	HP	45	28.7	7.95	445	330	18.2	8.7	36.0	1.0	170	21.7	148.3	Nil	195	24	59
127		Gulvani	HP	27	28.6	7.35	565	380	22.7	6.2	53.3	0.3	235	15.5	219.5	Nil	315	24	43
128		"	OW	9	24	7.3	708	470	19.2	9.9	69.3	0.3	310	24.7	285.3	Nil	315	27	37
129	Chhotaudepur	Piplej	HP	--	28.5	7.7	1180	726	187.6	24.5	39.8	3.0	225	61.2	163.8	Nil	320	241	124
130		"	OW	11	26	7.3	652	462	44.2	12	40.1	0.9	195	30.0	165.0	Nil	165	93	201
131		Nani Takri	BW	67	28	7.4	652	450	190.4	23.8	15.9	2.0	125	59.4	65.6	Nil	405	43	284
132		"	HP	91	28	7.9	910	434	46.5	9.3	46.6	0.7	215	23.2	191.8	Nil	290	32	94
133		Karvi	HP	--	28	7.6	800	510	53.4	10.9	54.1	0.7	250	27.2	222.8	6.0	324	33	88
134		"	OW	--	26	7.5	533	364	42.3	5.0	37.1	1.0	165	12.5	152.5	Nil	250	32	103
135		Katarvant	HP	--	28	7.4	741	520	42.5	16.9	62.6	2.1	300	42.2	257.8	Nil	250	53	105
136		"	OW	9	26	7.5	683	458	30.8	9.0	56.5	1.8	255	22.5	232.5	Nil	270	39	1093
137		Bediya	BW	65	28	7.6	1050	688	212.3	27.4	10.6	1.9	112	68.4	43.6	Nil	345	93	601
138		"	HP	27	28	7.6	1100	864	30.7	37.1	86.8	0.6	450	92.6	357.4	Nil	200	137	429
139		Chichva	HP	--	28	7.8	657	406	118.5	18.7	10.5	0.8	90	46.7	43.3	Nil	165	96	234
140		Hafeshwar	HP	--	28	7.9	1340	956	223.5	31.5	24.6	0.5	180	78.7	101.3	Nil	275	23	517
141		"	OW	--	26	7.5	654	472	18.0	7.2	63.7	0.3	280	18.0	262.0	6.0	330	112	72
142		Odhi	HP	--	28	7.6	954	642	21.9	39.2	40.4	4.6	264	97.9	166.1	Nil	255	103	188
143		"	OW	--	26	7.3	746	518	23.3	21.6	85.1	2.9	404	53.9	350.1	Nil	280	59	230
144		Ferquva	HP	--	28	7.5	766	498	41.2	26.8	58.6	2.9	308	66.9	241.1	Nil	275	51	117
145	Pavijetpur	Nanivant	HP	--	28	7.3	746	556	59.9	11.3	65.1	0.3	296	28.2	267.8	Nil	265	68	409

Detailed physical and chemical analysis of pre monsoon 2003 water samples.

Annexure-4.3

Sr. No.	Taluka	Village	Well Type	Depth 'm'	Temp. °C	pH	Cond. µS/cm	TDS mg/l	Na mg/l	Ca mg/l	Mg mg/l	K mg/l	Total Hard. as CaCO3 mg/l	Ca Hard. as CaCO3 mg/l	Mg Hard. as CaCO3 mg/l	Alkalinity (mg/l) CO_3	Alkalinity (mg/l) HCO_3	Chloride mg/l	Sulphate mg/l	Nitrate mg/l	Fluoride mg/l
1	Jambusar	Kaliari	HP	18	30.5	7.54	1500	778	202.4	29.2	71.5	6.9	376	82	294	Nil	490	121	720	10.5	0.62
2		Sindhav	BW	18	29.7	7.70	1760	950	352.9	37.2	3.9	29.1	120	104	16	10	445	204	600	1.9	0.5
3		Kora	BW	18	32.8	8.50	1730	864	342.1	34.9	4.5	14.9	116	98	13	20	235	299	555	8.0	2
4		Kora	BW	21	32.5	8.07	1700	966	273	38.1	1.3	106.5	112	107	5	Nil	345	239	775	5.0	3.45
5		Kora	HP	18	30.6	8.71	904	456	180.3	21.3	0	22.3	60	60	0	10	240	64	262	4.0	1.12
6		Nadiad	BW	--	30	7.50	1620	900	223.6	35.9	20.3	129.8	184	100	84	20	390	187	440	2.4	0.47
7		Nadiad	OW	11	28.8	7.80	786	400	146	19.3	33.5	31.5	192	54	138	Nil	310	27	207	0.3	0.25
8		Dabha	BW	36	30	7.50	6650	3910	1629	85.8	102.1	8.6	660	240	420	Nil	290	1765	2175	6.5	1.05
9		Dabha	BW	52	28.4	7.70	1070	598	163.9	24.5	39.7	1.2	232	69	163	10	300	102	360	0.5	0.62
10		Dabha	BW	73	28.5	7.47	12600	8432	2846	348	152.3	11.7	1600	973	627	Nil	205	4099	3975	6.6	0.98
11	Amod	Machhhesara	BW	15	29.3	8.26	1530	902	344.5	60.9	106.8	4.3	610	170	440	20	265	652	767	8.6	0.11
12		Machhhesara	BW	15	29.5	7.82	2900	1680	415.1	31.2	3.1	7.8	100	87	13	40	590	225	480	4.8	0.26
13		Machhhesara	BW	15	29.5	7.97	3340	1910	786.5	50.6	11.8	4.7	190	142	48	30	585	620	633	1.6	0.69
14		Dadapor	BW	--	29.4	7.41	1800	1120	361.3	37.5	35.3	17.8	250	105	145	20	310	220	400	2.5	0.4
15		Dadapor	HP	30	30.[illegible]	8.03	2070	1140	482.7	39.5	2.3	17.5	120	110	10	20	425	312	467	3.9	0.4
16		Asnera	BW	50	30	7.57	6740	4860	978.4	117.9	286.8	7.9	1510	330	1180	Nil	155	2070	1330	17.0	0.4
17		Asnera	HP	--	30	8.04	4230	2320	890	59.2	37.5	3.6	320	166	154	20	200	1090	900	15.5	1.12
18		Asnera	OW	12	28.9	8.06	1720	1000	171.6	30.4	92.3	116	465	85	380	20	410	222	467	0.7	0.19
19		Dora	BW	73	30.3	7.56	3880	2586	427.1	102.3	183.2	6	1040	286	754	Nil	200	1050	833	4.7	0.26
20		Dora	HP	45	30.6	7.97	761	560	194.2	12.8	66.1	0.5	308	36	272	Nil	240	80	217	2.4	0.11
21	Vagra	Keshwan	BW	20	29.6	7.45	13300	9450	2300	384.2	32.9	11.3	1210	1075	135	30	564	3309	7000	265.0	0.83
22		Keshwan	HP	30	29.6	8.20	1520	1080	309.8	33.1	0.1	4.8	93	93	0	20	430	170	450	0.9	0.26
23		Janiadara	HP	26	30.2	8.11	11400	9310	2512	312.3	0.1	41.2	874	874	0	30	535	1550	7300	0.8	--
24		Janiadara	OW	12	31.8	8.00	901	780	102	21.3	15.2	18.6	122	60	62	Nil	304	48	100	0.4	0.54
25		Kalam	BW	10	31.6	7.64	6290	4684	856	236	155.5	30.9	1300	660	640	40	200	1795	1200	35.0	0.26
26		Kalam	HP	9	29.5	7.57	9650	7880	1596	360.9	158.1	11.8	1660	1009	651	Nil	105	3219	1400	0.3	0.4
27		Vachhnad	BW	--	29.8	8.13	1340	930	178.2	26.3	40.4	9.6	240	74	166	Nil	255	440	300	1.4	0.26
28	Bharuch	Manad	BW	24	30.1	8.07	1500	990	296.4	31	55.5	3.0	315	87	228	10.0	130	340	400	1.0	0.33
29		Manad	HP	24	29.6	7.37	5720	3544	503.3	91.3	180.9	956	1000	255	745	60	715	997	2750	47.0	0.4
30		Sarnar	BW	--	29.7	7.67	7180	5048	1264	112.7	181.0	14.6	1060	315	745	Nil	160	2340	975	3.1	0.4
31		Deorol	HP	--	29.8	8.00	2750	1500	477	38.8	66.0	2.8	380	109	271	20	215	657	400	3.9	0.54
32		Vasdada	BW	33	29.7	7.92	766	500	209.9	15.7	57.4	22.8	280	44	236	20	200	85	267	0.2	0.11
33		Parkhet	BW	--	29.6	7.51	2480	1520	272	35.5	141.1	1.8	680	99	581	Nil	420	452	800	17.5	0.24
34		Paguthan	BW	--	29.4	7.46	2710	1800	201.7	39.2	194.5	6.9	910	110	800	Nil	405	540	951	23.5	0.4
35		Paguthan	HP	--	29.9	7.53	1260	690	162.1	19.1	87.9	0.6	415	53	362	20	325	125	240	0.7	0.19
36		Uparali	BW	55	29.6	7.53	2360	1440	306.9	39	116.9	3.5	590	109	[illegible]	20	315	530	512	1.3	0.25
37		Uparali	HP	36	30.2	7.93	724	360	19.1	14.2	51.6	1.1	252	40	212	10.0	215	72	212	1.2	0.19
38		Kavitha	BW	39	30.4	7.62	2850	2218	262.3	44.6	186.0	1.5	890	125	765	10.0	265	727	364	2.1	0.26
39	Padra	Masar	BW	48	--	7.48	5460	3290	939.5	86.4	123.5	4.0	750	242	508	Nil	375	1474	1338	12.0	0.47
40		Masar	HP	12	--	7.45	3540	2010	574.4	120.8	180.3	41	1080	338	742	10	445	742	1200	30.0	0.54
41		Dhobikuva	BW	121	--	7.63	1680	928	195.6	44.5	81.5	1.3	460	124	336	Nil	480	225	425	8.1	0.54
42		Dhobikuva	BW	45	--	7.84	2290	1328	196.2	29.6	150.0	1.3	700	83	617	20	375	417	350	8.0	0.62
43		Ambada	BW	--	--	7.93	2270	1220	463.8	45.3	25.1	4.6	230	127	103	Nil	675	235	550	6.2	1.3
44		Ambada	HP	--	--	7.54	2740	1676	601.9	50.4	28.9	2.1	260	141	119	Nil	715	377	738	13.0	1.12
45		Darapura	BW	100	--	7.65	3460	2020	656.3	67.3	44.2	4.2	370	188	182	Nil	450	637	1488	7.5	0.76
46		Sarsavani	BW	39	--	7.76	2360	1720	457	43.4	48.3	1.5	320	121	199	Nil	620	351	475	2.0	0.9

