For Official Use
Technical Report
Series

GROUNDWATER BROUCHURE
KHEDA DISTRICT
GUJARAT

Compiled
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Government of India
Ministry of Water Resources
Central Ground Water Board
West Central Region
Ahmedabad

AAP Year 13-14

KHEDA DISTRICT AT A GLANCE

Sl.No.	Items	Statistics
1	General Information	
	i) Geographical area as per state territory/as per village papers (Sq. Km)	4219/ 3944
	ii) Administrative Divisions (As on 3/2011) Number of Talukas Number of Villages/Towns	 10 618/11
	iii) Populations (As on 2011 census)	22,98,934
	iv) Average Annual Rainfall (mm) (1994 to 2010) normal annual rain fall (mm)	891.19
2.	GEOMORPHOLOGY	
	Major Physiographic Units: Moderate relief area, Piedmont zone, alluvial plain and coastal submarine zone.	
	Major Drainages: Perennial rivers- Mahi and Sabarmati Ephemeral streams- Luni, Varansi, Mohar, Shedhi, Vatrak, Maeshwa.	
3.	LAND USE (Sq. Km) (2004-05)	
	a) Forest area	96
	b) Net area sown	3129
	c) Cultivable area	4326
4.	MAJOR SOIL TYPES: Black, Medium black, black cotton, sandy and rocky types.	
5.	AREA UNDER PRINCIPAL CROPS (Sq. Km) (2004-05) : Rice 104, Jowar-10, Bajra-760, Wheat-830, Maize-220, Total cereals 2860, Gram 20, other pulses 40, Total pulses 160, Total food crops 3020, Ground nut-10, Seasam 90, Total oil seeds 220.	
6.	IRRIGATION BY DIFFERENT SOURCES (2004-05) (Areas and numbers of structures)	
	Dugwells	548 Sq. km/ 17959
	Tube wells/Borewells	984 Sq. Km/ 1532
	Tanks/Ponds	72 Sq. Km
	Canals	525 Sq. Km
	Other Sources	18 Sq. Km
	Net Irrigated area	2147 Sq. Km
	Gross Irrigated area	3020 Sq. Km
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-03-2011) No of Dug Wells No of Piezometers	25 12 13
8.	PREDOMINANT GEOLOGICAL FORMATIONS: Alluvium, Lametas, Deccan traps, granite and gneiss are the main geological formations in the district.	
9.	HYDROGEOLOGY	

- Major Water Bearing Formations: Ground Water occurs in unconfined to confined conditions in Alluvium, Lametas, Deccan traps, granite and gneiss.

Depth to water Level during 2011-12				
Period	Phreatic Aquifer (DTW)		Semi-confined Aquifer (PZ head)	
	Min	Max	Min	Max
Pre Monsoon	0.34 (Ladvel)	42.10 (Sarkhej)	7.24 (Matar-II)	47.98 (Sarkhej-II)
Post Monsoon	0.30 (Ladvel)	38.96 (Sarkhej)	5.94 (Matar-II)	43.54 (Sarkhej-II)

Long Term (10 Years) Water Level Trend (2001 to 2010)		
Trend	Pre-Monsoon	Post- Monsoon
Rise (m/Yr)	0.14 (Balasinor) to 0.92 (Mahudha)	0.139 (Mehmdabad) to 1.17 (Mahudha)
Fall (m/Yr)	0.058 (Mehmdabad) to 0.187 (Kapadvanj)	Nil

10.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2011)	
	No of wellsdrilled (EW, OW, Pz, SH, Total) EW 12,OW 9, PZ 15, SH 1, Total:.37	
	Depth Range(m)	40.75 to 152.9
	Discharge (Litres per minute)	697 to 4621 lpm
11	GROUND WATER QUALITY (3/2011)	
	Presence of chemical constituents more than permissible limit) Nil	
	Type of waters: Fresh and Potable.	
12.	DYNAMIC GROUND WATER RESOURCES (2009)	
	Annual Replenishable Ground Water Resources (MCM)	837.12
	Net Ground water Availability (MCM)	791.80
	Projected Demand for Domestic and industrial Uses upto 2025 (MCM)	78.62
	Stage of Ground Water Development (%)	63.34
13	AWARENESS AND TRAINING ACTIVITY- Nil	
	Mass Awareness Programmes organized (3/2012) No of Participants- (One Tier-III Training)	NIL
	Water Management Training Programmes organized (3/12)	NIL
14	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING(31/3/2011)	
	Projects completed by CGWB (No & Amount spent)	NIL
	Projects under technical guidance of CGWB (Numbers)	NIL
15	GROUND WATER CONTROL AND REGULATION (2009)	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Semi Critical Blocks	04
	Number of Safe Blocks	06
	Number of Saline Blocks	Nil
	No. Of Blocks Notified by CGWA	Nil
16	MAJOR GROUND WATER ISSUES Nil	

