For Official Use

Technical Report Series

DISTRICT GROUNDWATER BROCHURE

RAJKOT DISTRICT

GUJARAT

Compiled

By

Biswarup Mohapatra, Scientist-C

Government of India

Ministry of Water Resources

Central Ground Water Board

West Central Region

Ahmedabad

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RAJKOT DISTRICT AT A GLANCE

Sl.No	Items	Statistics	
1	**General Information**		
	i) Geographical area (Sq. Km)	11203	
	ii) Administrative Divisions (As on 2011) Number of Talukas No of towns Number of Villages	 14 23 835	
	iii) Populations (As on 2011 census) Rural Urban	37,99,770 15,91,188 22,08,582	
	iv) Average Annual Rainfall (mm)	592	
2.	**GEOMORPHOLOGY**		
	Major Physiographic Units	Pediments & Dissected Hills	
	Major Drainages	Bhadar, Aji, Machhu and Demai	
3.	**LAND USE (Sq. Km) as on 2006-07 (Source: Statistical Abstract of Gujarat 2011-12)**		
	a) Forest area b) Uncultivable land area c) Cultivable land area d) Fallow land e) Net area sown f) Area sown more than once g) Total Cropped area	368 1754 1021 274 7657 1386 9043	
4.	**MAJOR SOIL TYPES**		
	Mostly of Inceptisol and Entisol order and of Othids, Ochrepts, Orthents, Fluvents, Psamments and Aquepts suborder. The soils are sandy, loamy sand, clayey and silty type.		
5.	**AREA UNDER PRINCIPAL CROPS (Sq. Km) as on 2006-07** **(Source: Statistical Abstract of Gujarat 2011-12)**		
	Total cereals:1160 (Jowar:50, Bajra:270, Wheat:840) Total Pulses: 180, Total food Grains: 1340, Total Oil seeds:4370, Sugar Cane: 10, Cotton: 2530		
6.	**IRRIGATION BY DIFFERENT SOURCES as on 2006-07 (Areas and numbers of structures)** **(Source: Statistical Abstract of Gujarat 2011-12)**	No.	Area (Sq Km)
	Dug wells	91,109	2623
	Tube wells	1,560	
	Tanks/Ponds	-	15
	Canals	-	347
	Other Sources	-	44
	Net Irrigated area by Dug wells(Sq Km)	2513	
	Gross Irrigated area by Dug wells (Sq Km)	3446	
	Net Irrigated area by Tube wells (Sq Km)	110	
	Gross Irrigated by tube wells area (Sq Km)	125	
7.	**NUMBERS OF GROUND WATER MONITORING WELLS** OF CGWB (As on 31-03-2013) No of Dug Wells No of Piezometers	**56** 50 06	

8. **PREDOMINANT GEOLOGICAL FORMATIONS:** Dhrangadhra Sandstone of Cretaceous period and Deccan Trap basalt with Deccan traps the predominant geological formation.

9. **HYDROGEOLOGY**

Major Water Bearing Formations: Weathered & Fractured Basalts & Sandstone aquifer.

Depth to water Level during 2012-13				
Period	**Phreatic Aquifer (DTW)**		**Semi-confined Aquifer (PZ head)**	
	Min	**Max**	**Min**	**Max**
Pre Monsoon	0.78 (Maliya)	22.45 (Pedhla)	2.36 (Morbi)	13.65 (Jamkondarna)
Post Monsoon	1.68 (Morvi)	21.97 (Pedhla)	3.51 (Lodhika)	12.38 (Jamkondarna)

Long Term (10 Years) Water Level Trend (2003-2012)		
Trend	**Pre-Monsoon**	**Post- Monsoon**
Rise (m/Yr)	0.0119 (Sarvad) to 0.7058 (Ganod)	0.0056 (Lodhika) to 0.7622 (Upleta)
Fall (m/Yr)	0.0181 (Jamkondarna) to 0.1618 (Jetpur)	0.0129 (Jetpur Pethlad) to 0.8818 (Targhari)

10. **GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)**

No of wells drilled (EW, OW, Pz, SH, Total) EW 111,OW 32, PZ 8, SH 3 **Total: 154**	
Depth Range(m)	36 to 598
Discharge (Litres per minute)	8 to 1980
Transmissivity (m^2/day)	0.09 to 1100

11 **GROUND WATER QUALITY** **(As per chem. Analysis of samples collected during May 2012 NHS monitoring)**

Presence of chemical constituents more than permissible limit EC > 3000µs/Cm F > 1.5 mg/l NO_3 > 50mg/l	 04 villages 21 villages 02 villages
Type of water	Fresh & Saline

12.

DYNAMIC GROUND WATER RESOURCES (As on 2011)in MCM	
Annual Replenishable Ground Water Resources	1528.25
Net Ground water Availability	1451.83
Annual Ground Water Draft	948.65
Projected Demand for Domestic and industrial Uses up to 2025	103.44
Stage of Ground Water Development (%)	65.34

13 **AWARENESS AND TRAINING ACTIVITY**

Mass Awareness Programmes (MAP)	**NIL**
Water Management Training Programmes organized (WMTP)	**NIL**

14 **EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**

Projects completed by CGWB (No & Amount spent)	**NIL**
Projects under technical guidance of CGWB (Numbers)	**NIL**

15	**GROUND WATER CONTROL AND REGULATION (2011)**	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Semi Critical Blocks	Nil
	Number of Safe Blocks	14
	Number of Saline Blocks	Nil
	No. Of Blocks Notified by CGWA	Nil
16	**MAJOR GROUND WATER ISSUES** 1. Fast declining water level 2. Salinity in ground water. 3. High concentration of fluoride in major part of the district. 4. Ground water contamination due to unscientific well construction. 5. Uniformity in pumping pattern is required. 6. Demand vis-a-vis supply management. 7. Awareness among local people regarding water conservation measures required.	

DISTRICT GROUND WATER BROCHURE
RAJKOT

1.0 Introduction

Rajkot is one of the most important districts of the Saurashtra. The area falling under most of the district was part of United States of Saurashtra. Rajkot district lies between Latitude 20°30' & 23°12' North and 70°00' & 71°45' East. It is bounded by little Rann of Kachchh in the north, Surendranagar district in the east, Jamnagar district in the west and Junagadh and Amreli districts in the south. Rajkot district comprises of 14 talukas, i.e., Rajkot, Kotada Sangani, Gondal, Jetpur, Dhoraji, Upleta, Jamkandorna, Lodhika, Paddhari, Morvi, Maliya, Wankaner, Jasdan and Tankara. Rajkot district has a geographical area of about 11203 sq. km having 23 towns and 835 villages. The population of the district as per Census 2011 is 37,99,770.