Sr. No.	Taluka	Village	Well Type	Depth 'm'	Temp. °C	pH	Cond. µS/cm	TDS mg/l	Na mg/l	Ca mg/l	Mg mg/l	K mg/l	Total Hard. as CaCO3 mg/l	Ca Hard. as CaCO3 mg/l	Mg Hard. as CaCO3 mg/l	Alkalinity (mg/l)		Chloride mg/l	Sulphate mg/l	Nitrate mg/l	Fluoride mg/l
																CO_3	HCO_3				
47		Chorbhuj	BW	--	31.4	7.46	2760	1866	253.9	58.7	159.4	2.3	820	164	656	Nil	310	698	433	2.0	0.19
48		Karamadi	BW	76	30.4	7.81	2050	1056	313.6	47.1	52.6	3.7	348	132	216	Nil	195	472	575	2.0	0.26
49		Karamadi	BW	--	30.1	7.43	3030	1920	335.8	65.6	145.0	3.1	780	183	597	Nil	305	702	925	14.0	0.26
50		Kiya	BW	67	30.1	7.72	1940	1130	274.1	35.4	59.5	4.0	344	99	245	20	215	420	550	4.1	0.4
51	Karjan	Dhavat	BW	85	30.6	7.54	1930	1230	253.6	35.6	81.8	3.3	436	100	336	Nil	420	280	550	22.5	0.19
52		Kanthariya	BW	30	30.6	8.08	[illegible]	984	106.4	[illegible]	96.1	2.4	460	65	395	20	330	187	425	17.0	0.26
53		Kanthariya	HP	52	30	7.62	1390	804	117.3	23.3	90.1	2.8	436	65	371	Nil	375	170	300	4.5	0.19
54		Rarod	BW	38	32.3	7.55	2340	1400	274.4	45	106.5	3.7	564	126	438	Nil	325	533	388	0.5	0.33
55		Rarod	HP	--	30.8	7.13	7580	6770	412.6	106.2	863.4	2.1	3850	297	3553	Nil	1064	1745	1270	240.0	0.54
56		Shankarda	BW	73	32.1	7.06	3220	2354	220.1	67.7	235.9	3.2	1160	189	971	Nil	395	510	4600	7.3	0.4
57		Sevasi	BW	--	31.4	7.61	1780	938	378.2	40.6	3.9	3.1	130	114	16	Nil	515	210	350	1.5	0.62
58		Sevasi	HP	--	30.8	7.33	1550	880	195.8	44.3	85.6	1.2	476	124	352	Nil	510	140	340	15.0	0.69
59	Vadodara	City	BW	42	30.7	7.35	2740	1578	358.6	35.6	17.6	0.9	172	100	72	Nil	490	177	1500	10.5	1.05
60		City	BW	61	30.5	7.86	1470	894	279	62.7	0.0	1.1	175	175	0	Nil	425	137	360	35.0	0.62
61		Makarpura	BW	--	31.4	7.11	1830	1042	204.5	44.8	93.0	0.7	508	125	383	Nil	405	260	613	14.0	0.54
62		Makarpura	HP	--	30.1	7.97	2280	1286	582.2	23	0.0	0.5	64	64	0	20	775	175	302	4.9	6.0
63		Ankhi	BW	--	29.4	7.12	4930	3486	540.8	123.1	261.4	2.2	1420	344	1076	Nil	470	1260	1367	4.8	0.26
64		Amarapura	BW	76	30.7	7.65	1040	800	157.6	20	54.4	0.3	280	56	224	Nil	410	32	150	15.0	0.69
65		Amarapura	HP	61	29.3	7.53	1140	874	183.2	22.9	36.0	0.3	212	64	148	Nil	445	45	114	17.0	0.69
66		Gothada	BW	--	29.4	7.26	5870	5312	444.8	115.7	373.3	90.2	1860	324	1536	Nil	555	863	2850	16.0	0.33
67		Gothada	BW	61	30.5	7.40	1230	880	90.4	21.9	76.5	0.5	376	61	315	Nil	330	113	600	15.5	0.4
68		Gothada	HP	61	28.6	7.61	1060	588	87.5	18.2	56.6	0.3	284	51	233	Nil	325	92	289	9.2	0.4
69		Manjusar	BW	61	31.8	7.60	668	276	34.1	13.6	40.3	3.0	204	38	166	Nil	260	50	180	1.4	0.33
70		Manjusar	BW	45	32.1	7.72	814	630	153.5	19.8	11.3	3.0	102	55	47	Nil	325	46	98	2.1	0.61
71	Savli	Kadachhela	BW	61	32	7.32	2120	1400	335.9	36.3	62.8	0.8	360	102	258	Nil	480	288	567	31.9	0.98
72		Kadachhela	HP	58	31.5	7.77	1480	912	190.2	23.9	45.0	0.8	252	67	185	Nil	415	152	967	120	0.69
73		Kadachhela	OW	24	27.6	7.70	925	586	154.5	21.9	34.7	1.7	204	61	143	Nil	350	50	280	3.2	0.9
74		Nahra	BW	48	31.6	7.58	1060	730	208.8	25.2	11.1	0.7	116	70	46	Nil	365	75	250	3.2	1.2
75		Nahra	HP	67	31.4	8.02	850	530	195.4	20.6	0.0	0.5	58	58	0	Nil	350	34	130	1.4	1.05
76		Moti Bhadoi	BW	76	30.4	7.68	732	554	53.6	14.2	53.5	0.4	260	40	220	Nil	285	55	167	2.5	0.61
77		Moti Bhadol	HP	33	31	7.33	1910	1204	85.6	27.2	146.8	0.3	680	76	604	Nil	355	351	525	8.5	0.48
78		Khakharia	BW	61	31.3	7.92	996	770	91	26	47.5	0.5	268	73	195	Nil	240	140	240	4.5	0.48
79		Khakharia	HP	24	31.4	7.82	625	434	54	18.2	30.4	0.5	176	51	125	Nil	210	77	162	1.3	0.4
80		Kamrol	BW	24	31.2	7.61	1040	676	178.2	25.2	27.6	0.6	184	70	114	Nil	390	72	116	4.9	1.05
81		Kamrol	HP	--	31.7	7.72	3110	2134	741	51	0.0	1.5	143	143	0	Nil	760	355	1733	3.0	0.76
82		Abhrampura	BW	48	31.5	7.66	1610	1060	280.4	30.2	37.8	0.8	240	84	156	Nil	480	197	244	3.5	0.83
83		Abhrampura	HP	41	30.9	7.58	1770	1400	308.3	32	31.7	0.8	220	90	130	Nil	515	230	220	3.0	0.83
84		Juna Rampura	BW	--	30.5	8.23	1350	830	295	24.5	0.0	0.6	69	69	0	30	415	77	100	1.0	1.48
85	Waghodia	Juna Rampura	HP	--	30.7	7.73	1860	1006	518.6	49.6	14.9	2.3	200	139	61	20	535	456	1175	9.5	0.9
86		Nava Rampura	HP	--	--	7.91	451	205	32.9	12.8	30.2	1.0	160	36	124	Nil	175	29	40	0.2	0.26
87		Falod	BW	39	29.8	7.74	581	284	63.6	20.3	25.1	3.1	160	57	103	Nil	205	52	80	0.5	0.48
88		Falod	HP	27	31.7	7.11	9760	6506	1930	320	41.1	6.9	1064	895	169	Nil	605	2684	1061	215.0	0.33
89		Gorej	HP	61	30.5	7.64	2670	1700	175.9	44.4	57.3	608.7	360	124	236	Nil	595	252	1000	40.0	1.05
90		Sengur	BW	24	29.5	7.35	1000	640	47.3	27	70.1	21.4	364	76	288	Nil	230	93	190	10.2	0.26
91		Rasulpura	BW	61	--	7.43	2870	1592	465.2	61.2	61.4	2.5	424	171	253	20	340	656	750	1.9	0.48
92		Rasulpura	HP	42	--	7.34	2910	1670	597.9	59.2	14.2	1.7	224	166	58	30	560	405	1404	7.9	0.61
93	Dabhoi	Nariya	BW	91	--	7.86	2270	1264	494.8	40.4	23.1	1.3	208	113	95	130	605	185	688	3.5	5.4
94		Anguthan	BW	--	--	7.73	1890	1472	324.5	37.7	46.3	1.4	296	105	191	20	500	185	470	24.0	6.65
95		Anguthan	HP	--	--	7.69	2910	1772	607	52.4	48.9	6.1	348	147	201	60	735	410	1100	15.0	5.6
96		Nanahabipura	BW	91	30.7	7.77	1400	814	199.1	24.3	67.1	3.0	344	68	276	Nil	340	169	360	5.3	0.19
97		Nanahabipura	BW	85	31.2	7.55	1360	692	207.1	21.9	65.8	3.2	332	61	271	Nil	345	175	340	5.0	0.11
98	Sinor	Mindhol	BW	45	30.6	7.50	1710	1000	222.1	24.5	116.5	2.8	548	69	479	5	395	260	240	10.0	0.26
99		surasamal	BW	61	30.4	7.33	1460	950	206.6	23.9	93.6	2.6	452	67	385	Nil	398	190	240	10.0	0.26
100		Vaniad	BW	82	30.8	7.89	815	590	213.2	20.3	20.2	1.3	140	57	83	Nil	285	67	120	2.6	0.83
101		Vaniad	BW	89	31.4	7.75	869	520	205.9	21.6	23.2	1.3	156	60	96	Nil	320	67	120	2.9	0.76

Annexure-4.4

Detailed physical and chemical analysis of post monsoon 2003 water samples

Sr. No.	Taluka	Village	Well Type	Depth 'm'	Temp °C	pH	EC µS/cm	TDS mg/l	Na mg/l	Ca mg/l	Mg mg/l	K mg/l	Total Hardness mg/l	Ca Hard. as $CaCO_3$ mg/l	Mg Hard. as $CaCO_3$ mg/l	Alkalinity mg/l		Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Nitrate mg/l	Boron mg/l	Silica mg/l	Strontium mg/l	Mangenese mg/l
																CO_3	HCO_3								
1		Kaliari	BW	18	30.8	7.7	1680	960	327.1	63	5.5	24	180	157.3	22.7	20	500	158	767	2.1	9	0.78	4.004	1.48	0.021
2		"	HP	18	30	7.15	1460	850	136.8	44	86.1	53.1	464	109.9	354.1	Nil	502	105	700	0.26	16.5	0.55	9.43	1.67	0.015
3		"	OW	--	25.7	7.5	942	446	110.2	63.2	23.9	21.7	256	157.8	98.2	Nil	342	60	550	0.2	1.3	0.47	3.64	0.76	ND
4		Sindhav	BW	18	29.3	7.1	1990	1140	283.1	71.8	45.4	46.7	366	179.3	186.7	Nil	512	286	1017	0.36	0.3	0.74	6.72	0.93	ND
5		Kora	BW	18	30.2	7.6	1600	918	220	55.8	0.2	172	140	139.3	0.7	Nil	412	142	833	1.85	18.5	0.53	5.99	1.71	ND
6		"	BW	27	29.9	7.2	1570	824	100.9	54.7	31.0	174.8	264	136.6	127.4	Nil	430	121	700	0.25	20	0	0	0	0
7	Jambusar	"	HP	18	29.7	8.3	900	566	165.4	28.1	0.0	28.5	70	70.2	0.0	28	266	70	120	1.1	4	0.55	2.46	0.3	ND
8		Nadiad	BW	--	29.8	7.4	1700	974	243.9	67.5	5.7	143.9	192	168.5	23.5	Nil	506	201	590	0.46	1.6	0.59	4.45	0.53	ND
9		"	OW	--	--	8.09	959	650	135.1	37	23.2	36.9	188	92.4	95.6	Nil	373	58	360	0.35	0.5	0.52	5.61	0.51	ND
10		Da' ha	[illegible]	[illegible]	--	7.62	[illegible]	3734	1064	80.4	135.9	1.2	[illegible]	200.8	[illegible]	Nil	352	1923	2650	0.43	0.9	[illegible]	[illegible]	0.96	ND
11		"	BW	52	29.7	7.5	1110	646	124	34.7	60.4	1.3	335	86.6	248.4	Nil	364	37	520	0.42	15.5	0.84	5.96	2.4	ND
12		Dabha	BW	73	30	7.69	[illegible]	[illegible]	2418	615.8	29.7	11.3	1660	1537.7	122.3	Nil	228	4024	4000	0.89	5.7	1.15	5.14	5.1	ND
13		City	BW	--	--	7.91	4410	2132	461.2	233.6	42.9	615	760	583.3	176.7	Nil	668	695	2600	0.44	95	0.89	8.03	0.54	ND
14		Nada	BW	--	29.4	6.65	79300	81000	27730	6115	201.9	920	16100	15269.2	830.8	Nil	250	59189	50000	3.8	3.2	2.32	3.61	[illegible]	2.9
15		Machhhesara	BW	15	26.6	7.6	828	532	448.7	28.7	48.2	5.9	270	71.7	198.3	Nil	366	32	167	0.1	0.9	0.44	7.8	0.38	0.015
16		"	BW	15	28.2	7.8	3620	2104	799.7	88.1	9.7	4.6	260	220.0	40.0	0	590	340	1100	0.76	1.6	0.74	7.44	0.37	ND
17		Dadaper	BW	--	29.9	7.35	1840	1186	296.9	65.3	45.4	17.8	350	163.1	186.9	Nil	492	527	400	0.42	5.3	0.48	6.6	0.46	ND
18		"	BW	--	--	8.27	2830	1758	348.4	81.4	108.6	35.4	650	203.3	446.7	8	452	750	1433	0.33	27.5	0	0	0	0
19	Amod	"	HP	30	31.2	7.4	2010	1200	436.7	46.5	0.9	16.4	120	116.1	3.9	Nil	474	320	550	0.56	4	0.52	6.86	0.19	ND
20		Asnera	BW	24	28.4	7.74	6310	4320	922.8	217	169.7	7.4	1240	541.8	698.2	Nil	156	1989	1500	0.5	15	0.58	6.15	2.45	0.19
21		"	HP	--	29.3	7.95	4050	2326	817.6	86.7	22.7	3.3	310	216.5	93.5	Nil	234	1075	1250	1.07	14.5	0.59	5.34	0.76	0.021
22		"	OW	--	26.7	7.8	1330	932	124.6	45.6	49.1	128.4	316	113.9	202.1	Nil	442	130	220	0.22	0.8	0.45	8.65	0.79	ND
23		Dora	BW	73	29.4	7.6	3100	1822	325.2	200.2	89.9	4.9	870	499.9	370.1	Nil	180	850	833	0.31	0.2	0.44	5.68	1.24	ND
24		"	HP	45	28	7.8	665	344	303	10.1	67.7	0.5	304	25.2	278.8	Nil	272	47	150	0.14	1.9	0.39	8.06	0.41	ND
25		Keshwan	BW	21	29.6	7.3	6000	3680	2766	359.2	66.4	11.7	1170	896.9	273.1	Nil	614	3299	8000	0.78	245	0.95	8.26	1.03	ND
26		"	HP	27	--	7.84	12800	8888	865	322.7	14.4	10.5	865	805.8	59.2	Nil	338	1350	500	0.69	165	0.48	5.82	0.45	ND
27		"	OW	--	23.4	8.17	1130	646	183.5	43.7	19.2	5.6	188	109.1	78.9	16	322	147	295	0.15	0.2	1.76	3.79	0.55	0.015
28	Vagra	Janiadara	OW	--	25.6	8	1030	684	132.1	38.1	31.3	25.6	224	95.1	128.9	24	352	80	380	0.45	1	0.48	5.13	0.257	ND
29		Kalam	BW	33	--	7.8	4890	2776	649.9	295.5	56.4	41	970	737.9	232.1	Nil	302	1330	1100	0.33	29	0.6	6.12	1.55	ND
30		"	HP	--	30.6	7.4	10100	3800	1538	319	236.6	11.6	1770	796.5	973.5	Nil	134	3556	1800	0.43	0.2	0.6	5.76	2.72	ND
31		Vachhnad	BW	27	28.7	8.22	825	486	168.8	34.1	10.9	1.4	130	85.1	44.9	12	268	80	60	0.59	1.3	0.42	5.75	0.13	ND
32		Manad	BW	24	--	8.3	1170	658	156.5	34.6	47.0	2.2	280	86.4	193.6	20	316	152	200	0.38	0.6	0.41	7.21	0.33	ND
33		"	HP	24	29.1	7.4	1390	782	94.4	42.6	229.3	126.6	1050	106.4	943.6	Nil	422	162	375	0.44	0.7	0.44	7.18	0.81	ND
34		Samar	BW	39	29.6	7.6	7140	6144	1070	388.6	31.5	13.9	1100	970.3	129.7	Nil	164	2379	1200	0.2	5	0.55	5.81	1.64	ND
35		Vasdada	BW	33	--	8.25	942	418	123.8	31.2	28.7	25.9	196	77.9	118.1	Nil	286	111	101	0.5	0.4	0.4	8.27	0.32	ND
36	Bharuch	Paguthan	BW	45	29.4	7.7	2890	1800	351.8	74.6	120.0	5.7	680	186.3	493.7	20	226	732	813	0.5	9.5	0.49	6.62	0.85	ND
37		"	HP	--	29.3	7.1	1420	844	95.2	28.1	120.0	0.5	564	70.2	493.8	Nil	382	245	130	0.32	0.9	0.38	8.97	0.28	0.17
38		Uparali	BW	42	--	7.91	2830	1756	253.6	70.8	183.0	3.8	930	176.8	753.2	Nil	404	707	760	0.32	3.7	0.51	8.15	0.46	ND
39		"	HP	36	29.3	7.6	773	432	43.7	15.4	83.0	1.2	380	38.5	341.5	Nil	282	90	240	0.32	1.2	0.69	5.64	0.21	ND
40		Kavitha	BW	39	28.4	7.1	4440	2728	234.7	167.5	248.3	3.3	1440	418.2	1021.8	Nil	408	1282	390	0.38	2.2	0.83	4.42	0.8	0.35
41		"	BW	42	29.3	8.05	2820	1718	426	81.4	171.7	1.6	910	203.3	706.7	Nil	298	752	700	0.32	2.6	0.74	7.06	0.7	0.03
42		M[illegible]ar	BW	48	30.5	7.3	5530	3332	577	322.7	39.9	5.5	970	805.8	164.2	Nil	294	1570	2200	0.44	13.5	0.89	4.53	2.73	0.3
43		"	HP	12	28.2	6.9	3490	2140	185.4	216.6	182.0	41.1	1290	540.9	749.1	Nil	368	907	1350	0.14	15	0.77	15.27	2.06	0.058
44		Dhobikuva	BW	121	--	7.33	1390	872	322.2	53.2	16.3	2.2	200	132.8	67.2	32	450	135	220	0.74	4.5	0.78	2.69	0.12	ND
45	Padra	"	BW	45	--	7.88	1480	982	80	20	160.4	0.7	710	49.9	660.1	36	446	155	700	0.5	13.5	0.68	8.81	0.14	ND
46		Ambada	BW	--	30.2	8.45	2070	1368	468.7	67.5	13.7	5.4	225	168.5	56.5	40	658	222	550	2.2	5	0.84	4.26	0.09	ND
47		"	HP	--	--	8.48	2830	1762	667.8	82.8	5.6	2.1	230	206.8	23.2	52	692	402	825	1.14	14	0.93	4.1	0.48	ND
48		Darapura	BW	100	--	7.75	5920	3656	837	70.5	168.6	6.3	870	176.0	694.0	Nil	384	947	4400	0.5	3.7	0.88	3.41	1.58	ND
49		Sarsavani	BW	45	--	7.61	2650	1546	474.1	75.6	53.8	1.7	410	188.8	221.2	Nil	484	447	601	1	2.1	0.82	5.51	0.44	ND