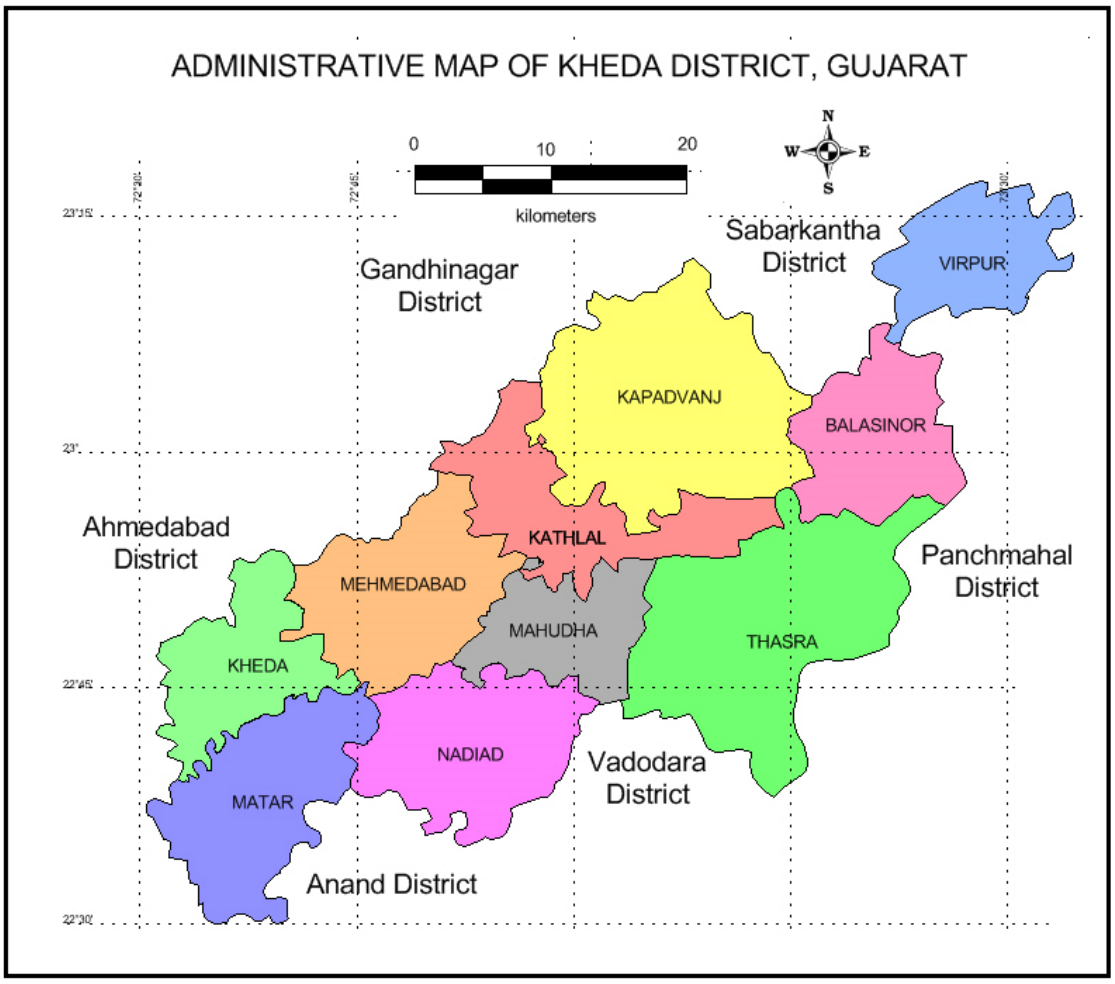
DISTRICT GROUNDWATER BROUCHURE
KHEDA DISTRICT
GUJARAT

Kheda district is a part of Gujarat plain and is subdivided into five sub –micro regions viz.Sabarmati – Vatrakplain,Nadiadplain,Aravalli Forested Rock –outcrops and Mahi plain on the basis of topography,climate,geology ,soil, and natural vegetation.