The Major rivers flowing through Rajkot district are Bhadar, Aji, Machhu, Demai and their tributaries. Some other small streams are Phulki, Jhinjhora and Ghodadroi. All the rivers, except the Bhadar, have very small catchments and are ephemeral in nature.

1.1 Studies/Activities by CGWB

Systematic hydrogeological survey was first taken up by S.K.Sharma in 1972-73 when he covered about 6000 sq. km area in northern parts of district comprising Malia, Morvi and parts of Wankaner taluka. Subsequently different workers of GSI and CGWB took up hydrogeological surveys in the district. The following table shows the areas covered by hydrogeological surveys by different officers.

Area Covered	Geographical Area (sq. km)	Year	Officer
A. Systematic Hydrogeological Surveys			
Wankaner Taluka along with adjoining parts of Surendranagar district.		1971-72	S. Romani
Northern parts comprising Malia, Morvi & parts of Wankaner Taluka	6000	1972-73	S. K. Sharma
Central parts	2018	1984-85	M. S. Jethra
Parts of district falling in Bhadar River Basin		1979-80	M. R. Kulkarni
Parts of Jasdan taluka	1693	1988-89	Ahmad
B. Reappraisal Hydrogeological Surveys			
Entire Rajkot District		1988-89	P. K. Jain P.C.Panchbhaya A.B.Kawade K.Balakrishna

1.2 Groundwater Exploration

The groundwater exploration in the district has been carried from 1969-72 and continued AAP 2006-07. The maximum depth of the borewells drilled is 598m at Lodika village. Accelerated exploration for drought relief has also been carried out during 1998-99 and 2003-04.

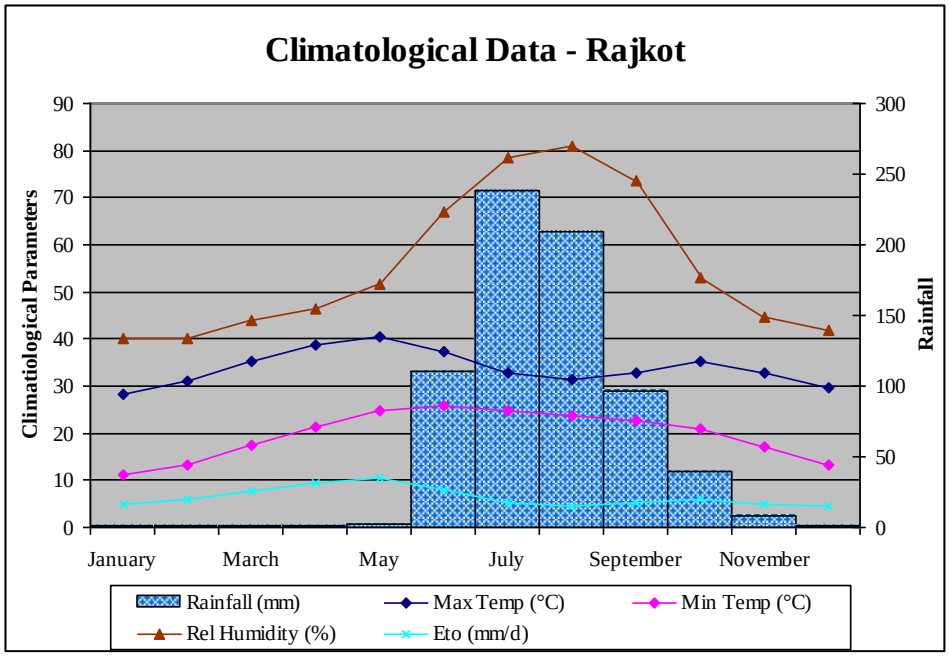
2.0 Rainfall and Climate

The district has semi arid climate. Extreme temperatures, erratic rainfall and high evaporation are the characteristic features of this type of climate. Climatologically data of Rajkot IMD station (1951-1980) that is nearest is given in the table 1.

General climate of the district is sub-tropical and is characterised by three well-defined seasons, i.e. summer - from April to June, monsoon - from July to September, and winter - from October to March.

Table 1

Month	Max Temp (Deg.C)	Mini Temp (Deg.C)	Humidity (%)	Wind Speed Kmpd	Sunshine (Hours)	Solar Rad. (MJ/m2/d)	ET (mm/d)	Rainfall (mm)
January	28.1	11.1	40.0	224.5	8.8	16.9	4.8	0.9
February	30.9	13.1	40.0	248.2	9.2	19.4	5.9	0.6
March	35.3	17.4	44.0	297.5	9.8	22.6	7.7	1.7
April	38.7	21.2	46.5	363.1	10.3	25.0	9.4	0.6
May	40.3	24.6	51.5	485.4	9.3	24.0	10.5	2.6
June	37.4	25.8	67.0	518.3	7.1	20.6	8.0	110.1
July	32.8	24.8	78.5	487.2	3.7	15.5	5.1	238.5
August	31.4	23.8	81.0	416.1	3.8	15.3	4.5	209.8
September	32.9	22.7	73.5	313.9	7.0	19.0	5.4	96.3
October	35.4	21.0	53.0	215.3	9.3	20.2	6.0	39.8
November	32.9	17.2	44.5	188.0	9.2	17.8	5.0	7.8
December	29.5	13.1	42.0	204.4	8.7	16.0	4.6	1.1
Total	-	-	-	-	-	-	-	709.8
Average	**33.8**	**19.7**	**55.1**	**330.2**	**8.0**	**19.4**	**6.4**	**-**



3.0 Geomorphology and Soil Type

Rajkot district is situated in the central part of Saurashtra peninsula. The northern part of the district bordering the Rann of Kachchh and comprising mainly the Malia taluka, is monotonous alluvial plain country. Towards south, i.e., in Morbi and Wankaner talukas, the topography is mainly rugged and undulating because of the underlying sandstone formations. The topography in these parts in intersected by ridges form by sandstone and intrusive dykes. Further south, the main underlying rock type is Deccan Trap basalt giving rise to rugged and rolling topography intersected by ridges formed by the dykes. Some of these ridges are as high as 300m AMSL. The most prominent ridge is situated along the northern boundary of the Bhadar River and runs along the basaltic dyke locally known as Sardhar Dyke. The elevations range from almost sea level to more than 300 m AMSL. The highest point is 304 m located near Bhadala in the east-central part of the district.