	Taluka	Village	Well Type	Depth 'm'	Temp °C	pH	EC µS/cm	TDS mg/l	Na mg/l	Ca mg/l	Mg mg/l	K mg/l	Total Hardness mg/l	Ca Hard. as $CaCO_3$ mg/l	Mg Hard. as $CaCO_3$ mg/l	Alkalinity mg/l		Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Nitrate mg/l	Boron mg/l	Silica mg/l	Strontium mg/l	Mangenese mg/l
																CO_3	HCO_3								
50		Chorbhuj	BW	67	29.3	7.68	2650	1546	234.3	88.1	143.4	2.5	810	220.0	590.0	Nil	326	660	440	0.32	2.3	0.71	6.95	0.46	0.16
51	Karjan	Karamadi	BW	73	--	7.64	3880	2346	362.5	217	164.8	3.8	1220	541.8	678.2	Nil	396	385	1350	0.32	14.5	0.76	7.16	1.11	0.084
52		Dhavat	BW	85	--	7.51	1890	1120	243.1	55	77.4	3.3	[illegible]	[illegible]	[illegible]	Nil	[illegible]	[illegible]	650	0.38	22.5	0.69	7.43	0.22	0.3
53		Kaninariya	BW	76	30	8.21	1150	612	93.4	24.7	81.2	1.9	396	61.7	334.3	Nil	388	130	240	0.38	5.2	0.63	7.31	0.094	ND
54		Shankarda	BW	85	30.1	7.1	3050	2146	231.3	83.6	255.5	4.6	1260	208.7	1051.3	Nil	418	581	4000	0.42	6.1	0.66	5.95	2.26	ND
55		Sewasi	BW	--	--	7.33	1510	940	232.7	43.3	10.2	3.3	150	108.1	41.9	Nil	554	120	220	[illegible]	14	0.66	4.38	0.047	ND
56		"	HP	--	--	7.29	3080	1680	459.9	167.5	30.6	1.5	544	418.2	125.8	Nil	490	542	650	0.5	22.5	0.69	3.85	0.39	ND
57	Vadodara	City	BW	61	28.1	7.57	1790	1072	184	64.8	26.3	1.1	270	161.8	108.2	Nil	514	145	875	1.9	20.5	0.68	2.69	0.38	ND
58		Makarpura	BW	27	28.3	[illegible]	1790	1020	587.7	41.3	111.0	0.7	560	103.1	456.9	Nil	440	247	788	0.62	14.5	0.67	6.32	0.35	ND
59		"	HP	--	28.3	7.86	2240	1320	310.6	23.2	3.4	0.6	72	57.9	14.1	Nil	936	147	240	3.8	4.5	0.82	3.59	0.049	ND
60		Ankhi	BW	76	--	7.67	3630	2140	623.3	232.2	19.5	3.8	660	579.8	80.2	Nil	374	835	3300	0.44	3.2	0.79	3.85	0.47	ND
61		Amarapura	BW	76	--	8.42	1030	602	112.9	35.2	48.6	0.3	288	87.9	200.1	28	420	35	70	0.74	17.5	0.56	8.82	0.074	ND
62		"	HP	61	--	7.4	1150	806	172.1	39.1	39.5	0.4	260	97.6	162.4	20	464	43	140	0.74	16	0.58	9.14	0.039	ND
63		Grthada	BW	61	--	7.57	4720	3290	387.9	250.9	260.9	71.8	1700	626.5	1073.5	Nil	576	740	4400	0.5	15.5	0.76	6.47	2.93	ND
64		"	BW	15	--	8.01	901	498	79.9	27.2	51.5	0.3	280	67.9	212.1	Nil	336	62	300	0.62	1.6	0.54	6.08	0.18	ND
65		"	OW	--	--	7.82	448	168	30.4	37.7	15.0	12.3	156	94.1	61.9	Nil	186	20	110	0.2	0.6	0.53	2.37	0.16	ND
66		Manjusar	BW	45	--	7.1	673	446	83.2	29.2	17.3	3.3	144	72.9	71.1	Nil	288	36	110	0.56	2	0.51	4.9	0.2	ND
67		"	BW	61	--	7.4	470	322	12.6	16	45.7	1.3	228	40.0	188.0	Nil	216	19	110	0.32	0.3	0.53	3.85	0.18	ND
68	Savli	Kadachhela	BW	45	--	7.76	2540	1478	331.6	67.5	61.1	0.9	420	168.5	251.5	Nil	506	300	800	0.88	325	0.61	7.02	0.1	ND
69		"	HP	58	--	7.42	5550	3676	270.7	387.8	18.6	1.6	1045	968.3	76.7	Nil	280	1395	2800	0.62	120	0.66	8	0.53	0.098
70		Nahra	BW	48	--	7.4	1020	680	193.8	49.3	0.5	0.7	12[illegible]	123.1	1.9	24	376	63	225	1.14	4.8	0.59	4.95	0.13	ND
71		"	HP	67	--	7.[illegible]	880	510	192	36.2	0.0	0.5	90.4	90.4	0.0	20	346	38	150	1	1.8	0.56	4.85	0.21	ND
72		Moti Bhadol	BW	76	--	7.1	1630	980	108.4	78.6	136.0	1.5	656	96.4	559.6	Nil	374	249	860	0.5	17.5	0.55	9.53	0.45	ND
73		"	HP	33	--	7.[illegible]	2680	1630	140.6	86.8	64.0	0.3	480	216.7	263.3	Nil	466	607	590	0.56	4.7	0.56	11.4	0.58	ND
74		Khakharia	BW	61	31.4	7.55	793	420	89.1	34.6	25.7	0.4	192	86.4	105.6	Nil	270	44	220	1	3.7	0.51	5.02	0.21	ND
75		"	HP	24	29.1	7.75	474	274	51.6	21.5	20.0	0.4	136	53.7	82.3	Nil	158	90	120	0.44	0.8	0.18	3.43	0.28	0.042
76		Kamrol	BW	24	--	8	1100	684	177.7	39.8	19.6	0.7	180	99.4	80.6	8	434	72	225	1.34	4.9	0.37	3.49	0.31	0.018
77		"	HP	--	--	8.08	3120	1800	657	66.8	0.0	1.7	167	166.8	0.2	12	816	372	2750	0.88	2.9	1.75	6.29	0.14	0.019
78		Abhrampura	BW	48	--	8.01	1480	924	223.6	46.9	34.7	1.1	260	117.1	142.9	Nil	472	174	305	0.88	7	0.37	5.87	0.6	0.019
79		"	HP	41	--	8.05	1360	800	216.1	43.8	23.0	0.7	204	109.4	94.6	Nil	482	120	220	1	4.3	0.38	5.74	0.19	ND
80		Juna Rampura	BW	--	--	8.22	1720	1000	385.8	53.1	4.7	1.1	152	132.6	19.4	20	654	128	170	0.88	0.3	0.7	5.17	0.12	ND
81	Waghodia	"	HP	--	--	8.04	2320	1546	462.4	72.7	1.1	1.6	186	181.5	4.5	Nil	668	258	1125	0.94	10	0.83	4.02	0.079	ND
82		Falod	BW	39	--	7.62	497	222	34.3	26.4	30.2	3.5	190	65.9	124.1	Nil	200	42	80	0.44	1	0.18	2.64	0.41	ND
83		"	HP	18	--	7.47	15700	10465	2881	967.7	54.3	25.4	2640	2416.3	223.7	Nil	512	4768	3200	0.88	295	1.22	2.69	10.49	0.024
84		Gorej	HP	61	--	8	3190	2014	131.8	91.4	32.0	84.1	360	228.2	131.8	Nil	668	285	2050	0.94	1.2	0.58	6.05	1.01	ND
85		Nimeta	BW	55	--	7.31	7250	4350	1440	446.8	137.1	4.5	1680	1115.7	564.3	Nil	536	1250	14000	0.82	1.2	1.52	3.54	1.5	ND
86		Khervadi	BW	--	--	8.15	2570	1538	506	67.1	4.5	3.4	186	167.5	18.5	32	528	372	1575	2.8	0.9	0.37	4.17	0.13	ND
87		Rasulpura	BW	61	30.6	7.3	2020	1200	376	64.3	23.2	3	256	160.6	95.4	Nil	620	670	1300	1	1.6	0.45	4.34	0.15	ND
88		"	HP	42	29.1	7.6	1390	716	219.2	42.3	36.5	1.5	256	105.6	150.4	Nil	482	410	400	0.74	3.2	0.35	3.8	0.076	ND
89		Nariya	BW	36	30.4	7.35	2210	1266	341.7	42.2	27.9	2	220	105.4	114.6	Nil	548	190	800	2.2	3.2	0.82	2.79	1.64	ND
90		Anguthan	BW	--	30.2	7.95	2190	1242	473	72.7	7.4	1.5	212	181.5	30.5	44	794	190	900	7	6.8	0.97	2.92	0.15	ND
91	Dabhoi	"	HP	--	29.6	7.4	2930	1800	382	87.8	25.5	2	324	219.2	104.[illegible]	Nil	824	420	1250	2.6	0.8	1.05	2.64	1.36	ND
92		Tarsana	BW	64	30.5	7.6	3500	2070	722.7	88.1	1.9	6.1	228	220.0	8.0	Nil	500	560	4300	0.94	1.2	0.65	3.05	0.7	ND
93		"	BW	61	28.5	7.5	1670	988	290.7	53.4	24.0	5.5	232	133.3	98.7	Nil	486	156	600	0.98	3	0.43	3.15	0.69	ND
94		"	HP	21	28.5	7.4	3720	2104	802	87.8	0.0	6.7	219.2	219.2	0.0	32	768	602	2200	1.14	12.2	1.59	2.85	0.26	0.018
95		Bhimpura	BW	61	30.1	7.6	1060	548	193.2	38.1	10.9	1.9	140	95.1	44.9	Nil	426	85	75	0.82	3	0.27	3.74	0.39	ND
96		"	HP	42	28.9	7.8	2770	1663	697.2	74.5	0.0	0.6	186	186.0	0.0	40	1076	205	640	13	1.4	1.17	2.98	0.34	0.012
97		Nanahabipura	BW	91	30.9	7.55	1340	750	145.5	46.5	68.0	3.2	396	116.1	279.9	Nil	402	184	380	0.32	5.3	0.4	4.97	0.25	0.065
98		Mindhol	BW	45	30.1	7.4	1570	800	124.6	33.3	104.2	2.8	512	83.2	428.8	Nil	454	242	305	0.38	8.4	0.28	6.97	0.08	0.018
99	Sinor	Surasamal	BW	61	--	7.42	1400	860	140.2	37.6	89.0	2.7	460	93.9	366.1	Nil	432	181	275	0.38	10	0.28	7.09	0.19	0.059
100		Vaniad	BW	82	31.6	7.68	814	552	144.1	35.6	18.3	1.3	164	88.9	75.1	Nil	332	58	90	0.88	3.1	0.25	5.95	0.26	0.06
101		Motafofaliya	BW	--	30.6	7.56	1160	702	118.2	32.1	68.0	2.2	360	80.2	279.8	Nil	412	114	1[illegible]0	0.44	9.2	0.29	6.38	0.12	ND