The latitude and longitude of the district are 22°30’ to 23° 17’ and 72°30’ to 73°34’ respectively. The district is bounded on the north by Saberkanthadistrict, on the east by Panchmahaldistrict, on the west by Ahmedabad and Gandhinagar district on the south by Ananddistrict (Fig.1).The district is divided in ten talukas with Nadiad as district headquarters (Fig.2).Geographically the district has a small hilly area only in northern parts of Kapadvanj and Balasinortaluka.Thetraining portion of the district is plain sloping gently from the North-East towards the South-West.

The district has nine rivers of which Mahi Sabermati principal perennial rivers. The river Mahisagar.Total length of Mahi river in the district is about 180km.Total length of Sabermati river in the district is 88km.Other rivers of the district viz.SAhedhi,Vatrak,Meshwo and Khari meet Sabarmati river at its left bank.

Figure-1



Rainfall and climate

Temperatures vary considerable from season to season. As per climatological data of nearest Indian Meteorological Department (IMD) Station at Ahmedabad (Latitude 23°04' N: Longitude 72°38' E) presented in Table 1, the summers are generally hot and winters are cool. Means Maximum temperatures ranges between 28.4°C during January to about 41.8°C during May and the mean minimum temperatures vary between 11.7°C during January and 27°C during June.

The relative humidity in Anand as per IMD varies between 32% during March and 79% during August. The wind velocity in the district varies from about 74km/d during November and 174 km/d during June.

Table I: Climatological Data of Ahmedabad IMD Station

Month	Max Temp (°C)	Min Temp (°C)	Humidity (%)	Wind Spd. Kmpd	Sunshine (Hours)	Solar Rad. (MJ/m2/d)	ETO (mm/d)	Rainfall (mm)
January	28.4	11.7	43.0	100.1	9.6	17.5	3.4	2.6
February	31.3	13.8	36.0	101.8	10.2	20.5	4.2	1.1
March	36.0	18.8	32.0	108.7	9.3	21.7	5.3	1.0
April	39.9	23.4	34.5	120.8	10.0	24.5	6.6	0.9
May	41.8	26.2	42.5	158.7	10.6	25.9	7.8	6.0
June	38.4	27	59.5	174.2	8.8	23.2	6.7	108.7
July	33.3	25.7	76.0	150.1	4.6	16.8	4.4	265.3
August	31.9	24.8	79.0	124.2	4.3	16.0	3.9	219.8
September	33.4	24.1	71.0	103.5	6.7	18.5	4.4	171.9
October	35.8	20.9	50.5	74.2	9.5	20.3	4.4	10.8
November	33.2	16.5	43.0	79.4	9.7	18.1	3.6	8.9
December	29.8	13	45.0	91.0	9.5	16.7	3.2	2.6
Total	-	-	-	-	-	-	-	799.6
Average	34.4	20.5	51.0	115.6	8.6	20.0	4.8	-

Soil & Crop

The soils of the district can be classified into the following Cropping main types: goradu (gravelly) ,black, sandy and Pattern rocky type. The principal crops grown in Kheda are the ordinary millets and pulses,rice,wheat,tobacco and a little indigo.Bajri is the principal crop and the staple grain food. Tobacco is the most valuable crop produced in the district. It is grown mostly in the charotar tract. Castor seed and sesame are the only oilseeds grown in the district.

Irrigation

The irrigated area in the district constitutes about 46% of the district. A preponderantly agricultural economy would prosper if adequate irrigation facilities are available to farmers. There are quite a few tank irrigation schemes in various parts of the district .Data relating to the irrigation potential created by these schemes are provided in table 4.It is observed from the data that in 4 talukas of the district viz.Kapadvanj,thasra,balasinor and Virpur ,the aggregate irrigation possibilities are expected to cover around 5493 hectares of land.

Previous Works

Geological mapping in the Delhi-Aravalli mountainous region in the north-eastern part of the district was carried out by geo-scientists from Geological of India (GSI), the prominent among them are Dr.A.M.Heron and P.K. Ghose(Heron and Ghosh,1938).

The groundwater survey in the area commenced in the sixties and have continued till date.V.V.Rane ,G.Balasubramaniam, B.K. Singh ,etc., of GSI carried out systematic hydrogeological survey between

1962-63 and 1970-71.R. N.Meshram of CGWB carried out systematic hydrogeological survey in 1981-1982 and M.N.Khan&P.R.Gupte ,of CGWB carried out reappraisal hydrogeological survey in 1984-1985.During the year 1990-1994,CGWB carried out studies for conjunctive use of surface and groundwater in Mahi right Bank Command area (MRBC),also covers southern find out technical feasibility and economic viability of optimum utilisation of water resources .A mathematical model of the MRBC area was also prepared and long term simulation was done for various possible strategies.