The soils found in the district are mostly of Inceptisol and Entisol order and of Othids, Ochrepts, Orthents, Fluvents, Psamments and Aquepts suborder.

In the northern most part of the district comprising Malia taluka, the soils are sandy, loamy sand, clayey and silty type. They are moderately deep (25 to 75 cm). The colour of the soils is dark yellowish brown to very dark greyish brown. These soils are mostly saline with EC more than 4.0 mmhos/cm and cation exchange capacity of 20 to 40 me/10 gm of soil.

In the central part of the district comprising Wankaner, Morvi, Paddhari, Lodhika, Jasdan, Rajkot, Jam Kandorna and Kotada Sanghani talukas, the soils are of clayey loam to clay type. They are moderately deep to deep and vary in colour from very dark brown to very dark greyish brown and reddish brown. The EC of the soils is generally less than 1.0 mmhos/cm and cation exchange capacity is between 40 and 60 me/100 gm of soil.

The soils in the southern part of the district comprising Jetpur, Dhoraji, Upleta and Gondal talukas are similar to the soils of the central part. They are clayey loam to clayey type, very dark grey to dark greyish and dark brown in colour and moderately deep (25 to 75 cm). The EC of the soils is generally less than 1.0 mmhos/cm and cation exchange capacity is between 30 and 35 me/100 gm of soil.

4.0 Ground Water Scenario

4.1 Hydrogeology

Hydrogeologically the district can be broadly divided into three i.e Dhrangadhra Sandstone of Cretaceous period, Deccan Trap basalt and alluvium (Figure.5).

Dhrangadhra Sandstone:

This is the oldest water bearing formations in the district. It occupies about 1000 sq. km area in the north-eastern part comprising parts of Wankaner and Morvi talukas in continuity with the sandstone exposures in the adjoining Surendranagar district. Few sandstone inliers are also seen within the overlying basalt. The sandstone is poorly permeable in general but moderate to high permeability may be observed along the bedding planes and fractures. Exploratory drilling in this formation has revealed that

persistent carbonaceous shale; inter-bedded with medium to coarse-grained sandstone, occur at depths varying between 83 and 220 m. This shale horizon forms an important marker from the groundwater point of view as the groundwater is generally potable to brackish above it whereas as it is saline below. The groundwater in this formation occurs under phreatic to confined conditions. Exploitation of groundwater in areas underlain by Dhrangadhra Sandstone is through dug well, dug-cum-bored wells and tubewells. The depth of dug wells generally range from 10 to 40 m. The tubewells and bores in the dug-cum-bored wells are generally drilled down to 80 to 200 m bgl depending on the occurrence of shale horizon as discussed above. The yields of dug wells range between 30 and 120 m^3/day.

Deccan Trap:

Deccan trap occupies a major part of the district (about 8850 sq. km) and forms the most important aquifer system. It generally forms a poor aquifer due to compactness and poor primary porosity. However, the upper weathered parts, which at places are up to 20 m thick, form good aquifer in the district. At deeper levels, the secondary porosity developed as a result of tectonic activities, in the form of joints, and fractures, shear zones, form repository of groundwater at many places. The dykes, particularly in the southern part of the district, play an important role in occurrence and movement of groundwater. At places, the dykes are highly weathered and themselves form potential aquifers. At other places where the dykes are more compact, they act as subsurface barrier for the groundwater flow and well constructed upstream of these dykes have yield good yields.

The groundwater in Deccan trap occurs under phreatic to confined conditions. The groundwater is generally tapped through dug wells varying in depth from 10 to 50 m. At places, dug-cum-bored wells are also constructing bores below the bottom of dug wells. The yield of dug wells and dug-cum-bored wells generally range from 20 to 100 m^3/day.

Alluvium:

The fluvio-marine alluvium of Upper Tertiary to Quaternary age occupy about 1200 sq. km area in the northern parts of district in Malia and Morvi talukas It mainly consists of clay, clayey sand, silt and gravel. The alluvium in the district generally forms a poor aquifer due to predominance of argillaceous material. The groundwater development in this formation is limited due to poor quality.

Groundwater in this formation occurs under phreatic and confined conditions. It is exploited through dug wells ranging in depth from 3 to 20 m. The yields of wells range between 20 and 80 m^3/day.

Depth to Water Level

The depth to water level in the district ranges from 0.78 to 22.45mbgl during the pre monsoon period with 70% of the stations showing water level less than 10m (Figure.2). Maliya village has recorded the shallowest water level whereas the deepest water level was recorded at Pedhla village. During the post monsoon period the depth to water level ranged from 1.68mbgl at Morbi village to 21.97mbgl at Pedhla village with about 85% of the station showing water level less than 10m (Figure.3).

Long Term Water Level Trend:

Analysis of the long-term groundwater level trend for 10 years from 2003-2012 of the district reveals that rise in groundwater level predominant throughout the district. Long term rise in water level during the pre-monsoon period ranged from 0.01 to 0.70 m/yr while the fall ranged from 0.01 to 0.16 m/yr. The highest rise was recorded at Ganod village while the highest fall was recorded at Jetpur Village. The long term water level fluctuation for the Post monsoon period also reveals that rise in groundwater level is predominant thought out the entire district with rise in water level ranging from 0.0056 to 0.76m/yr while fall recorded in the district ranged from 0.013 to 0.88m/yr. Upleta village recorded the highest rise during the post monsoon period whereas Targhadi village recorded the highest fall.

4.2 Ground Water Resources

The ground water resources potential as on March 2011 of Rajkot district and stage of development are presented in table-2. It may be observed from the table that all the assessment units (Talukas) fall under safe category and the stage of ground water development of the district is 65.34%.