ND-Not Detected

Trace Element Distribution in the Study Area

Annexure 4.5

Taluka	Village	Well Type	Be		Al	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Sr	Mo	Cd	Sb	Ba	Pb	U
			Concentration in ppb																		
Jambusar	Kaliari	BW	0.02	3.006	60.12	19.2	9.52	8.700	475.86	0.1	1.360	5.3	4.08	2.76	99.16	2.62	0	0.1	5.66	0.6	1.56
	Sindhav	BW	0.02	1.740	34.8	40.2	8.34	7.58	487.06	0.1	1.36	6.32	7.06	5.96	366.76	21.62	0	0.3	16.64	1.72	1.28
	Kora	BW	0.02	3.254	65.08	29.3	6.92	6.000	499.02	0.1	1.300	5.46	11.6	7.4	659.7	25.52	0.1	0.2	302.3	1.62	3.22
	Kora	HP	0.12	2.348	46.96	54.2	5.84	5.48	458.34	0.1	1.16	7.62	17	10.9	217.82	5.42	0.1	0.1	19.22	1.28	1.96
	Nadiad	BW	0.00	3.651	73.02	37.5	5.8	5.080	475.74	0.1	1.120	5.72	7.96	6.36	579.4	12.06	0	0.4	40.18	0.98	2.94
	Dabha	BW	0.2	1.212	60.6	12.0	15.3	18.95	674.95	0.1	4.2	2.6	13.4	5	206.4	0.65	ND	0.1	6.9	3.5	0.05
	Dabha	BW	0.06	1.673	33.46	55.3	5.22	4.620	469.42	0.1	1.440	4.98	7.92	8.82	158.62	2.5	0.1	0.4	8.22	2.4	0.72
	Dabha	BW	0.1	0.736	73.6	13.2	41	41.4	1415.4	0.2	9	10.3	49.3	9.7	621.7	0.8	1.0	0.2	14.8	11.2	0.1
Amod	Machhhcsara	BW	0.06	2.941	58.82	60	4.76	5.5	541.42	0.1	5.48	8.18	31.5	6.6	481.98	2.14	0.1	0.2	17.04	2.58	0.24
	Machhhcsara	BW	0.18	0.889	17.78	52.4	8.82	5.140	370.64	0.1	0.920	9.6	6.98	15.4	33.22	12.36	0	4.8	9.1	44.5	1.6
	Dadapor	BW	0.04	0.895	17.9	26.6	6.96	4.46	460.18	0.5	2.92	7.86	4.96	5.52	527.28	1.06	0	0.2	27.48	3.02	0.88
	Dadapor	HP	0.18	0.463	9.26	35.5	5.78	5.780	379.26	0.1	3.100	11	22.4	4.78	48.54	3.04	0.1	0.9	6.24	26.6	1.32
	Asnera	BW	0.05	0.544	27.2	7.8	34.8	20.75	754.6	0.1	5.25	2.8	13.6	4.6	350.25	0.35	ND	0.4	14.95	1.65	0.05
	Asnera	HP	0.08	1.189	23.78	3.62	6.38	8.5	306.9	0.1	3.22	1.9	9.5	1.98	49.34	0.084	0.1	0.1	5.78	3.44	0.02
	Dora	BW	0.08	0.432	8.64	3.02	7.30	10.18	310.42	0	1.84	1.16	6.84	2.12	111.15	0.22	0.1	0	4.32	5.52	0.02
	Dora	HP	0.3	1.345	134.5	16.5	26.8	35	1435.9	0.1	5.9	4.5	20.9	6.6	38.9	0.3	0.4	0.4	8.1	8.7	0.1
Vagra	Keshwan	BW	0.02	1.375	27.5	6.68	5.5	7.02	312.98	0.1	1.8	4.16	15.4	2.94	70.2	5.32	0.1	0	5.12	0.76	0.08
	Keshwan	HP	0.6	0.432	43.2	19.2	32.5	36.5	1573.9	0.2	12	6.3	45.1	7.4	56.7	0.9	0.3	0.2	20.6	9.3	0.5
	Janiadara	HP	0.08	1.421	71.05	12	15.2	19.75	760.65	0.1	4.55	4.4	31.8	5	94.1	16.25	0.1	0.1	3.75	2.05	0.1
	Kakam	BW	0.1	0.634	63.4	11.7	26	34.2	1425.8	0.2	8.9	3.8	20.1	7.5	121.6	1.3	0.6	0.2	17.4	2.6	--
	Kakam	HP	0.06	1.545	30.9	37.1	4.58	8.360	1244.9	0.5	8.920	14.7	18.7	16.7	5743.5	4.64	0.1	0.2	225	1.46	0.3
	Vachhnad	BW	0.06	1.491	29.82	91.6	5.08	4.02	514.96	0.1	2	3.82	5.94	10.8	472.38	4.1	0	0.3	18.34	1.32	0.84
Bharuch	Manad	BW	0.2	1.556	77.8	15.7	13.6	17.55	803	0.1	5.45	2.75	9.1	3.7	64.3	0.4	ND	0.2	8.4	1.65	0.05
	Manad	HP	0.05	0.752	37.6	11.5	12.5	16.05	824.7	0.1	3.6	2.3	5.7	3.3	16.2	2.95	ND	0.1	7.95	1.45	0.05
	Samar	BW	0.08	29.845	596.9	35.3	5.54	7.26	854.26	0.2	5.22	15.3	26.7	12.8	2411.9	6.54	0.1	0.1	55.14	1.82	0.54
	Vasdada	BW	0.04	1.098	21.96	67.7	5.1	8.360	461.52	0.2	2.940	8.2	57.6	5.3	497.02	2.38	0.2	1.5	45.62	24.9	0.3
	Parkhet	BW	0.04	0.742	14.84	47.7	5.58	7.12	426.72	0.1	2.92	14.9	30.6	3.8	161.12	6.56	0.1	0.2	15.48	7.72	0.48
	Paguthan	BW	0.18	0.763	15.26	44.9	4.64	7.000	418.24	0.1	1.560	5.46	21	4.08	163.24	5.74	0.1	0.4	10.72	9	0.32
	Paguthan	HP	0.04	0.806	16.12	86.9	4.68	5.64	426.06	0.1	1.56	6.46	15.1	5.02	86.64	2.08	0.1	0.3	4.4	28.5	0.5
	Uparali	BW	0.04	0.479	9.58	45.4	9.06	14.220	440.62	0.1	2.000	6.7	36.7	3.5	145.52	5.18	0.1	0.1	8.4	8.84	0.12
	Kavitha	BW	0.15	1.522	76.1	9.35	18.6	20.8	876.55	0.2	6.8	2.65	34.9	3.1	75.35	0.4	0.1	0.1	26.2	5.1	0.05
Padra	Masar	BW	0.18	1.188	23.76	28.7	8.82	10.64	436.02	0.1	2.7	13.7	17.3	6.36	338.96	3.96	0	0.2	16.98	3.6	0.72
	Masar	HP	0.1	0.299	5.98	19.3	7.58	7.300	427.32	0.1	1.500	9.78	16.5	4.04	78.38	7.36	0.1	0.6	3.74	22.9	1.34
	Dhobikuva	BW	0.24	9.810	196.2	12.6	10.5	9.2	431.78	0.1	1.58	7.68	15.7	2.06	77.34	1.06	0.1	0.4	8.36	2.84	1.36
	Ambada	BW	0.1	1.980	39.6	40.3	12.3	8.160	434.76	0.1	2.100	12.1	8.54	2.84	270.28	13.06	0.1	0.3	14.12	24.8	4.54
	Darapura	BW	0.04	1.233	24.66	12.5	10.6	8.46	443.36	0.1	2.64	16.2	26	3.08	314.34	1.68	0.1	0.1	7.52	29.6	1.12
	Sarsavani	BW	0.00	9.251	185	22.7	9.48	7.480	428.2	0.1	0.140	8.52	18.1	5.78	51.72	7.1	0.1	0.8	21.72	68.5	3.82

Taluka	Village	Well Type	Be		Al	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Sr	Mo	Cd	Sb	Ba	Pb	U
			Concentration in ppb																		
Karjan	Chorbhuj	BW	0.14	0.652	13.04	28.8	7.18	8.880	507.1	0.1	3.160	6.38	57.3	3.56	656	1.3	0	0.1	13.4	31.6	0.42
	Karamadi	BW	0.24	0.335	6.7	37.7	6.74	7.8	497.46	0.1	2.42	6.1	32.9	3.54	520.52	2.08	0	0.1	8.98	34.6	0.34
	Kiya	BW	0.00	0.790	15.8	29.4	6.44	8.740	456.58	0.1	2.260	5.52	47.3	5.06	205.76	2.66	0	0.3	7.22	31.4	0.38
	Dhavat	BW	0.04	0.387	7.74	38.6	6.18	9.1	439.16	0.1	1.92	8.72	32	2.84	60.96	2.74	0.1	0.8	9.16	42.7	0.38
	Kanthariya	BW	0.04	0.557	11.14	49.8	5.84	6.740	442.26	0.1	1.040	4.24	8.84	2.56	154.36	3.22	0	0.1	7.22	13.1	0.4
Vadodara	Shankarda	BW	0.06	0.843	16.86	2.64	5.34	7.8	348.68	0.1	5.02	3.28	20.6	1.24	110.2	0.1	0.1	0	7.92	1.34	0.02
	Sewasi	BW	0.00	0.538	10.76	7.04	6.38	7.880	419.74	0.1	1.520	18.8	20.6	1.58	149.92	2.32	0	0.9	29.36	26.1	1.52
	City	BW	0.32	0.732	14.64	8.04	11.3	9.16	441.18	0.1	2.48	8.6	57	2.14	355.4	0.92	0	0.2	10.96	59.3	1.4
	Makarpura	BW	0.18	0.488	9.76	16.2	11.1	8.960	417.54	0.1	2.540	8.08	34.0	1.96	52.82	0.54	0.1	0.1	5.08	53.4	0.44
	Makarpura	HP	0.1	0.904	18.08	34.9	12.5	7.74	420.04	0.1	1.66	13.6	8.16	3.72	147.58	7.06	0	0.1	12.06	51.7	7.94
	Ankhi	BW	0.00	0.514	25.7	5.75	13.4	16.5	806.65	0.1	5.3	3.4	27.7	3.2	69.65	0.15	0.3	0.2	10.95	2.1	0.05
Savli	Amarapura	BW	0.00	0.277	5.54	24.2	8.36	8.360	413.24	0.1	1.920	5.86	21.8	1.46	64.52	0.96	0	0.3	4.12	44.6	0.76
	Gothada	BW	0.05	1.147	57.33	5.5	17.8	18	828.7	0.1	3.95	2.7	21.8	2.5	44.9	0.25	0.3	0.1	7.75	5.6	0.05
	Gothada	BW	0.1	1.526	30.52	17.1	6.86	8.040	435.22	0.1	4.200	6.1	22.6	1.18	151.96	1.92	0.1	0.1	6.76	19.7	0.38
	Manjusar	BW	0.1	0.331	6.62	9.1	6.46	7.14	426.56	0.1	2.64	8.62	12.8	0.94	357.34	0.76	0.1	0.1	5.2	13.3	0.46
	Kadachhcla	BW	0.14	0.415	8.3	28.5	6.12	7.040	401.6	0.1	1.660	8.38	25.7	2.12	37.14	1.3	0.1	0.4	4.28	39.4	0.58
	Kadachhcla	HP	0.04	11.936	238.7	18.1	5.3	8.52	417.68	0.2	9	10.6	18.6	2.72	30.34	2.22	0	0.4	34.26	6.92	0.58
	Nahra	BW	0.1	2.316	46.32	18.9	5.56	6.920	411.02	0.1	1.760	7.78	19	1.46	184.46	2.64	0	0.1	3.74	18.5	2.62
	Moti Bhadol	BW	0.04	1.331	26.62	21.1	5.6	8.6	438.56	0.1	1.92	4.04	51.6	2.02	178.66	0.9	0	0.1	19	9.62	0.5
	Moti Bhadol	HP	0.1	0.526	10.52	17.7	5.5	6.640	447.12	0.1	1.620	3.2	16	1.34	425.48	0.88	0.1	0.7	6.22	30	0.52
	Khakharia	BW	0.02	0.461	9.22	2.72	5.3	6.48	319.7	0	1.98	1.34	2.38	1.24	11.4	0.2	0.1	0	2.54	0.44	0.02
Waghodia	Kamrol	BW	0.00	1.075	21.5	28.3	16.2	6.1	384.12	0.1	1.2	9.78	5.28	1.82	29.64	0.56	0	0.1	3.36	30.2	6.04
	Kamrol	HP	0.14	1.026	20.52	28.4	11.2	8.300	383.88	0	1.160	4.7	6.68	1.34	42.5	1.76	0.1	0.1	4.94	29.3	1
	Abhrampura	BW	0.04	2.038	40.76	22.4	9.32	7.06	398.06	0.1	0.78	5.36	11.3	2.8	67.72	2.22	0	0.1	10.24	37.4	2.18
	Juna Rampura	BW	0.14	0.583	11.66	5.68	6.92	7.680	428.96	0.1	1.580	4.64	24.2	1.36	252.02	1.38	0.1	0.1	13.26	30.6	0.62
	Falod	BW	0.6	0.671	67.1	7.7	33.9	34.6	1724.8	0.2	14.2	8.5	62.4	5.9	163.9	0.2	0.5	0.1	23.2	10.1	0.1
	Falod	HP	0.14	2.665	53.3	31.2	6.56	5.860	362.2	0.1	1.280	5.98	4.06	3.5	738.84	105.7	0.1	0.1	48.54	29.8	1.82
	Gorej	HP	0.28	3.175	63.5	5.32	8.34	6.88	376.14	0.1	1.16	6.78	17.6	1.9	103.32	0.94	0	0.1	6.36	41.9	0.16
Dabhoi	Rasulpura	BW	0.1	3.939	78.78	16.4	15.1	6.08	360.42	0.1	0.66	8.12	4.5	1.76	36.7	6.26	0	0.1	5.24	39.1	12.6
	Anguthan	BW	0.00	0.612	12.24	12.1	9.08	6.060	363.16	0.1	0.840	7.54	3.44	1.42	20.02	7.52	0	0.2	0.29	28.6	24.58
	Anguthan	BW	0.04	0.414	8.28	28.3	6.96	6.84	378.46	0.1	0.76	3.4	7.26	1.28	18.12	1.02	0	0.1	4	25.3	0.86
Sinor	Nanahabipura	BW	0.00	0.644	12.88	38.6	6.54	7.22	404.32	0.1	1.04	4.22	7.14	1.56	24.78	1.12	0	0.1	3.94	40.6	0.6
	Mindhol	BW	0.1	0.483	9.66	44.4	6.74	6.540	384.7	0.1	0.940	6.54	8.1	1.72	84.68	3.54	0	0.1	3.42	33.1	1.28
	Vaniad	BW	0.02	0.452	9.04	2.9	11.8	7.56	336.16	0	2.14	1.06	15.1	1.28	21.64	0.1	0.1	0.1	3.56	0.82	0.02

Annexure 5.1

Summation of Annual Rainfall in Study Area (1961-2003)