Landuse and Cropping Pattern

As per minor Irrigation Census(MI Census 2000-2001) the total cultivable command area is 3,18,896 ha out of which potential created is 1,82,229 ha and potential utilized is 55,83,30 ha.The net area irrigated is 54,775 ha of which Kharif accounts for 30,240(mainly paddy) and Rabi 23,880 ha(mainly wheat).Apart from this the perennial 774 ha and other crops in 936 ha area are also irrigated .Net area irrigated through ground water is 54,018 and surface water (mi) is 573.

Geology

Quaternary, Post Miocene and Tertiary in the area were deposited over a sinking basement in the western part whereas eastern part is predominantly occupied by formations varying in age from Archean to Tertiary age. In the western part the main formation is of quaternary age, formed by alluvium deposited by Mahi,Sabarmati and Watrakrivers. They comprise multilayered formations of gravel, sand, clay and kankers intermixed at places. The clay and sand horizons from alternate layers having pinching and swelling nature. Thekankers, pebbles and the gravels form lenses. Thickness of alluvium increase form north and north west towards south and south west direction .Alluvium is underlain by Deccan traps in general with intervening blue clays at some places. TheDeccan trap is also exposed in eastern area near Dakor.Balasinor area is occupied by limestone formation of Mesozoic age which is famous for occurrence of Dinosaur fossils.Aravalli formations exposed in Virpurarea, they are intruded by post AravalliGranites.The general geological succession is as given below.

Era	Period/Epoch	Series/Formation	Description
Quaternary	Recent to Pleistocene	Alluvium	Fluvial sediments, piedmont, Flood plain & valley-fill deposit &eolian sand
	Unconformity		
Tertiary	Palaeocene	Supratrappean	Laterites,Lithomergicclays,calc.Sandstone& band of L.St.etc.
	Unconformity		
	L.Eocene to U.Cretaceous	Deccan Trap	Basaltic lava flow
	Unconformity		
Mesozoic	M.Cretceous	Infratrappeans (Lametas)	,Limestones& sandstone
	Unconformity		
Proterozoic	Pre Cambrian	Post Aravalli	Godhra granite Intrusive
	Unconformity		
Archean	AravalliSupergroup		Quartzite,Schist&phyllite