TABLE 2 GROUND WATER RESOURCES POTENTIAL

Sr. No.	Taluka	Net Annual Ground Water Availability (Ham)	ANNUAL GROUND WATER DRAFT (Ham)			Projected Demand for Domestic and Industrial uses upto 2025 (Ham)	Ground Water Availability for future irrigation (Ham)	Stage of Ground Water Development (%)
			Irrigation	Domestic And Industrial uses	Total			
1	2	9	10	11	12	13	14	15
1	Dhoraji	11528.44	6344.30	689.00	7033.30	924.00	4260.14	61.01
2	Gondal	17793.89	10529.60	805.00	11334.60	1079.00	6185.29	63.70
3	Jamkandorna	8589.54	5294.90	229.00	5523.90	307.00	2987.64	64.31
4	Jasdan	14101.25	8906.10	796.00	9702.10	1067.00	4128.15	68.80
5	Jetpur	11594.95	7177.70	450.00	7627.70	604.00	3813.25	65.78
6	Kotdasangani	6175.84	3853.40	231.00	4084.40	324.00	1998.44	66.14
7	Lodhika	6096.94	3871.00	140.00	4011.00	187.00	2038.94	65.79
8	Maliya	0.00	0.00	0.00	0.00	0.00	0.00	
9	Morvi	12010.81	6771.50	847.00	7618.50	1081.00	4158.31	63.43
10	Paddhari	9531.04	6170.70	221.00	6391.70	206.00	3154.34	67.06
11	Rajkot	15470.79	8317.80	2152.00	10469.80	2883.00	4269.99	67.67
12	Tankara	8054.67	5132.50	255.00	5387.50	342.00	2580.17	66.89
13	Upleta	11491.90	7217.10	516.00	7733.10	690.00	3584.80	67.29
14	Wankaner	12743.34	7462.60	485.00	7947.60	650.00	4630.74	62.37
District Total		**145183.39**	**87049.20**	**7816.00**	**94865.20**	**10344.00**	**47790.19**	**65.34**

4.3 Ground Water Quality

The results of chemical analysis of the ground water samples collected during the ground water network monitoring of May 2012 in Rajkot district is tabulated in the Table -3 below. EC>3000 μS/Cm has been observed at 4 stations, where NO3 > 50mg/l has been observed at only 2 stations. Concentration of fluoride more than the permissible limit i.e. 1.5mg/l is observed at 21 stations.

Table-3: Range of Different Chemical Constituents of Groundwater in Rajkot District

Constituents	Unit	Range
pH		7.09-8.19
EC	(μS/Cm) at 25°C	816-5890
Total Hardness	(mg/l)	110-1580
Total Dissolved Solids	(mg/l)	547-3946
HCO_3^-	(mg/l)	85-1183
Cl^-	(mg/l)	57-1631
SO_4^{--}	(mg/l)	1-453
NO_3^-	(mg/l)	0.8-152
Ca^{++}	(mg/l)	20-476
Mg^{++}	(mg/l)	14-180
Na^+	(mg/l)	45-826
K^+	(mg/l)	0.2-21.0
F^-	(mg/l)	0.0-2.26

4.4 Status of Ground Water Development (Taluka wise)

The groundwater development in the district is mainly through dug wells, bore wells and tube wells. Their yield potential and suitability of drilling rigs techniques is presented in table-4.

Table-4 Ground Water Potential & Feasible Structures

Taluka	Wells feasible	Suitable drilling technique	Depth of well (m)	Discharge (lpm)
Dhoraji, Gondal, Jamkondarna, Jasdan, Jetpur, Kotda Sangni,Lodhika, Paddahari, Rajkot,	Dugwell	Manual	10-30	80-150

Tankara, Upleta, Wankaner	Borewells	Down the Hole Hammer (DTH)	100-200 (upto 500m in Rajkot city)	100-300
Maliya	Dugwell	Manual	10-25	200-300
	Tubewells	Direct Rotary & Reverse Rotary	50-75	300-500
Morbi, Wankaner	Dugwell	Manual	15-30	200-300
	Tubewells	Direct Rotary & Reverse Rotary	100-200	600-1000

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1Ground Water Development

The groundwater development in Rajkot district is through dug well, bore well, hand pumps and tube wells etc. the district can be broadly divided into two units i.e hard rock area and soft rock area (alluvium/sandstone).

In talukas like Dhoraji, Jetpur and Kotada Sanghani those are underlain by basaltic formation, advanced techniques like remote sensing & geophysical surveys may be used for siting the groundwater structures. In the sandstone area, the scope for ground water development exists only in Wankaner taluka. Here also the quality of groundwater is brackish to saline at deeper levels. Hence, care may be taken to properly identify the saline zones through electrical logging and sealing these zone at the time of construction of tubewells. These measures are essential to prevent the existing fresh water zones from getting contaminated.

There is large area falling between Wankaner and Rajkot where the sandstone is overlain by Deccan trap Basalt. The thickness of basaltic lava flows is only few meters near the contact near Wankaner but gradually increases to more than 500 m, further south, near Rajkot. These sandstone aquifers, occurring below the basalt have not been explored so far due to limitations of the presently available drilling technology. However, reportedly the private drilling companies are constructing tubewells down to 300 m depth in these parts of district using the DTH drilling rigs. These wells pierce through 100 to 150 m thick Deccan Trap basalt and tapped the underlying sandstone aquifers. The boreholes are terminated on the top of sandstone and a small cavity is formed in the sandstone. Fairly high yields of good quality of groundwater were reported in these tubewells. Detailed groundwater explorations down to 500 m depth are required to be taken up in these areas.

5.2 Water Conservation and Artificial Recharge

The suitable recharge structures feasible in the district are Percolation tanks/ponds, Recharge wells check dams and nalla bunds etc depending on the hydrogeological conditions. In the entire hard rock terrain, scope exists for augmenting

the groundwater resources through the artificial recharge. Large scale artificial recharge schemes may not be feasible due to non availability of prolific aquifers and paucity of source water. However, small and cost effective measures like contour bunding, nalla plugging, small check dams may be quite effective in increasing the groundwater recharge.

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Various rainwater harvesting schemes depending on the suitable hydrogeological conditions have been constructed in the district viz. Check dams, Recharge wells, percolation tanks and ponds, deepening the of the village ponds etc and have shown good impact on the groundwater scenario.

6.0 Ground Water Related Issues and Problems

1. Fast declining water level
2. Salinity in ground water.
3. High concentration of fluoride in major part of the district.
4. Ground water contamination due to unscientific well construction.
5. Uniformity in pumping pattern is required.
6. Demand vis-a-vis supply management.
7. Awareness among local people regarding water conservation measures required.

7.0 Awareness and Training Activity

No Water management training programme and Mass awareness has been conducted in the district by CGWB.

8.0 Areas Notified by CGWA/SGWA

None

9.0 Recommendations

1. There is an urgent need for management of resources for sustainable development. There is not much scope for further development of groundwater resources in major parts of the district.