YEAR	Bharuch				Vadodara													Nandod	Study Area Average
	JAMBUSAR	AMOD	VAGRA	BHARUCH	PADRA	KARJAN	VADODARA	SAVLI	WAGHODIYA	DABHOI	SINOR	SANKHEDA	Tilakwada	Jetpur - pavi	Nsawadi	Chhota udaipur	Kawant	Kevadia col.	
1961	-	612	-	-	952.5	753.9	872.29	-	-	-	-	-	713.59	-	-	-	-	-	781
1962	512	404.7	416.6	617.5	1018.5	739.19	685.6	900.1	731.1	879.1	-	1097	674.6	-	983	1024.8	-	-	763
1963	772.89	732.2	850.8	893.9	1359	776.79	1003.39	1094.6	913.39	702.09	823	941.7	917.99	-	823.3	1082.5	-	725.2	901
1964	1224.69	1206.59	918.1	1290	1502.5	1106.2	842.1	728	865.59	-	1127.09	776	651.79	-	726	902.59	482.8	-	957
1965	579.1	355	639.59	605.1	858.1	634	510.6	720.2	512.1	619.69	693.96	485.1	832.3	-	775.79	657.29	488.2	534.2	618
1966	309.19	581	541.2	576.3	739.6	719.79	768.2	533	714.2	759.4	712.69	920.7	652.9	-	696.4	696.69	220.9	689.8	637
1967	914.8	757.79	773.79	787.2	959	1039.29	1048.6	965	-	1223.59	889	1201	1121.8	-	1251.39	1112.8	220.9	1339.19	975
1968	418.2	466	596.19	810.7	654	529.1	555.09	456.5	424.5	753.7	695	739.29	1223.09	-	599.6	766.89	101	930.99	631
1969	724.89	777	681.79	645.09	1091	930.8	1078.8	-	1444	720.5	1054	1250.59	1662.69	-	1277.89	-	1263	-	1043
1970	921.4	1079	1502.5	1440.29	1719	1282.49	2160.59	-	1570	1676.99	1446	1824.39	1740.59	-	1838.29	1585.5	447	-	1482
1971	603.09	1022	611.4	613.4	1162	834.49	676.3	-	822.8	993.499	723	995.79	1059.99	-	814.79	919	421	661.49	808
1972	286.19	509	328.2	340.09	401	656	380.2	425.1	634.7	667	946.59	727	795.19	-	777.4	532	533	764.3	571
1973	775.79	859	752.2	862.99	1173	922.09	1227.59	1018	1455.1	1342.69	1146.59	1483	1514.79	1424.99	1292	1423	1297.1	1294.99	1181
1974	257.39	298	372.29	117.39	311.09	230.39	303.9	559.59	400.59	739.9	429.69	496	634.4	529.79	660.59	425	693	463.5	440
1975	651.89	991	903.8	682.7	907	1017	812.9	1745	882.69	846.29	1409.4	1087.89	1536.29	837.1	1079.2	767	856.6	-	1001
1976	1172.99	1064.1	1110.3	219.5	1421.7	1352	1730	2688.7	2111.5	1701.99	1988	1902	2582.29	2238.2	2209.29	1778	1381.9	1938.5	1699
1977	785.7	748	742.59	577.5	1181	1416.5	1070.6	2003.49	1181.5	1051.49	1485	1407	1710.6	1585.2	1444.19	1462	779	1160.1	1211
1978	718.6	728	767.8	758.6	1251.09	1212	1074.09	1009.3	1534.9	1026.5	1290	1206	1377.59	992	888.49	1105	1205	975.6	1062
1979	598.99	946	570.59	592	864	1254.6	620.8	636	817.19	886.79	1010	732.5	1207.19	802.1	849	866	863.9	1154.7	848
1980	886.19	532	454.39	397	1099	991.29	940.49	736.39	1246.09	702.6	661.5	745	771.8	817.39	689.69	696.1	498.5	580.8	747
1981	602	891	782.89	-	748	931	810.3	912.79	1165	1502.19	1401	1470	1745.5	1406.3	1186.6	2008.09	526.1	1175.4	1133
1982	625	469.19	433.49	-	668	856.6	644.39	613	731	724.5	736	830	833.1	441	585.09	743	-	585.39	657
1983	1054.8	903	998.1	596.79	1258	1298	1378.09	999	1027.5	964.3	1467.5	1209.69	1267.89	466.89	1127.1	1524.6	656.8	1132.59	1074
1984	395	425	597.49	604.4	552	829	706.69	639	582.6	1062.6	990	920	1195.69	1413	875	921.49	586	857	786
1985	486	268.9	321.8	1111.3	544	714	632.49	707	629.2	775.3	894	405.5	869.19	421	432	528.79	286	-	590
1986	290	293	301.69	1090	321.2	491	303.49	303.09	429.99	588	674	386	583.4	448.49	408.19	526.59	262.1	455.89	453
1987	299	233	182	1017.5	412.3	320	393.6	286	341.4	438.89	315	496.39	479.49	353.9	553	625	202	518.79	415
1988	845	529	689	1671	1018.5	1059	1003.5	1099	987.5	1411.1	829	1061	1140.3	1177.79	689.1	1276	740	1054.4	1016
1989	922	534.1	575	1306	825	1131.29	856	967	461.09	828.8	748	1010	1043	970.6	970	1129	585	890.89	875
1990	783	598	487	439.4	1476	1084.4	779.69	1027.1	780.8	1211.8	585.5	1479	1159.5	1522.5	1228	1068	789	1198.3	983
1991	568	384	255	231	777	1022	700.29	726	753.4	585	485	1041	856	746.5	720	688	535	680.59	653
1992	572	451	606	769.5	962	741	754.6	695	516	802	670	1120	695	820	641	851	487	630.4	710
1993	822	637	413	459	826	1036	806.49	786	749	786	702	1349	1256	914.5	927	942	732	939.6	838
1994	975	792	612	913.5	935	1222	1350.7	1217	1090	1093	795	1986	1209	1709.5	939	1353	831	1038.3	1115
1995	507	349	297	635	445	1039	638	541	1039	743	567	911	808	746	722	729	495	720.2	663
1996	400	389	475	739	766	891	1045.1	1151	992	840	725.29	2077	1259.4	1497	1137	1215	1267	939.4	989
1997	571	507	460	890	750	1875	1170	1164	971.5	757	618	1736	1715	1261	1372	1070	1142	1020.19	1058
1998	776	771	631	1760	469	1912	1154	1174	1116	1760	988	1345	1448	1045	1233	1256	989	1146.89	1165
1999	252	290	254	527	146	716	350	533	398	314	1581	776	582	443	528	338	383	625.39	502
2000	262	279.5	361	541	229	890	398	606.29	315	480	400	464	405	236	308	279	157	405.4	390
2001	437	695	685	926	482	572	858	734	516	-	795	1213	596	935	846.5	-	1007	715.4	751
2002	616	861	936	1092	375	933.5	806	661	685.5	745	501	846	809	-	705.5	591.5	-	951.09	757
2003	613.5	1016	1153	947.5	438	1075.5	979	1102	1011.5	1516	1079	1345	1176	1049	415	-	970	1223.79	1006
Mean	**637.79**	**633.35**	**620.01**	**777.35**	**838.30**	**954.35**	**857.69**	**893.90**	**867.10**	**930.56**	**904.31**	**1083.20**	**1081.70**	**975.02**	**910.10**	**960.65**	**667.92**	**892.18**	**858.99**
Maximum	**1224.69**	**1206.59**	**1502.50**	**1760.00**	**1719.00**	**1912.00**	**2160.59**	**2688.70**	**2111.50**	**1760.00**	**1988.00**	**2077.00**	**2582.29**	**2238.20**	**2209.29**	**2008.09**	**1381.90**	**1938.50**	**1699.50**
Minimum	**252.00**	**233.00**	**182.00**	**117.39**	**146.00**	**230.39**	**303.49**	**286.00**	**315.00**	**314.00**	**315.00**	**386.00**	**405.00**	**236.00**	**308.00**	**279.00**	**101.00**	**405.40**	**389.79**
Range	**972.69**	**973.59**	**1320.50**	**1642.61**	**1573.00**	**1681.61**	**1857.10**	**2402.70**	**1796.50**	**1446.00**	**1673.00**	**1691.00**	**2177.29**	**2002.20**	**1901.29**	**1729.09**	**1280.90**	**1533.10**	**1309.71**
SD (mm)	**266.83**	**262.28**	**286.69**	**406.08**	**377.92**	**336.70**	**366.93**	**506.81**	**420.61**	**416.10**	**406.15**	**456.44**	**442.09**	**600.88**	**400.12**	**469.64**	**392.74**	**441.97**	**277.91**
Coefficient of Variation	41.84	41.41	46.24	52.24	45.08	35.28	42.78	56.70	48.51	44.71	44.91	42.14	40.87	61.63	43.96	48.89	58.80	49.54	32.35

Source: Data Centre (Gandhinagar)

Annexure 1.2

Departure and Cumulative Departure from Mean Annual Rainfall of Rainguage Station Located in the Study Area

YEAR	JAMBUSAR D	JAMBUSAR CD	AMOD D	AMOD CD	VAGRA D	VAGRA CD	BHARUCH D	BHARUCH CD	PADRA D	PADRA CD	KARJAN D	KARJAN CD	VADODARA D	VADODARA CD
1961	-	-	-0.03	-0.03	-	-	-	-	0.14	0.14	-0.21	-0.21	0.07	0.02
1962	-0.20	-0.20	-0.36	-0.39	-0.33	-0.33	-0.21	-0.21	0.21	0.35	-0.23	-0.44	-0.20	-0.18
1963	0.21	0.01	0.16	-0.23	0.37	0.04	0.15	-0.06	0.62	0.98	-0.19	-0.62	0.17	-0.01
1964	0.92	0.93	0.91	0.67	0.48	0.52	0.66	0.60	0.79	1.77	0.16	-0.46	-0.02	-0.03
1965	-0.09	0.84	-0.44	0.23	0.03	0.55	-0.22	0.38	0.02	1.79	-0.34	-0.80	-0.40	-0.43
1966	-0.52	0.32	-0.08	0.15	-0.13	0.43	-0.26	0.12	-0.12	1.67	-0.25	-1.04	-0.10	-0.54
1967	0.43	0.76	0.20	0.34	0.25	0.68	0.01	0.13	0.14	1.82	0.09	-0.95	0.22	-0.32
1968	-0.34	0.41	-0.26	0.08	-0.04	0.64	0.04	0.17	-0.22	1.60	-0.45	-1.40	-0.35	-0.67
1969	0.14	0.55	0.23	0.31	0.10	0.74	-0.17	0.00	0.30	1.90	-0.02	-1.43	0.26	-0.41
1970	0.44	1.00	0.70	1.01	1.42	2.16	0.85	0.86	1.05	2.95	0.34	-1.08	1.52	1.11
1971	-0.05	0.94	0.61	1.62	-0.01	2.15	-0.21	0.65	0.39	3.34	-0.13	-1.21	-0.21	0.90
1972	-0.55	0.39	-0.20	1.43	-0.47	1.68	-0.56	0.08	-0.52	2.81	-0.31	-1.52	-0.56	0.34
1973	0.22	0.61	0.36	1.78	0.21	1.89	0.11	0.19	0.40	3.21	-0.03	-1.55	0.43	0.77
1974	-0.60	0.01	-0.53	1.25	-0.40	1.49	-0.85	-0.65	0.63	2.59	-0.76	-2.31	-0.65	0.13
1975	0.02	0.03	0.56	1.82	0.46	1.95	-0.12	-0.78	0.08	2.67	0.07	-2.25	-0.05	0.07
1976	0.84	0.87	0.68	2.50	0.79	2.74	-0.72	-1.49	0.70	3.36	0.42	-1.83	1.02	1.09
[illegible]	0.23	1.10	0.18	2.68	0.20	2.94	-0.26	-1.75	0.41	3.77	0.48	-1.35	0.25	1.34
1978	0.13	1.23	0.15	2.83	0.24	3.17	-0.02	-1.78	0.49	4.26	0.27	-1.08	0.25	1.59
1979	-0.06	1.17	0.49	3.32	-0.08	3.09	-0.24	-2.01	0.03	4.30	0.31	-0.76	-0.28	1.32
1980	0.39	1.56	-0.16	3.16	-0.27	2.83	-0.49	-2.50	0.31	4.61	0.04	-0.72	0.10	1.41
1981	-0.06	1.50	0.41	3.57	0.26	3.09	-	-	-0.11	4.50	-0.02	-0.75	-0.06	1.36
1982	-0.02	1.48	-0.26	3.31	-0.30	2.79	-	-	-0.20	4.30	-0.10	-0.85	-0.25	1.11
1983	0.65	2.14	0.43	3.74	0.61	3.40	-0.23	-2.74	0.50	4.80	0.36	-0.49	0.61	1.71
1984	-0.38	1.76	-0.33	3.41	-0.04	3.36	-0.22	-2.96	-0.34	4.45	-0.13	-0.62	-0.18	1.54
1985	-0.24	1.52	-0.58	2.83	-0.48	2.88	0.43	-2.53	-0.35	4.10	-0.25	-0.87	-0.26	1.28
1986	-0.55	0.97	-0.54	2.30	-0.51	2.37	0.40	-2.13	-0.62	3.49	-0.49	-1.36	-0.65	0.63
1987	-0.53	0.44	-0.63	1.66	-0.71	1.66	0.31	-1.82	-0.51	2.98	-0.66	-2.02	-0.54	0.09
1988	0.32	0.77	-0.16	1.50	0.11	1.77	1.15	-0.67	0.21	3.19	0.11	-1.91	0.17	0.26
1989	0.45	1.21	-0.16	1.34	-0.07	1.70	0.68	0.01	-0.02	3.18	0.19	-1.73	0.00	0.26
1990	0.23	1.44	-0.06	1.29	-0.21	1.49	-0.43	-0.42	0.76	3.94	0.14	-1.59	-0.09	0.17
1991	-0.11	1.33	-0.39	0.89	-0.59	0.90	-0.70	-1.13	-0.07	3.86	0.07	-1.52	-0.18	-0.02
1992	-0.10	1.23	-0.29	0.60	-0.02	0.87	-0.01	-1.14	0.15	4.01	-0.22	-1.74	-0.12	-0.14
1993	0.29	1.52	0.01	0.61	-0.33	0.54	-0.41	-1.54	-0.01	4.00	0.09	-1.66	-0.06	-0.20
1994	0.53	2.04	0.25	0.86	-0.01	0.53	0.18	-1.37	0.12	4.11	0.28	-1.38	0.57	0.38
1995	-0.21	1.84	-0.45	0.41	-0.52	0.01	-0.18	-1.55	-0.47	3.64	0.09	-1.29	-0.26	0.12
1996	-0.37	1.47	-0.39	0.03	-0.23	-0.23	-0.05	-1.60	-0.09	3.56	-0.07	-1.36	0.22	0.34
1997	-0.10	1.36	-0.20	-0.17	-0.26	-0.49	0.14	-1.46	-0.11	3.45	0.96	-0.39	0.36	0.70
1998	0.22	1.58	0.22	0.04	0.02	-0.47	1.26	-0.19	-0.44	3.01	1.00	0.61	0.35	1.05
1999	-0.60	0.97	-0.54	-0.50	-0.59	-1.06	-0.32	-0.52	-0.83	2.19	-0.25	0.36	-0.59	0.46
2000	-0.59	0.38	-0.56	-1.06	-0.42	-1.48	-0.30	-0.82	-0.73	1.46	-0.07	0.30	-0.54	-0.08
2001	-0.31	0.07	0.10	-0.96	0.10	-1.37	0.19	-0.63	-0.43	1.03	-0.40	-0.10	0.00	-0.08
2002	-0.03	0.04	0.36	-0.60	0.51	-0.86	0.40	-0.22	-0.55	0.48	-0.02	-0.13	-0.06	-0.14
2003	-0.04	0.00	0.60	0.00	0.86	0.00	0.22	0.00	-0.48	0.00	0.13	0.00	0.14	0.00