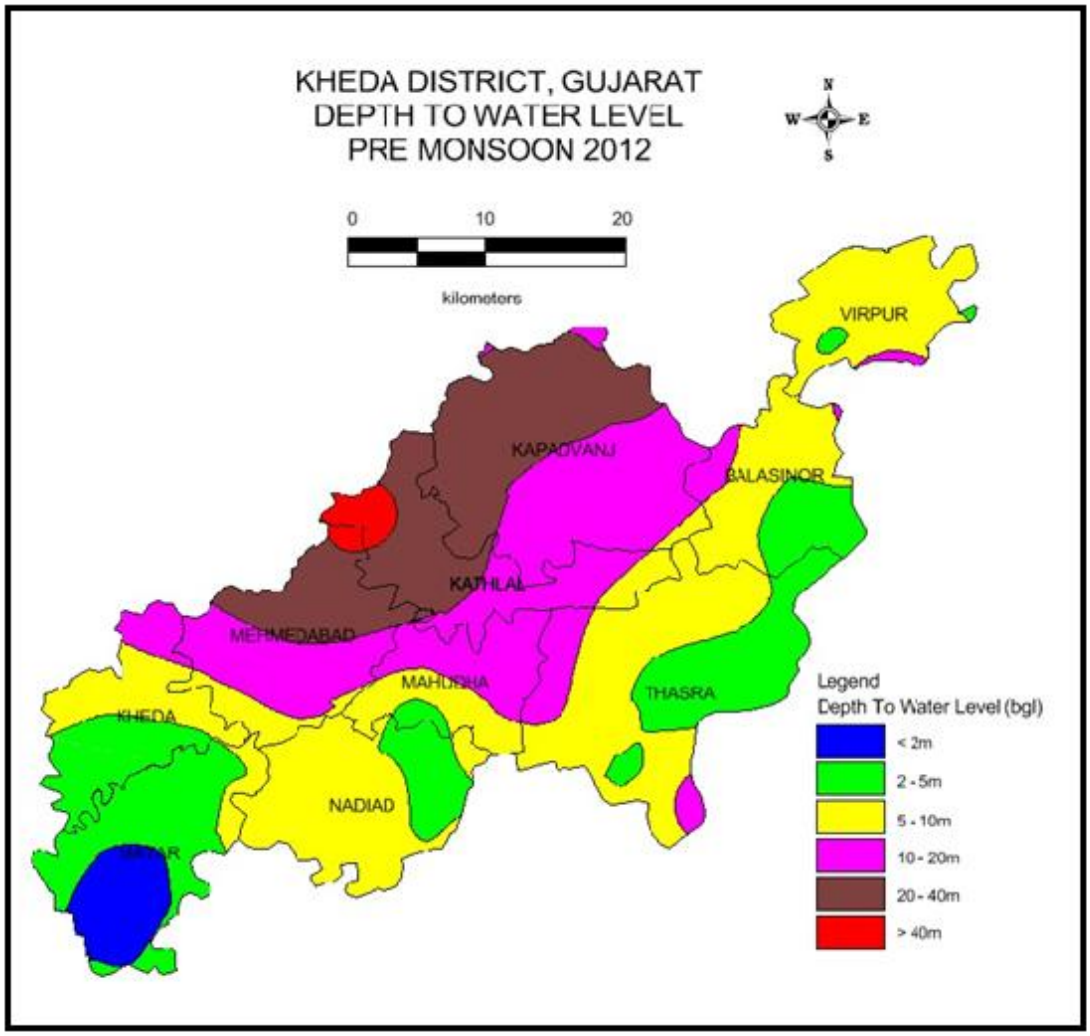
Hydrogeological Setting

The Kheda district lies in the Cambay basin situated between Saurashtra crater and aravalli Swell and Deccan Shield in the east. The basin comprises both marine formations. Major part of the district is

underlain by alluvium which intern is underlain by Tertiary sedimentary formations with in The Cambay Sedimentary Basin. The alluvium mainly consists of fine to coarse grained sand ,gravel,silt,clay and Kankar.The thickness of alluvium gradually increases from piedmonts zone in the northeast towards west and southwest. Maximum thickness of alluvium in the district is estimated to be about 250-300 m in the south western part. In western and south western part ground water occurs both under phreatic and confined conditions in arenaceous horizons that form a multi-layered aquifer system. The occurrence and movement of groundwater is mainly controlled by inter-granular pore spaces. In Alluvium two major aquifers can be identified within the explored depth.Groundwater in the upper unit occurs under phreatic conditions, which at places becomes semi-confined to confined .The lower unit, comprising a few hundred meters of alternating sandy and clayey horizons, formsa multiple confined aquifer system. The general disposition of these aquifers in the study area is as follows.

Description	Aquifer	Depth(m bgl)
Hydrogeological Unit-I		Less than 40
Hydrogeological Unit-II	Confined I	40-195
	Confined II	205-275