2. Suitable ground water regulation may be enforced for protecting the critical and semi-critical talukas of the district.

3. Creating awareness among the farmers regarding water conservation through judicious use of water and adoption of efficient irrigation techniques like drip/sprinkler irrigation.

4. Three talukas where still scope exists for development of groundwater, i.e., Dhoraji, Jetpur and Kotada Sanghani, are underlain by basaltic aquifers. Therefore, the advanced techniques like remote sensing & geophysical surveys may be used for siting the groundwater structures. In the sandstone area, the scope for ground water development exists only in Wankaner taluka. Here also the quality of groundwater is brackish to saline at deeper levels. Hence, care may be taking to properly identify the saline zones through electrical logging and sealing these

zones at the time of construction of tubewells. These measures are essential to prevent the existing fresh water zones from getting contaminated.

5. There is large area falling between Wankaner and Rajkot where the sandstone is overlain by Deccan trap Basalt. The thickness of basaltic lava flows is only few meters near the contact near Wankaner but gradually increases to more than 500 m, further south, near Rajkot. These sandstone aquifers, occurring below the basalt have not been explored so far due to limitations of the presently available drilling technology. However, reportedly the private drilling companies are constructing tubewells down to 300 m depth in these parts of district using the DTH drilling rigs. These wells pierce through 100 to 150 m thick Deccan Trap basalt and tapped the underlying sandstone aquifers. The boreholes are terminated on the top of sandstone and a small cavity is formed in the sandstone. Fairly high yields of good quality of groundwater were reported in these tubewells. Detailed groundwater exploration down to 500 m depth is required to be taken up in these areas.

6. In the entire hard rock terrain, scope exists for augmenting the groundwater resources through the artificial recharge. Large-scale artificial recharge schemes may not be feasible due to non-availability of prolific aquifers and paucity of source water. However, small and cost effective measures like contour bunding, nalla plugging, small check dams may be quite effective in increasing the groundwater recharge.