YEAR	SAVLI D	SAVLI CD	WAGHODIYA D	WAGHODIYA CD	DABHOI D	DABHOI CD	SINOR D	SINOR CD	SANKHEDA D	SANKHEDA CD	TILAKWADA D	TILAKWADA CD	JETPUR-PAVI D	JETPUR-PAVI CD	NASWADI D	NASWADI CD
1961	-	-	-	-	-	-	-	-	-		-0.34	-0.34	-	-	-	-
1962	0.01	0.01	-0.16	-0.16	-0.06	-0.06	-	-	0.01	0.01	-0.38	-0.72	-	-	0.08	0.08
1963	0.22	0.23	0.05	-0.11	-0.25	-0.31	-0.09	-0.09	-0.13	-0.12	-0.15	-0.87	-	-	-0.10	-0.02
1964	-0.19	0.05	0.00	-0.11	-	-	0.25	0.16	-0.28	-0.40	-0.40	-1.27	-	-	-0.20	-0.22
1965	-0.19	-0.15	-0.41	-0.52	-0.33	-0.64	-0.23	0.08	-0.55	-0.96	-0.23	-1.50	-	-	-0.15	-0.37
1966	-0.40	-0.55	-0.18	-0.69	-0.18	-0.32	-0.21	-0.29	-0.15	-1.11	-0.40	-1.89	-	-	-0.23	-0.60
1967	0.08	-0.47	-	-	0.31	-0.51	-0.02	-0.31	0.11	-1.00	0.04	-1.86	-	-	0.38	-0.23
1968	-0.49	-0.96	-0.51	-1.20	-0.19	-0.70	-0.23	-0.54	-0.32	-1.32	0.13	-1.72	-	-	-0.34	-0.57
1969	-	-	0.67	-0.54	-0.23	[illegible]	0.17	-0.37	0.15	-1.16	0.54	-1.19	-	-	0.40	-0.16
1970	-	-	0.81	-0.39	0.80	0.07	0.60	0.23	0.68	-0.48	0.61	-0.58	-	-	1.02	0.86
1971	-	-	-0.05	-0.44	0.07	0.14	-0.20	0.03	-0.08	-0.56	-0.02	-0.60	-	-	-0.10	0.75
1972	-0.52	-1.48	-0.27	-0.66	-0.28	-0.15	0.05	0.07	-0.33	-0.89	-0.26	-0.86	-	-	-0.15	0.61
1973	0.14	-1.34	0.68	0.02	0.44	0.30	0.27	0.34	0.37	-0.52	0.40	-0.46	0.46	0.46	0.42	1.03
1974	-0.37	-1.72	-0.54	-1.20	-0.30	0.09	-0.52	-0.18	-0.54	-1.06	-0.41	-0.88	-0.46	0.00	-0.27	0.75
1975	0.95	-0.77	0.02	-1.18	-0.09	0.00	0.56	0.38	0.00	-1.05	0.42	-0.46	-0.14	-0.14	0.19	0.94
1976	2.01	1.24	1.44	0.26	0.83	0.83	1.20	1.57	0.76	-0.30	1.39	0.93	1.30	1.16	1.43	2.37
[illegible]	1.24	2.48	0.36	0.60	0.13	0.13	0.64	2.22	0.30	0.00	0.58	1.51	0.63	1.78	0.59	2.95
1978	0.13	2.61	0.77	1.01	0.10	0.23	0.43	2.64	0.11	0.11	0.27	1.79	0.02	1.80	-0.02	2.93
1979	-0.29	2.32	-0.06	0.95	-0.05	0.19	0.12	2.76	-0.32	-0.21	0.12	1.90	-0.18	1.62	-0.07	2.86
1980	-0.18	2.15	0.44	1.44	-0.24	-0.06	-0.27	2.49	-0.31	-0.52	-0.29	1.62	-0.16	1.46	-0.24	2.62
1981	0.02	2.17	0.34	1.79	0.61	0.80	0.55	3.04	0.36	-0.17	0.61	2.23	0.44	1.90	0.30	2.92
1982	-0.31	1.85	-0.16	1.29	-0.22	0.38	-0.19	2.85	-0.23	-0.40	-0.23	2.00	-0.55	1.36	-0.36	2.57
1983	0.12	1.97	0.18	1.47	0.04	0.61	0.62	3.48	0.12	-0.28	0.17	2.17	-0.52	0.84	0.24	2.80
1984	-0.29	1.69	-0.33	0.96	0.14	0.76	0.09	3.57	-0.15	-0.43	0.11	2.28	0.45	1.28	-0.04	2.77
1985	-0.21	1.48	-0.27	0.68	-0.17	0.45	-0.01	3.56	-0.63	-1.06	-0.20	2.08	-0.57	0.72	-0.53	2.24
1986	-0.66	0.82	-0.50	0.45	-0.37	0.08	-0.25	3.31	-0.64	-1.70	-0.46	1.62	-0.54	0.18	-0.55	1.69
1987	-0.68	0.14	-0.61	-0.15	-0.53	-0.45	-0.65	2.65	-0.54	-2.24	-0.56	1.06	-0.64	-0.46	-0.39	1.30
1988	0.23	0.37	0.14	-0.59	0.52	0.07	-0.08	2.57	-0.02	-2.26	0.05	1.12	0.21	-0.25	-0.24	1.05
1989	0.08	0.45	-0.47	0.12	-0.11	-0.56	-0.17	2.40	-0.07	-2.33	-0.04	1.08	0.00	-0.25	0.07	1.12
1990	0.15	0.60	-0.10	0.49	0.30	-0.26	-0.35	2.05	0.37	-1.97	0.07	1.15	0.56	0.30	0.35	1.47
1991	-0.19	0.41	-0.13	0.36	-0.37	-0.63	-0.46	1.58	-0.04	-2.01	-0.21	0.94	-0.23	0.07	-0.21	1.26
1992	-0.22	0.19	-0.40	0.09	-0.14	-0.77	-0.26	1.32	0.03	-1.97	-0.36	0.59	-0.16	-0.09	-0.30	0.96
1993	-0.12	0.07	-0.14	-0.05	-0.16	-0.78	-0.22	1.10	0.25	-1.73	0.16	0.75	-0.06	-0.15	0.02	0.98
1994	0.36	0.43	0.26	0.34	0.17	-0.61	-0.12	0.98	0.83	-0.89	0.12	0.87	0.75	0.60	0.03	1.02
1995	-0.39	0.03	0.20	0.54	-0.20	-0.81	-0.37	0.61	-0.16	-1.05	-0.26	0.61	-0.23	0.37	-0.21	0.81
1996	0.29	0.32	0.14	0.49	-0.10	-0.91	-0.20	0.41	0.92	-0.13	0.16	0.78	0.54	0.90	0.25	1.06
1997	0.30	0.62	0.12	0.61	-0.19	-1.00	-0.32	0.09	0.60	0.47	0.59	1.36	0.29	1.20	0.51	1.57
1998	0.31	0.94	0.29	0.78	0.89	-0.10	0.09	0.18	0.24	0.71	0.34	1.70	0.07	1.27	0.35	1.92
1999	-0.40	0.53	-0.54	0.23	-0.66	-0.77	0.75	0.93	-0.28	0.43	-0.46	1.24	-0.55	0.72	-0.42	1.50
2000	-0.32	0.21	-0.64	0.14	-0.48	-1.25	-0.56	0.37	-0.57	-0.15	-0.63	0.61	-0.76	-0.04	-0.66	0.84
2001	-0.18	0.03	-0.40	-0.27	-	-	-0.12	0.25	0.12	-0.03	-0.45	0.17	-0.04	-0.08	-0.07	0.77
2002	-0.26	-0.23	-0.21	-0.07	-0.20	-1.45	-0.45	-0.19	-0.22	-0.24	-0.25	-0.09	-	-	-0.22	0.54
2003	0.23	0.00	0.17	0.10	0.63	-0.82	0.19	0.00	0.24	0.00	0.09	0.00	0.08	0.00	-0.54	0.00

YEAR	Chhota udaipur D	Chhota udaipur CD	Kawant D	Kawant CD	KEVADIA D	KEVADIA CD	Study Area Average D	Study Area Average CD
1961	-	-	-	-	-	-	-0.09	-0.09
1962	0.07	0.07	-	-	-	-	-0.11	-0.20
1963	0.13	0.20	-	-	-0.19	-0.19	0.05	-0.15
1964	-0.06	0.14	-0.28	-0.28	-	-	0.11	-0.04
1965	-0.32	-0.18	-0.27	-0.55	-0.40	-0.59	-0.28	-0.32
1966	-0.27	-0.45	-0.67	-1.22	-0.23	-0.82	-0.26	-0.58
1967	0.16	-0.30	-0.67	-1.89	0.50	-0.09	0.14	-0.44
1968	-0.20	-0.50	-0.85	-2.74	0.04	-0.05	-0.27	-0.71
1969	-	-	0.89	-1.85	-	-	0.21	-0.50
1970	[illegible]	0.15	-0.33	-2.18	-	-	0.73	0.23
1971	-0.04	0.11	-0.37	-2.55	-0.26	-0.31	-0.06	0.17
1972	-0.45	-0.34	-0.20	-2.75	-0.14	-0.45	-0.34	-0.16
1973	0.48	0.14	0.51	-1.81	0.45	0.00	0.38	0.21
1974	-0.56	-0.41	0.04	-1.77	-0.48	-0.48	-0.49	-0.28
1975	-0.20	-0.61	0.28	-1.49	-	-	0.17	-0.11
1976	0.85	0.24	1.07	-0.42	1.17	0.70	0.98	0.87
[illegible]	0.52	0.76	0.17	-0.25	0.30	[illegible]	[illegible]	1.28
1978	0.15	0.91	0.80	0.55	0.09	0.79	0.24	1.51
1979	-0.10	0.81	0.29	0.85	0.29	1.08	-0.01	1.50
1980	-0.28	0.53	-0.25	0.59	-0.35	0.44	-0.13	1.37
1981	1.09	1.62	-0.21	0.38	0.32	0.76	0.32	1.69
1982	-0.23	1.40	-	-	-0.34	0.10	-0.23	1.45
1983	0.59	1.99	-0.02	0.36	0.27	0.37	0.25	1.70
1984	-0.04	1.94	-0.12	0.24	-0.04	0.06	-0.08	1.62
1985	-0.45	1.50	-0.57	-0.33	-	-	-0.31	1.31
1986	-0.45	1.04	-0.61	-0.94	-0.49	-0.43	-0.47	0.83
1987	-0.35	0.69	-0.70	-1.64	-0.42	-0.85	-0.52	0.32
1988	0.33	1.02	0.11	-1.53	0.18	-0.25	0.18	0.50
1989	0.18	1.20	-0.12	-1.65	0.00	-0.25	0.02	0.52
1990	0.11	1.31	0.18	-1.47	0.34	0.09	0.14	0.66
1991	-0.28	1.03	-0.20	-1.67	-0.24	-0.14	-0.24	0.42
1992	-0.11	0.91	-0.27	-1.94	-0.29	-0.20	-0.17	0.25
1993	-0.02	0.89	0.10	-1.84	0.05	-0.15	-0.02	0.23
1994	0.41	1.30	0.24	-1.60	0.16	-0.04	0.30	0.52
1995	-0.24	1.06	-0.26	-1.86	-0.19	-0.23	-0.23	0.29
1996	0.26	1.32	0.90	-0.96	0.05	0.02	0.15	0.45
1997	0.11	1.44	0.71	-0.25	0.14	0.16	0.23	0.68
1998	0.31	1.75	0.48	0.23	0.29	0.30	0.36	1.03
1999	-0.65	1.10	-0.43	-0.20	-0.30	0.00	-0.42	0.62
2000	-0.71	0.39	-0.76	-0.96	-0.55	-0.24	-0.55	0.07
2001	-	-	0.51	-0.46	-0.20	-0.44	-0.13	-0.05
2002	-0.38	0.00	-	-	0.07	-0.18	-0.12	-0.17
2003	-	-	0.45	0.00	0.37	0.19	0.17	0.00

Annexure 5.3

Seasoanal Water Level Fluctuation Data from the Study Area (Source:GWRDC, Gandhinagar)