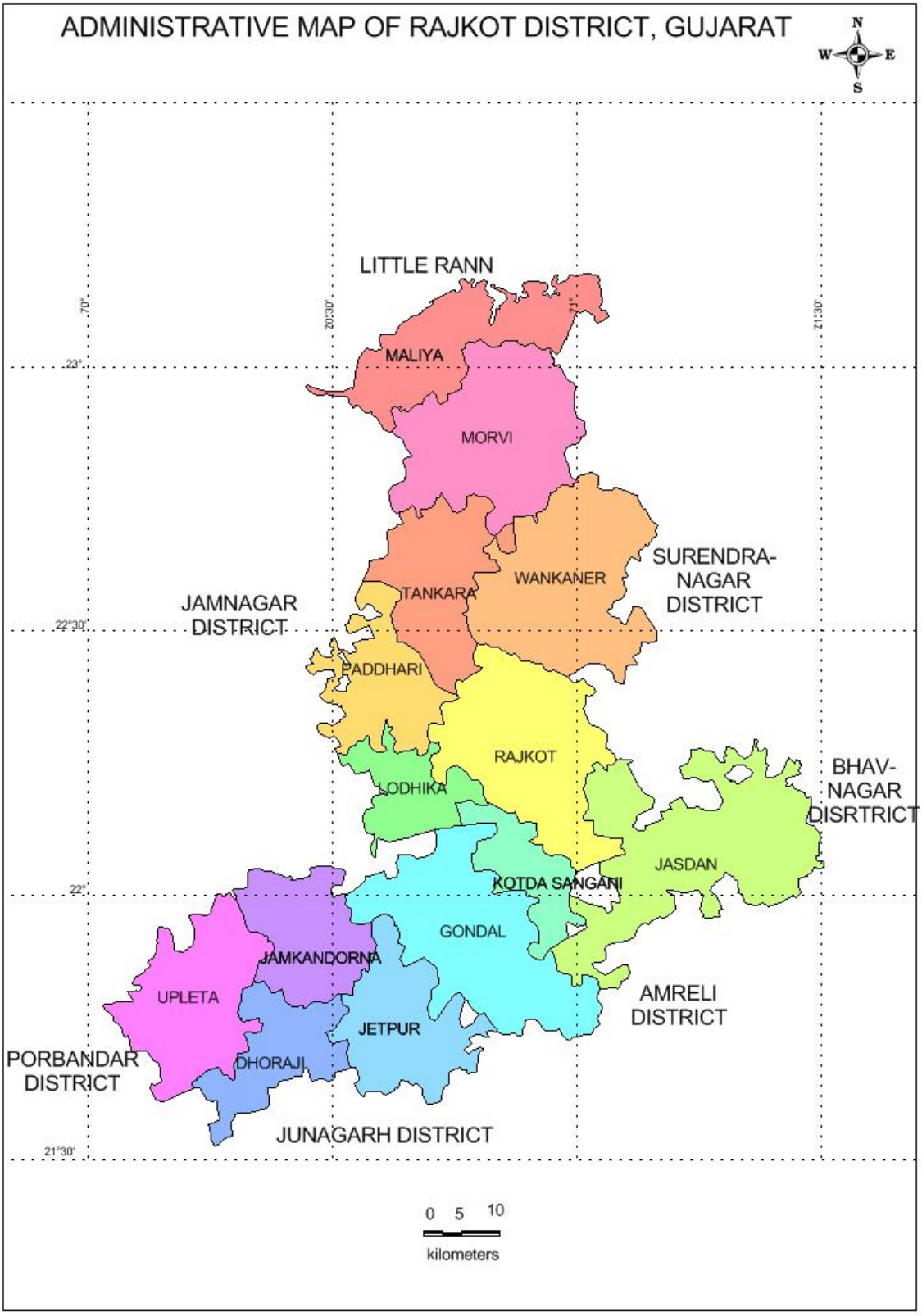

Fig1: Administrative Map of Rajkot District

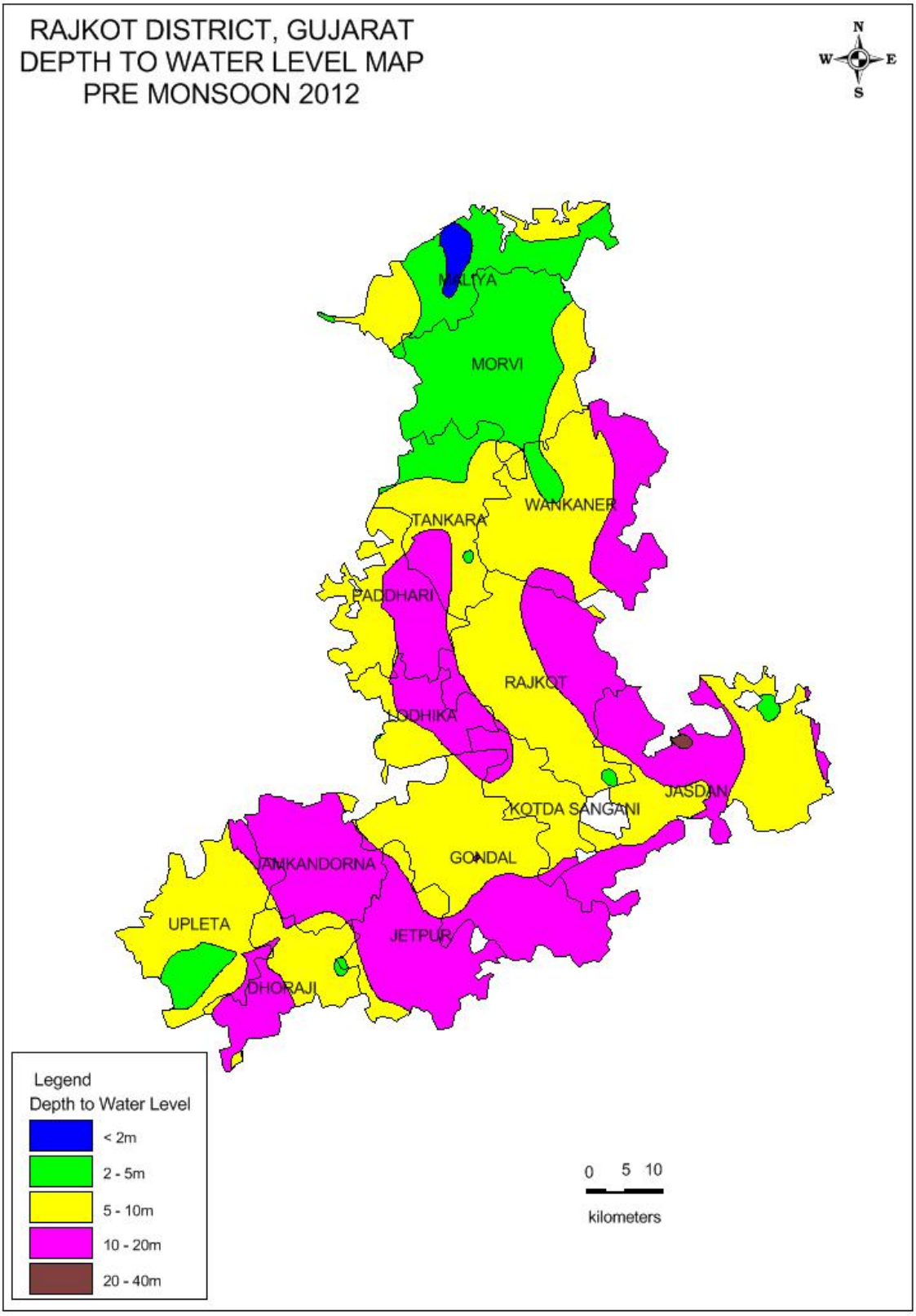

Fig 2: Map showing Depth to water level Pre-Monsoon-2012

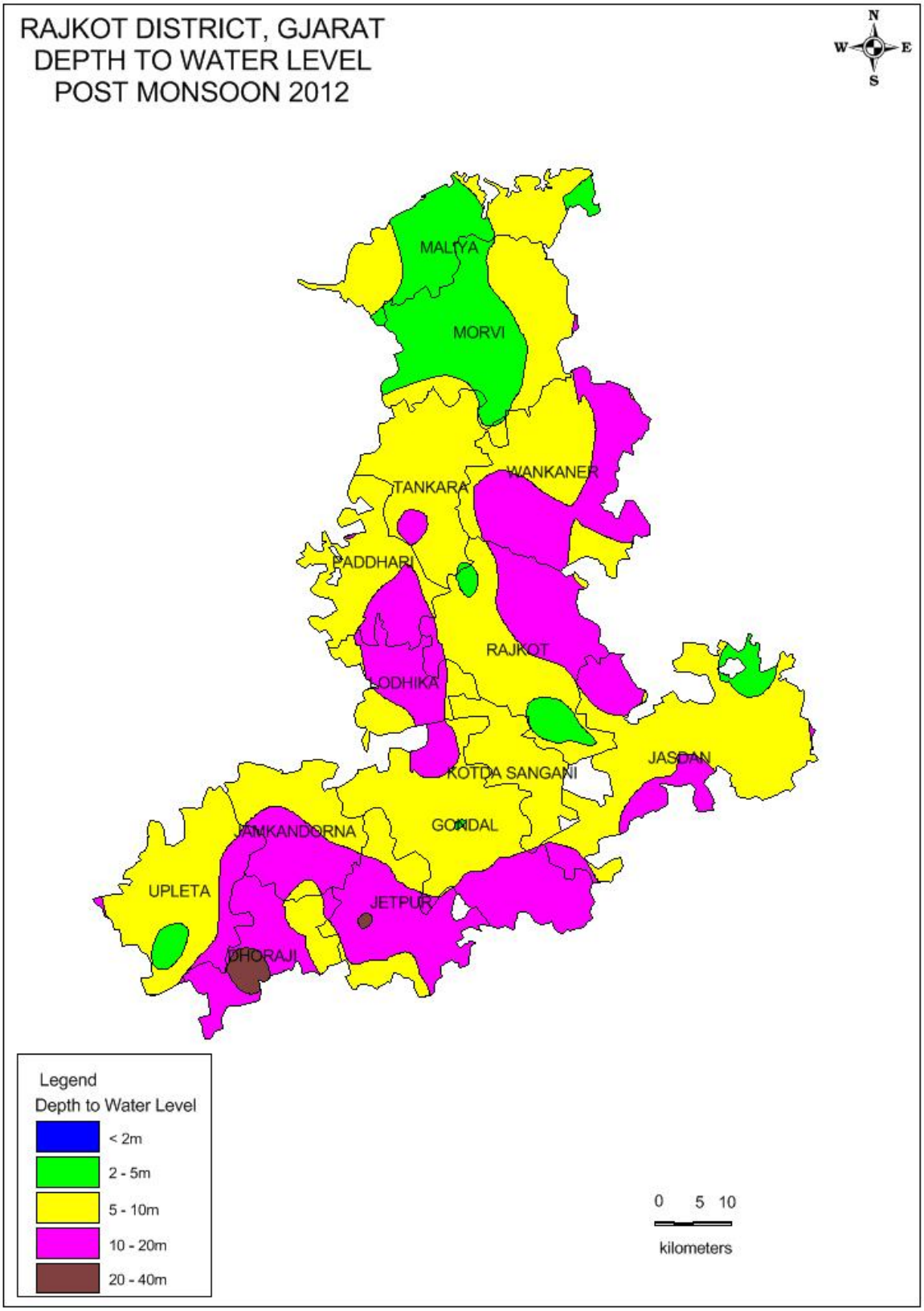

Fig 3: Map showing Depth to water level Post-Monsoon-2012

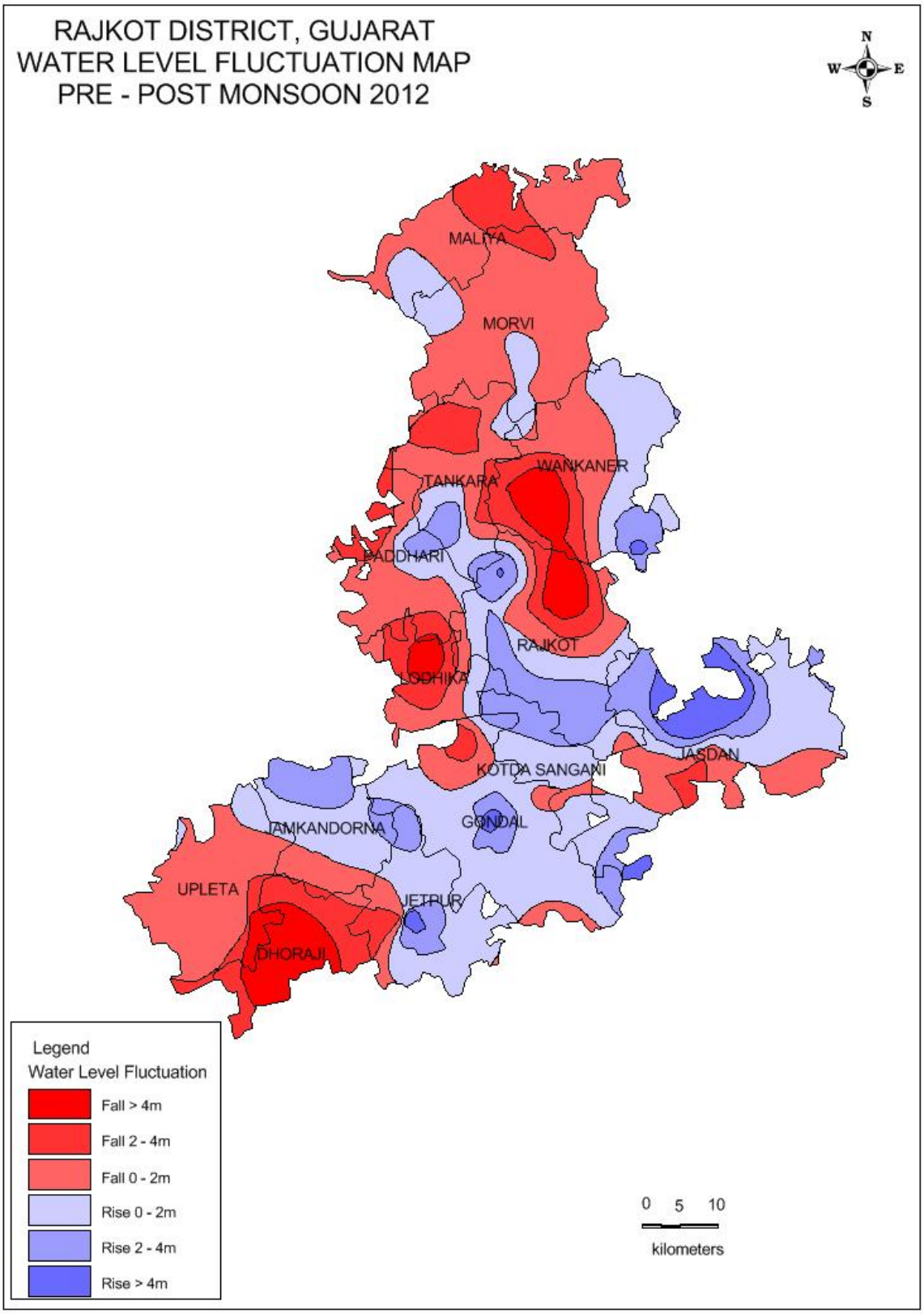

Fig 4: Map showing water level fluctuation May-Nov-2012

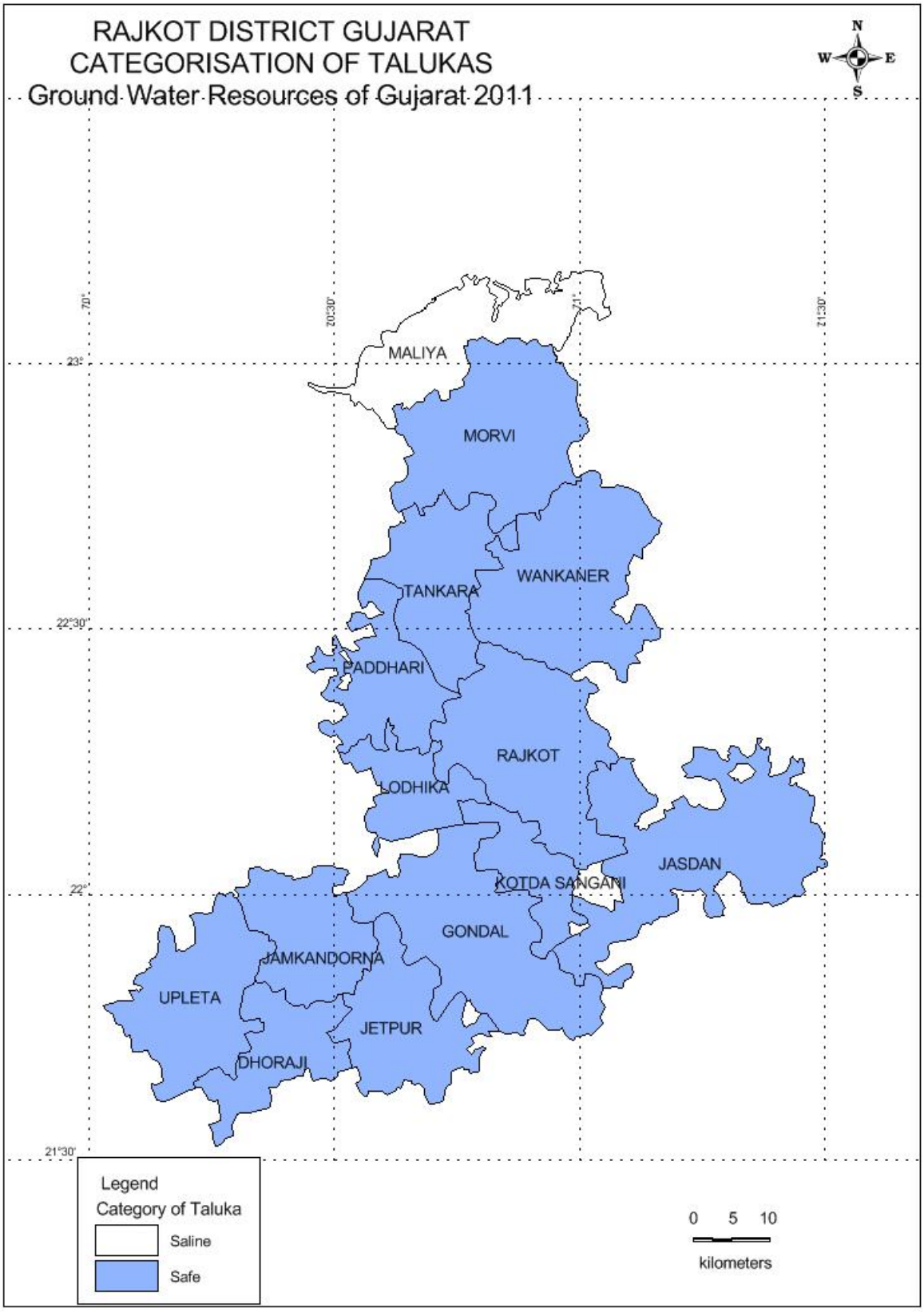