Sr. No.	Taluka	Village	1993		1994		1995		1996		1997		1998		1999		2000		2001		2002		2003		Decadal Avg.		Elevation (m)
			May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	
1		Bhadkodra	7.33	5.74	7.6	5.90	6.82	5.71	7.27	6.20	7.46	5.90	6.80	4.60	6.00	6.95	7.10	7.00	7.20	6.85	6.15	6.43	7.64	6.25	7.0	6.1	6.4
2		Dahegam	11.90	10.32	11.8	9.04	10.85	9.40	11.95	8.75	11.73	9.50	8.68	8.90	10.33	--	--	12.05	12.82	--	--	--	12.05	6.88	11.3	9.4	12.2
3		Kalak	8.00	6.40	8.1	5.60	8.48	0.00	9.75	9.75	9.75	0.00	6.53	5.77	--	--	--	--	--	--	--	--	--	--	8.4	4.6	10.0
4	Jambusar	Kavi	12.40	11.16	11.6	11.97	9.96	10.98	10.90	11.70	11.34	12.80	10.30	9.02	5.60	4.00	5.97	5.10	--	4.20	5.92	4.25	6.28	3.36	9.0	8.0	17.4
5		Sarod	16.65	12.65	17.4	12.97	14.85	14.30	15.95	15.60	16.80	15.75	16.50	15.95	16.35	16.20	15.02	18.10	18.00	16.35	--	17.75	--	17.35	16.4	15.7	16.8
6		Tankaria	4.68	2.00	4.8	1.50	3.60	3.72	6.30	3.40	6.20	2.30	7.45	1.32	7.35	4.95	7.00	3.30	5.60	2.30	4.86	2.80	5.30	2.00	5.7	2.7	12.1
7	Amod	Amod	--	7.99	--	15.90	17.78	16.35	18.30	18.30	18.30	17.00	18.30	15.00	--	--	--	--	--	--	--	--	--	--	18.2	15.1	14.1
8	Vagra	Vagra	12.10	10.35	11.8	9.25	11.55	10.47	12.05	10.27	12.35	11.15	12.03	8.96	11.90	11.05	13.10	11.80	-	10.15	-	12.08	-	10.85	12.1	10.6	15.3
9		Bharuch	8.70	6.38	9.1	4.22	6.90	6.90	9.45	5.57	9.45	7.45	9.30	5.40	8.35	8.15	-	9.00	-	12.35	-	-	-	-	8.7	7.3	18.7
10	Bharuch	Sankhwad	10.40	6.55	11.1	4.00	8.40	8.40	11.15	6.95	8.50	8.50	9.70	1.70	9.80	6.10	11.20	6.70	8.50	7.60	8.26	2.85	3.75	3.00	9.2	5.7	8.9
11		Chansad	16.09	14.70	16.4	13.90	14.55	14.55	15.50	14.55	15.55	12.36	12.50	[illegible]	12.00	12.30	16.50	13.80	16.90	15.60	17.20	13.09	13.95	13.00	15.2	13.5	25.4
12		Amla	21.56	19.21	21.5	16.60	19.01	17.86	21.16	15.66	20.96	17.46	17.83	16.56	--	--	-	-	-	-	-	-	-	-	20.3	17.2	24.9
13	Padra	Masor	15.40	15.45	15.0	16.18	--	16.18	15.63	16.18	16.18	--	15.41	16.15	16.18	--	--	--	--	--	--	--	--	--	15.6	16.0	21.2
14		Asoj	28.06	27.95	27.9	6.03	27.05	29.50	27.60	29.50	29.50	26.80	24.73	25.46	25.48	26.05			--	--	--	--	--	--	27.2	16.0	42.8
15		Atladara	15.28	13.48	14.8	12.40	12.28	12.28	12.93	11.23	11.75	9.88	11.73	10.00	10.40	10.20	10.80	10.10	10.60	9.88	11.38	9.24	11.08	8.13	12.1	10.6	31.3
16		Sokhda	22.08	15.80	21.1	11.37	17.75	17.55	21.20	11.70	18.17	11.90	17.10	10.60	17.35	17.00	22.00	22.10	-	18.80	-	-	24.20	15.50	20.1	15.2	41.4
17	Vadodara	Dashrath	21.23	18.65	20.8	16.60	20.55	20.70	20.90	16.80	18.25	15.90	17.65	15.60	17.50	17.60	18.10	17.80	17.60	16.80	17.10	16.90	19.90	15.60	19.1	17.2	39.5
18		Varnama	16.80	14.15	15.3	10.80	13.20	13.17	14.15	11.50	13.20	8.35	10.97	7.35	11.20	12.30	13.35	12.35	15.40	13.50	14.94	13.40	13.75	9.70	13.8	11.5	25.3
19		Bapod	7.15	6.75	7.4	2.85	7.15	6.10	7.25	4.45	7.05	4.67	8.07	0.50	8.80	8.95	12.10	9.50	10.55	6.55	10.40	4.50	7.05	1.85	8.4	5.2	35.1
20		Tundav	16.66	14.62	--	10.35	13.97	0.00	13.85	9.00	12.90	11.00	13.01	8.75	13.58	13.35	--	14.92	--	16.20	18.95	19.50	--	10.83	14.7	11.7	44.6
21		Gothada	--	10.99	--	7.42	11.60	11.60	11.60	7.20	11.60	9.00	11.11	5.70	9.90	--	--	--	--	--	--	--	--	--	11.2	8.7	49.8
22	Savli	Rasulpur	11.02	5.30	8.0	7.21	4.82	5.40	8.90	3.20	6.47	2.95	5.60	2.72	6.00	9.95	11.15	11.16	10.45	9.90	--	11.38	--	6.55	8.1	6.9	51.1
23		Vadala	10.01	3.25	12.2	5.51	11.86	11.42	12.90	11.42	11.45	9.25	12.65	8.35	11.25	11.50	13.33	10.03	13.34	9.95	12.13	10.76	12.56	7.15	12.2	9.0	60.6
24		Jarod	7.70	4.50	8.6	2.05	6.25	4.55	9.15	2.60	6.25	3.00	5.10	1.05	5.55	5.70	8.75	8.05	8.90	6.92	8.95	7.35	-	4.25	7.5	4.5	55.8
25		Goraj	9.10	7.93	8.6	5.95	7.45	6.00	7.85	4.95	6.90	6.33	6.00	4.10	6.40	7.45	7.95	7.55	9.65	7.75	8.25	7.00	7.90	6.00	7.8	6.5	68.2
26	Vaghodia	Kandha	10.45	1.23	9.5	0.29	11.55	1.00	11.97	0.25	10.85	0.70	8.00	0.35	11.20	7.65	6.65	6.55	4.45	0.45	7.60	3.05	6.85	0.80	9.0	2.0	48.9
27		Bhaniyara	10.40	9.03	11.4	8.20	10.75	9.20	11.50	9.90	11.47	8.85	11.25	6.70	9.95	13.30	-	-	-	10.65	-	-	-	9.15	11.0	9.4	42.7
28		Saidal	7.12	5.46	7.7	2.37	--	4.50	6.83	3.50	6.04	3.50	5.60	3.70	5.57	5.47	7.25	7.82	--	6.83	7.89	7.98	--	4.48	6.7	5.1	64.4
29		Karamasiya	11.44	4.00	--	--	13.80	9.39	12.06	8.10	10.20	--	4.29	7.97	9.22	--	--	--	--	--	11.23	--	--	--	10.3	7.4	74.3
30		Amreshwar	7.05	8.03	9.4	1.80	8.75	5.35	9.60	1.72	7.87	3.80	7.76	0.60	7.85	7.90	9.20	7.20	10.15	3.95	-	-	-	-	8.6	4.5	51.8
31		Vega	11.42	5.92	11.8	5.28	10.84	7.55	11.51	5.50	13.10	5.00	7.65	5.00	7.55	11.23	--	17.00	--	11.85	10.73	--	--	8.15	10.6	8.2	39.1
32	Dabhoi	Chhatral	16.81	12.62	16.9	10.90	15.69	13.25	16.30	9.00	14.65	10.00	11.63	7.15	12.00	11.50	16.60	15.55	18.30	10.30	18.30	13.30	17.25	15.20	15.9	11.7	35.3
33		Dharampuri	19.25	18.23	19.3	18.70	19.20	17.70	19.55	18.10	19.20	17.85	17.93	14.82	17.70	8.95	18.85	18.75	20.00	18.65	19.15	15.95	18.80	17.35	19.0	16.8	44.7
34		Sathod	--	9.42	12.3	8.43	10.85	8.65	18.05	6.95	10.30	7.60	6.75	5.10	9.30	9.10	23.00	19.30	23.30	9.50	11.93	8.95	12.00	6.85	13.8	9.1	40.4
35	Sinor	Sinor	22.78	20.01	22.4	17.93	23.93	17.80	23.73	19.81	21.93	20.63	21.64	16.16	21.56	20.63	23.73	22.63	25.53	20.13	24.83	22.13	25.78	19.83	23.4	19.8	32.5
36		Sankheda	19.80	18.68	19.6	16.80	18.90	18.75	19.90	16.18	18.90	18.35	18.60	16.60	18.90	19.20	-	-	-	-	-	-	-	-	19.2	17.8	58.2
37		Manjrol	--	13.50	--	9.92	14.20	11.55	--	3.55	12.80	10.30	10.80	7.40	12.30	11.60	-	-	-	-	-	-	-	-	12.5	9.7	54.9
38		Bodeli	3.16	0.36	2.8	0.95	2.34	1.36	2.58	--	--	0.88	1.95	--	--	--	--	1.07	2.89	1.23	0.62	0.96	1.58	0.59	2.2	0.9	83.2
39	Sankheda	Makni	--	10.25	9.7	12.15	11.75	--	9.40	10.68	9.35	11.95	7.95	11.40	11.90	--	--		8.75	--	--	--	--	--	9.8	11.3	71.9
40		Alladpur	9.34	6.74	9.3	7.75	9.42	7.96	10.35	7.71	9.60	8.00	8.38	7.25	8.68	8.00	9.70	8.92	11.28	10.23	9.23	7.40	9.98	6.81	9.6	7.9	78.3
41		Govindpura	6.02	3.47	6.1	3.00	6.03	4.23	7.01	3.83	6.39	4.12	6.30	3.57	5.81	4.67	6.15	7.05	9.70	5.52	7.63	4.77	7.26	3.28	6.8	4.3	51.0
42		Pitha	12.64	8.95	13.7	4.92	9.31	8.17	10.90	5.70	9.11	5.86	9.28	6.06	8.56	8.84	10.39	9.70	12.02	11.48	12.54	11.78	--	9.52	10.8	8.3	75.8

Sr. No.	Taluka	Village	1993		1994		1995		1996		1997		1998		1999		2000		2001		2002		2003		Decadal Avg.		Elevation (m)
			May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	May	Nov	
43		[illegible]jetha	--	7.00	[illegible]	7.00	0.90	7.00	7.00	29.80	31.98	7.00	7.00	29.67	--	[illegible]	[illegible]	30.93	--	--	--	31.67	32.02	[illegible]	[illegible]	20.2	[illegible]
44	Tilakwada	Utavli	30.47	30.10	30.9	29.80	28.90	28.90	30.00	29.80	29.90	29.65	29.30	29.40	30.50	27.60	30.90	20.50	-	-	-	-	-	-	30.1	28.2	49.2
45		Namaria	17.60	15.40	17.8	14.50	16.40	15.40	17.00	14.85	15.50	14.60	13.85	13.00	14.30	14.00	-	-	-	-	-	-	-	17.90	16.1	15.0	66.8
46		Bhundol	8.55	5.98	7.1	3.84	6.19	8.46	7.14	5.44	10.75	4.00	6.36	5.80	6.50	8.54	8.60	8.15	9.54	10.26	7.34	6.85	8.81	3.38	7.9	6.4	110.1
47		Pavi	4.48	2.44	4.2	2.72	3.50	2.58	4.10	2.70	3.35	3.00	3.70	2.08	3.80	3.22	4.70	5.25	6.52	4.37	--	4.35	6.13	2.98	4.4	3.2	107.8
48		Suskal	7.51	4.63	6.0	2.41	4.40	4.56	6.39	3.70	5.54	4.15	4.41	4.35	3.31	5.56	--	--	--	7.21	--	5.01	--	4.19	5.4	4.6	93.1
49		Bar	10.23	6.48	10.9	3.78	9.33	6.28	9.69	1.08	9.43	5.58	8.71	1.56	9.06	9.03	12.53	12.03	-	8.63	12.95	10.18	-	5.38	10.3	6.4	151.1
50	Jetpur Pavi	Gutanwad	6.81	6.16	6.9	5.88	6.60	5.35	7.20	6.05	6.55	7.15	5.65	5.50	2.65	2.90	8.05	8.00	8.05	6.35	8.05	7.09	-	6.65	6.6	6.1	132.5
51		Jabugam	7.85	4.58	8.3	1.93	6.20	4.22	7.45	2.00	5.60	3.00	6.25	2.10	6.30	5.50	9.50	9.10	-	6.10	-	5.10	-	2.70	7.2	4.2	87.8
52		[illegible]	10.30	4.57	10.5	2.40	5.70	4.57	6.95	6.97	9.20	3.15	6.10	1.80	6.60	6.00	7.80	7.60	10.10	7.50	8.75	8.30	10.4[illegible]	5.90	8.4	5.3	115.3
53		Karali	10.15	6.45	10.2	5.82	8.90	6.90	10.05	5.77	9.35	6.35	8.10	4.40	7.60	6.30	10.50	10.50	10.75	4.95	10.70	8.38	10.65	6.10	9.7	6.5	99.5
54		Uchapan	4.94	4.76	5.0	3.89	4.00	4.16	6.51	4.41	4.16	5.56	2.87	2.46	3.52	3.86	7.16	6.96	--	-	-	-	-	-	4.8	4.5	117.9
55		Dugdha	8.60	3.78	7.3	3.00	8.65	3.95	8.20	3.10	5.00	4.85	4.55	3.50	6.85	3.20	8.70	8.30	8.70	3.50	7.55	3.40	5.90	2.90	7.3	4.0	260.7
56		Saripani	8.58	6.15	9.1	5.63	7.40	6.00	8.90	5.50	8.30	7.35	8.75	5.35	9.20	8.40	-	-	-	5.50	-	-	-	5.50	8.6	6.2	129.1
57	Nasvadi	Tanakhla	8.75	5.65	8.5	3.77	8.50	4.80	8.06	4.10	8.20	8.20	8.50	6.98	--	9.00	-	7.70	-	8.70	-	-	-	7.40	3.4	6.6	103.7
58		Vadiya	--	8.36	10.9	7.26	9.62	7.95	9.38	6.58	9.03	10.68	8.38	6.06	8.51	8.23	10.48	10.13	10.70	8.88	10.68	10.30	10.13	6.28	9.8	8.2	64.9
59		Sengpur	9.58	5.13	8.6	3.35	9.32	6.53	8.93	3.40	6.92	3.90	8.70	3.90	8.30	8.74	9.70	9.80	12.87	7.86	9.73	7.23	9.07	3.00	9.3	5.7	129.6
60		Waghach	6.04	4.72	6.2	1.99	5.93	5.22	7.40	1.90	6.13	4.90	8.61	4.90	6.45	6.38	6.85	7.00	--	5.03	5.97	4.80	9.03	3.96	6.9	4.6	113.4
61		Navapara	8.40	6.80	7.3	5.50	6.50	5.70	6.75	5.70	5.80	5.80	7.25	5.60	5.60	5.35	7.50	6.60	5.80	5.45	7.35	5.70	9.50	5.65	7.1	5.8	69.8
62	Nandod	Chhindiapura	5.88	5.52	6.0	5.30	5.50	5.08	5.85	5.35	5.70	5.20	5.42	5.90	5.50	5.10	6.15	6.40	7.30	5.60	8.10	5.40	5.60	5.30	6.1	5.5	72.1
63		Survani	5.28	2.98	5.3	2.75	5.10	2.85	5.23	2.67	4.75	4.05	5.30	2.65	5.80	3.60	6.00	5.00	--	3.20	6.70	6.70	5.50	2.70	5.5	3.6	225.3
64		Ferkuva	6.69	7.00	8.2	6.68	7.28	4.70	7.08	5.44	6.36	4.50	7.10	4.57	6.15	6.73	9.85	8.85	10.20	10.20	10.38	7.40	9.17	4.25	8.0	6.4	91.4
65		Jojh	11.11	8.76	11.2	6.85	11.13	8.86	11.80	7.50	10.88	7.80	11.10	7.40	11.25	10.70	12.20	11.18	--	11.03	12.50	11.44	--	8.45	11.5	9.1	167.2
66		Chisadia	10.90	9.88	11.0	8.72	11.18	10.00	13.38	9.50	10.93	9.40	11.00	9.51	11.22	11.17	10.90	--	--	10.95	--	--	--	9.30	11.3	9.8	199.0
67	Chhotaudepur	Asala	7.50	4.63	8.0	3.50	7.35	5.28	8.42	4.10	7.04	4.60	8.52	4.08	8.72	9.41	9.10	9.94	--	7.30	8.82	7.95	9.65	4.19	8.3	5.9	127.6
68		Ambala	5.20	2.95	5.5	2.70	4.75	2.50	5.50	1.70	5.00	2.65	4.94	2.55	5.60	5.10	8.40	8.40	8.50	4.60	6.95	4.46	6.60	3.00	6.1	3.7	222.2
69		Zoz	11.07	9.00	11.5	6.18	10.75	8.80	11.10	7.15	11.00	7.85	11.28	7.15	9.80	8.30	12.80	12.70	12.82	11.30	--	11.75	--	6.50	11.3	8.8	167.2
70		Kevdi	7.40	5.58	7.5	4.12	6.80	5.65	7.45	4.20	6.90	4.95	6.95	3.62	6.10	6.80	8.45	7.70	9.10	6.50	8.73	6.58	8.10	4.90	7.6	5.5	197.8
71		Panwad	9.22	4.10	9.0	3.37	10.00	5.48	8.36	4.50	9.17	5.30	9.43	4.25	8.49	8.05	16.30	14.45	--	6.58	8.07	6.88	15.18	3.12	10.3	6.0	168.3
72		Baladgam	11.79	10.03	12.1	9.01	11.85	10.27	13.00	9.50	13.85	10.75	12.41	10.00	12.05	11.85	12.75	13.21	--	11.65	13.13	12.10	--	--	12.5	10.8	176.1
73	Kavant	Vagudan	6.73	4.65	6.7	4.80	6.32	5.01	6.65	5.53	8.53	5.70	8.53	5.10	8.53	--	--	6.65	--	6.38	--	--	--	--	7.2	5.5	261.1
74		Dungargam	10.80	7.50	11.0	7.55	10.80	8.00	11.10	10.[illegible]	13.18	9.40	11.92	5.00	11.50	10.10	14.70	14.50	13.10	7.80	12.82	8.75	13.70	5.70	12.2	8.6	162.2
75		Nalvant	6.30	5.00	5.5	4.50	5.05	3.50	9.40	2.30	5.65	5.20	5.52	4.50	5.00	4.50	9.25	8.10	8.88	5.80	8.35	4.80	9.60	4.30	7.1	4.8	151.3
76		Raisingpura	11.78	8.10	11.7	3.06	10.90	5.67	10.60	2.65	9.57	4.25	11.20	1.09	8.10	7.07	11.90	11.60	10.90	7.07	9.85	9.03	9.92	4.60	10.6	5.8	345.7