Fig 5: Map showing Categorisation of Talukas as per GWRE 2011

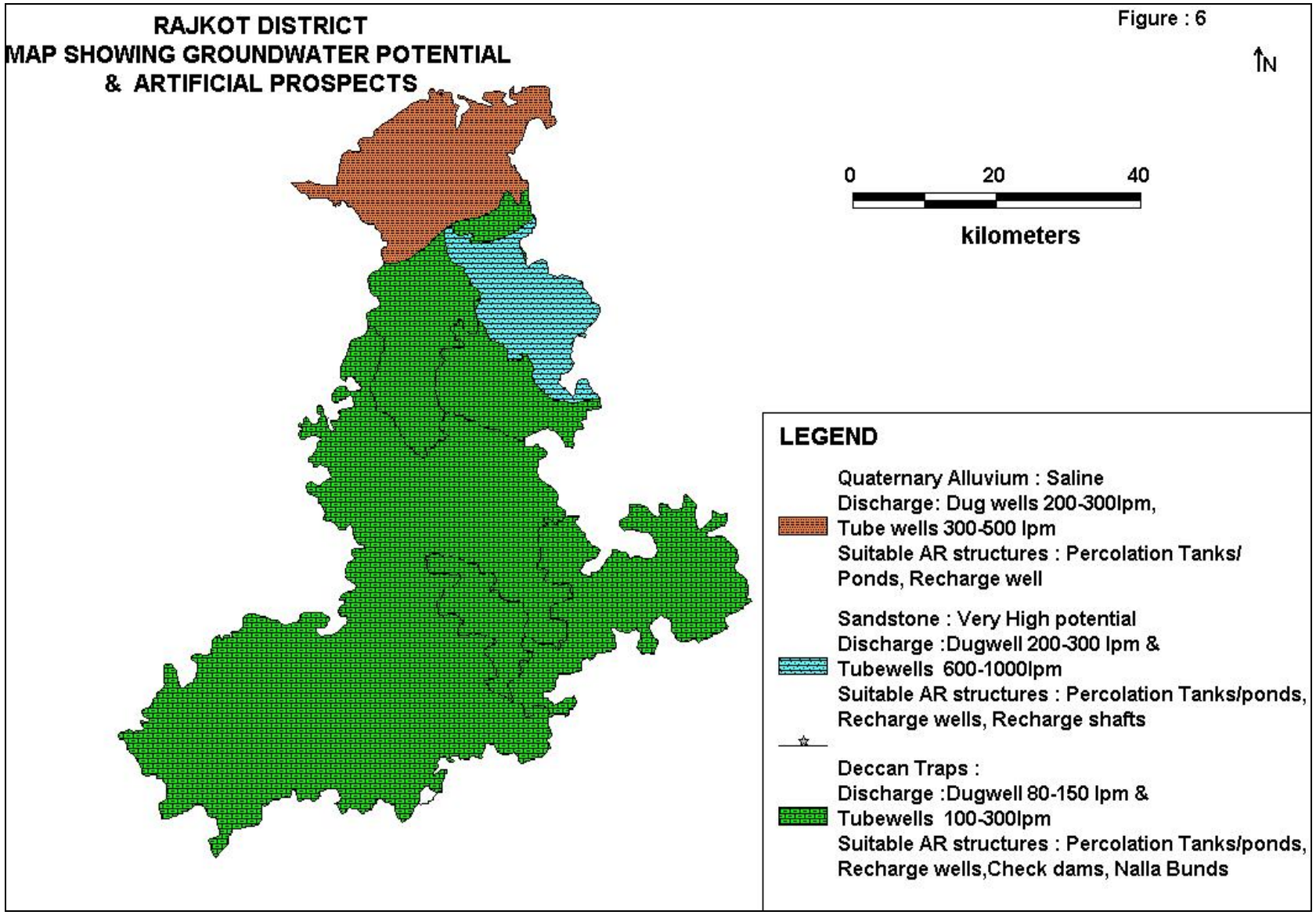

Fig 6: Map showing Ground Water Potential and Artificial Recharge Prospects in Rajkot District