Summary of the Thesis Entitled

APPLIED HYDROGEOLOGICAL STUDIES ON THE ALLUVIAL DEPOSITS BETWEEN LOWER REACHES OF MAHI AND NARMADA RIVERS, GUJARAT

Submitted to

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

For The Degree of

Doctor of Philosophy in Geology

by

SUMIT TRILOKCHANDRA DABRAL

Department of Geology
Faculty of Science
The Maharaja Sayajirao University of Baroda
Vadodara – 390 002

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INTRODUCTION

Development of any area to a large extent depends upon the utilizable water resources present and its development potential. Rapid pace of industrial and agricultural development coupled with population growth has necessitated to look in the intricacies of hydrogeological regime with a view to reexamine the role of natural processes that affect the natural water resources in terms of quality and quantity. Further, to explore the possibilities of tapping deeper water resources and aspects of conjunctive use.

The Study Area:

The Gujarat state is bestowed with a wide variation of geo-environmental conditions. Its rock formation, from present day to 2500 million years displays wide variety of rock types. Out of the state's total area of about 1,96,000 km^2, nearly 80,000 km^2 (~40%) is covered by hard rocks and about 82,000 km^2 (~60%) is occupied by alluvial plain (Merh, 1995). Groundwater in the state occurs in all geological formations. The unconsolidated and semi-consolidated formations being porous and permeable constitute ideal repositories of groundwater. Whereas in hard rock (consolidated formations the occurrence of groundwater is restricted within the weathered and fractured zones.

The study area constitutes a part of Mahi - Narmada interstream (Doab) region. It has a distinct physiographic boundary and is bordered by the Gulf of Cambay in the West, the rocky uplands in the East, Mahi River in the North and Narmada River in the South and sprawl in about 11,000 sq km. The area lies between 72° 30' E and 73° 43' E longitudes and 21° 40' N and 22° 53' N latitudes, falling in 46/ B, C, F G, J & K topographic sheets of the Survey of India. The alluvial tract being part of "Gujarat alluvial plains" comprises huge thickness of marine, fluvial and aeolian sediments deposited during the Quaternary period. These sediments consists of intercalations of sand, silt, clay and gravel fractions with the perceived development of clacretised bands. These unconsolidated sediments and serve as repository for groundwater in unconfined, semi-confined and confined conditions. The Eastern part of the study area is covered by hard rocks consisting of Deccan Trap, Granite, Gneiss, Quartzite, Phyllite, Slate, Schist, Marble, Sandstone, Dolomite and Limestone.

Objective and Scope:

The study aims at carrying out an in-depth study on hydrogeological aspects of Mahi-Narmada Interstream area with the following defined objectives:

1. To work out the various hydrogeological environs through understanding the role of quaternary processes.
2. Hydrogeochemical study of the groundwater with special reference to seasonal changes in ionic content and its characterization in terms of potability and toxicity.
3. Isotopic study of the groundwater delineates the regions of groundwater recharge and its pattern.
4. To work out various geochemical facies, to identify groundwater characteristics and source (recharge) area.
5. To envisage water resource management model through identified ground water recharge sites using Remote Sensing and Geographical Information System (RS & GIS) techniques.

Approach and Methodology:

To achieve the above cited objectives a multi - disciplinary approach has been adopted. The envisaged methodology has dealt with following aspects.

1. Geological Framework:

- Physiographically the study area constitutes a part of Mainland Gujarat. This area is geologically represented by the rocks of Precambrain Crystallines, sedimentaries of Cretaceous, Deccan Traps and Sedimentary formations of Tertiary and Quaternary periods. The Cambay Graben is one of the three major marginal rift basins in the western margin of the Indian Craton and situated in Gujarat (Biswas, 1982). Mesozoic rocks and Deccan basalts in the Cambay basin forms the floor over which Cenozoic sediments have been deposited. The thickness of Quaternary and Tertiary sediments tends to varies in Cambay basin. The Eastern Cambay Basin Bounding Fault extends almost N-S across the middle of the Mainland broadly separating the Quaternary deposits from older rocks. The structure is reflected in the topography which typically shows progressive stepping down from south to north along E-W faults and from east to west along N-S faults (Maurya et al., 2000).

2. *Field work and Geochemical Analysis:*

- The prime objective of the study was to work out various hydrogeochemical environs of groundwater. This was achieved through groundwater sampling on seasonal basis. For this entire area was divided into 10 x 10 km grid. From the grid, center point was picked up as the nodal village for water sample collection. From each village one open well sample, one hand pump sample (considering it as a shallow aquifer) and one tube well (considering it as a deeper aquifer) sample was collected for pre and post monsoon seasons. The water samples were collected for a period of two years i.e. pre- monsoon period of the year 2002 to post monsoon period of the year 2003. Details on groundwater sampling is given in Table No-1

Table-1 Pattern of Groundwater Sampling in Study Area.

Sr. No.	Season	Total No of samples collected	Identified objectives	Remark
1	June 2002	52	Major Cations and Anions	Samples from Bore well, Hand pump and open well collected mainly from open area and agricultural field
2	Oct-Nov 2002	145	Major Cations and Anions and Isotope[1]	
3	May-June 2003	101	Major Cations, Anions and Trace elements[2]	
4	Oct-Nov 2003	101	Major Cations, Anions and Trace elements[3]	

[1] For isotope samples analysed at PRL, Ahmedabad
[2] For Trace elements samples analysed at NGRI, Hyderabad
[3] For Trace elements samples analysed in RSIC at IIT Powai

- Representative water samples were collected from in air tight, high density polyethylene bottles (HDPE); each bottle was previously washed with diluted hydrochloric acid and distilled water.

- For isotopic measurements, 15ml glass bottles were used to collect water samples. Moreover, for trace element analysis 100ml high density polyethylene air tight bottles were used for groundwater sample collection. These bottles were also previously rinsed with distilled water and diluted hydrochloric acid to minimize contamination.

- Infield measurements of parameters like temperature, electrical conductivity (EC, µS/cm at 25°C), Total Dissolved Salt (TDS) and pH were carried out using portable field measurement instruments. The analysis was carried out as prescribed in the manual

'Standard Methods for the Examinations of the Water and Waste Water, 20th edition'. The chemical parameter like alkalinity, total hardness, calcium hardness, magnesium hardness, chloride was done with titration method. Major cations like Na^{++}, Ca^{++}, K^{+} were analyzed with systronics 128-Flame Photometer. While parameter like sulfate, nitrate and fluorite were analyzed with UV- Spectrophotometer. Trace element analysis was done in ICP-MS and ICP-AES while isotope analysis was done at PRL. Oxygen isotopic analyses were done using a Stable Isotope Ratio Mass Spectrometer (GEO 2020, PDZ Europa U.K.) with automatic water equilibration system.

3. *Preparation of Thematic Maps:*

➢ Various thematic maps viz. Geology, drainage basin, hydrogeomorphological, slope, Digital Elevation Model (DEM), Landuse , cross-section profiles, water table contour map, geochemical maps, contour maps of variable geochemical parameters like pH, Total Dissolved Solids, Electrical conductivity, Chloride, Nitrate, Sulphate, Fluoride, Trace element and oxygen isotope etc were prepared using SOI topographic sheets (on 1:250,000 and 1:50,000 scale), satellite imageries, administrative maps, secondary data like scientific publications, government reports and information available on internet. Maps of pre and post monsoon have been developed and compared on GIS environment. For working out secular changes on groundwater regime, GWRDC and CGWB data have been used.

4. *Remote Sensing and GIS:*

➢ In the present study, integrated remote sensing and GIS techniques have been used to generate groundwater potential map and prediction of recharge zones in the study area. Various information like geology, geomorphology, soil, structures, landcover/landuse, and other relevant information have been extracted from satellite data, Survey of India (SOI) topographical sheet and aided by field checks. Spatial information of groundwater chemistry water table conditions, rainfall data have also been considered to prepare various thematic maps and subsequent analysis. Coral Draw-12 and AutoCad 2004 for map drawing, Plotchem for geochemical analysis, Arc GIS-8.6 for GIS and ERDAS Imagine 8.6 software were used for generating thematic maps. All the thematic information layers have been digitized and analyzed in GIS environment to derive composite maps for identifying suitable zones for construction of artificial recharge structures. Based on the study prima facie it appears that the eastern parts of the study area are the potential zones of groundwater recharge.

Results and Discussion:

Hydrogeomorphology Characterization

In order to study the subsurface geology of the Quaternary sequence some of the available bore holes logs were studied in greater detail. The central and western part consists of Quaternary deposits having intercalated sediments of sand, silt and clay, which host the aquifers mainly in semi-confined and unconfined conditions and at few places in confined state. Well lithologs of eastern part were also studied to know the rock type and depth of weathering.

Hydrogeochemistry

Chemical hydro geological investigation has been carried out with a view to characterize groundwater for its domestic and irrigation suitability. The average range of constituent ions in groundwater samples of pre and post monsoon periods indicate minute but noticeable change in their ionic content. The average difference indicate an overall decrease in pH, TDS, Ca, Mg and Sulphate whereas increase in total hardness, chloride and nitrate concentration from pre to post monsoon season. The pH level of the ground water fall in alkaline field and most of them are well within the range. Categorizing water in accordance with the drinking water standards has established that majority of samples have either one or two constituents in higher concentration making it unfit for drinking. δ^{18} O isotopic concentration of groundwater sample shows considerable variation in stable isotopic values ranging between -3.16 to 1.06‰. Pieper's Trilinear plot has been used to determine the genetic classification of water. Overall ground water facies in the study area is Na-Mg-Ca-K: SO_4-Cl-4CO_3 type. The Gibb's plots indicate that evaporation is a main geochemical process occurring in the study area which is trending towards rock water interaction.

The correlation coefficient among various chemical variables shows pH –ve correlation with most of the parameters except alkalinity. The correlation between the Ec and other parameters is significantly positive except K; TDS, Na, Ca is strongly co-relatable with most of the variables except alkalinity; alkalinity is slightly negative correlatable with Mg, K, and TH, whereas significant with Ec and slightly correlatable with other parameters. Cl is significant with Ec, TDS, Na and Ca while slightly negative with pH, alkalinity; SO_4 is significant with Ec, TDS, Na, and Ca while negative with pH.

Therefore, overall groundwater quality tends to deteriorate from eastern hilly zone to western coastal plains which follow the ground water gradient direction.

Groundwater Behaviour and Resource Potential

The study area receives rainfall due to SW monsoon and is limited to the period between June to September. The period is further extended upto November due to retreating monsoon. The rainfall data for 42 years i.e. from 1961 to 2003 from 18 rain gauge stations located within the study area is used. The average rainfall for the study area stands at 858.99 mm.

The water levels from the year 1993-2003 for nearly 76 wells have been studied for its pre and post monsoon fluctuations. The fluctuation values were compared with the corresponding rainfall to deduce the sensitivity of the aquifer to rainfall. As the recharge to the aquifers is rainfall dependent, overall water levels are lowest in the month of May (Pre-monsoon) whereas higher in November (Post-monsoon). In order to develop clear understanding of seasonal behavior of water levels for litho-specific aquifers, the author has constructed observation well hydrographs by considering 1993-2003 pre and post monsoon water levels. Almost all well hydrographs show strong correlation with the rainfall input.

The groundwater resource potential assessment for any area is carried out using standard approaches that utilizes mainly replenishable component of recharge on annual basis. There exits several approaches for evaluation of groundwater recharge which in turn depends upon the factors influencing infiltration variables and their attributes. The author, for estimation of groundwater recharge has adopted Water Level Fluctuation and Specific Yield Approach and Rainfall –Recharge empirical methods as suggested by different workers. The groundwater recharge estimated by various approaches is summarized in table given below.

Table 7.1 Comparison of Groundwater recharge in the Study Area by Various Approaches.

Sr No.	Approach	Rock Type	Area (km^2)	Percentage Normal Rainfall (859mm)	Recharge (MCM)	Total Recharge (MCM)
1	G'water over Exploitation Committee	Alluvial	7488.194	20	1286.472	1597
		Hard Rock	3613.297	10	310.382	
2	Sukhija	Alluvial	7488.194	8	514.58	608
		Hard Rock	3613.297	3	93.11	
3	Specific Yield Approach	Alluvial	7488.194	*2.1-2.7	2052	2261
		Hard Rock	3613.297	*1.68-2.56	209	

*Water Table Fluctuation/Specific Yield Approach

Water Table Fluctuation and Specific Yield Approach would provide the most dependable estimates on the groundwater storage. Hence, the author has considered 2261 MCM as recharge for the study area.

Remote Sensing and GIS

- Overall characterization of the study area based on various adopted approach it can be concluded that the poor recharge zone constitutes 26.1%, moderate zone 37.2% and good recharge zone is 36.7% of the total study area.

- In the present study an integrated remote sensing and GIS based methodology has been used to identify the area suitable for recharge. This has been presently cross checked with the water table fluctuation data for this area. It has been found that the zones identified through GIS approach actually show increase in water table after monsoon which is quite higher from the other areas.

- After getting the final overlay map, the TDS contour map has been superimposed on it to identify the area suitable for groundwater development in terms of its quality also..

- The result of this study is useful for identifying potential zones for recharging shallow aquifers, while for deeper aquifers further details like sub surface information and aquifer characteristics are required along with field inputs.