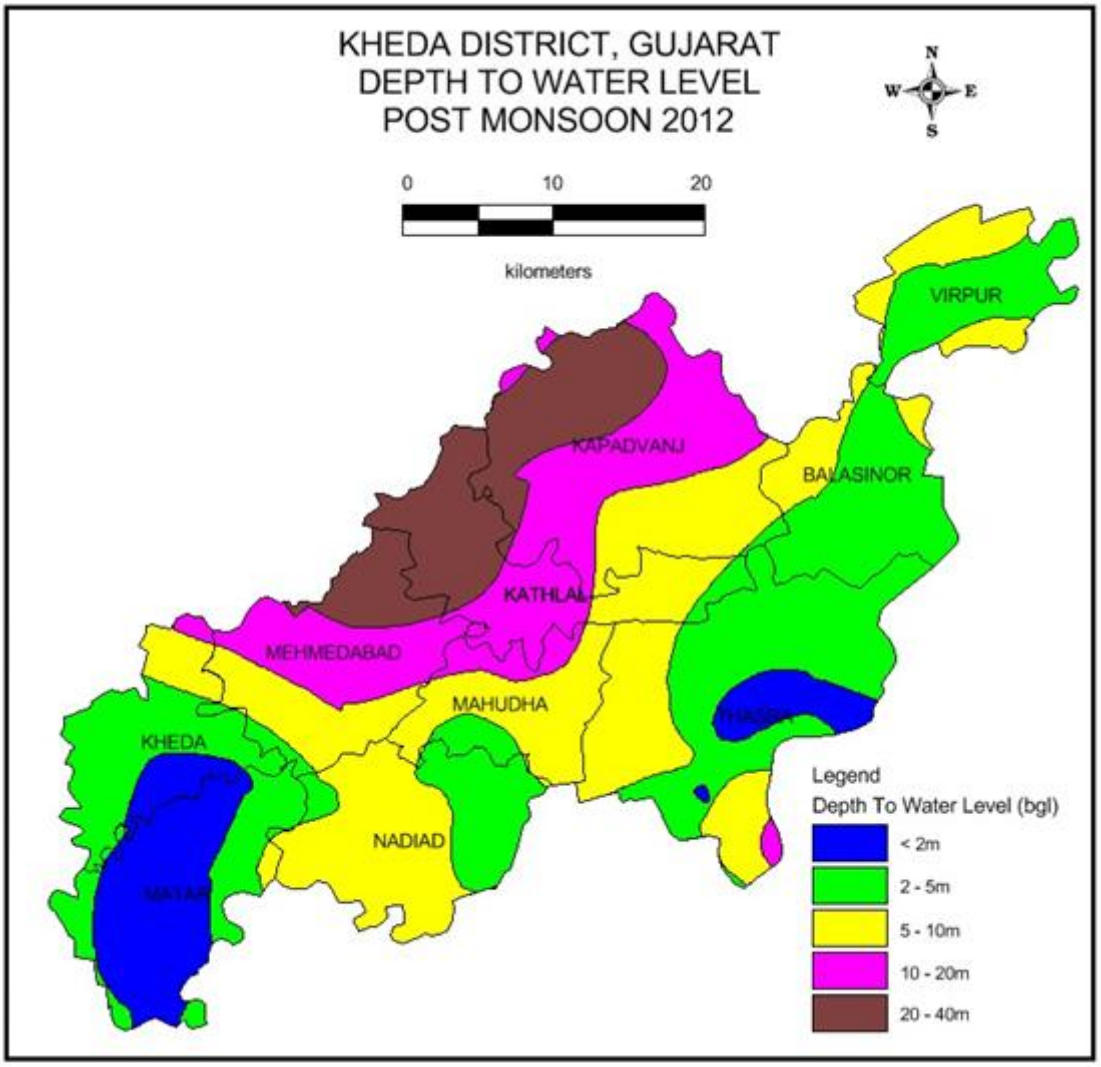
Figure-2



In the piedmont plain in central part of district, the nature of sediments is more uniform and only phreatic aquifer is present. This belt forms the principal recharge zone for the deeper aquifers. The argillaceous

beds in the central and western parts, mainly act as confining layers. In the north eastern part covered by hard rock formation groundwater occurs in top weathered and fractured formation. Groundwater is extensively developed by dug, dug-cum-bored and tube wells in areas underlain by alluvium. Depth of dug and dug-cum-bored wells varies 5 m to 38 mbgl whereas depth to water level, in general, varies from 5 to 15 mbgl.A map depicting spatial distribution of Depth to water level Pre-Monsoon in Kheda District is presented in fig. 2.The depth to water level in the district ranges between 2m to about 40m during May 2012.Nearly 7% area of the district is covered by the water level of less than 2m bgl. Nearly 18% area of the district is covered by the water level of 2m to 5m bgl. Nearly 35% area of the district is covered by the water level of 5m to 10m bgl. Nearly 19% area of the district is covered by the water level of 10m to 20m bgl. Nearly 16% area of the district is covered by the water level of 20m to 40m bgl. Nearly 5% area of the district is covered by the water level of greater than 40m bgl. A map depicting spatial distribution of Depth to water level Post-Monsoon in Kheda District is presented in fig. 3.

Figure-3



The depth to water level in the district ranges between 2m to about 40m during May 2012.Nearly 9% area of the district is covered by the water level of less than 2m bgl. Nearly 32% area of the district is covered by the water level of 2m to 5m bgl. Nearly 28% area of the district is covered by the water level of 5m to 10m bgl. Nearly 18% area of the district is covered by the water level of 10m to 20m bgl. Nearly 13% area of the district is covered by the water level of 20m to 40m bgl. Free flowing artesian wells were reported earlier, in fifties, in western part of the district. Their depths were more than 300 mbgl and reportedly yielded ground water of inferior quality .However; free flowing wells are not observed at present.

Behaviour of Water Levels

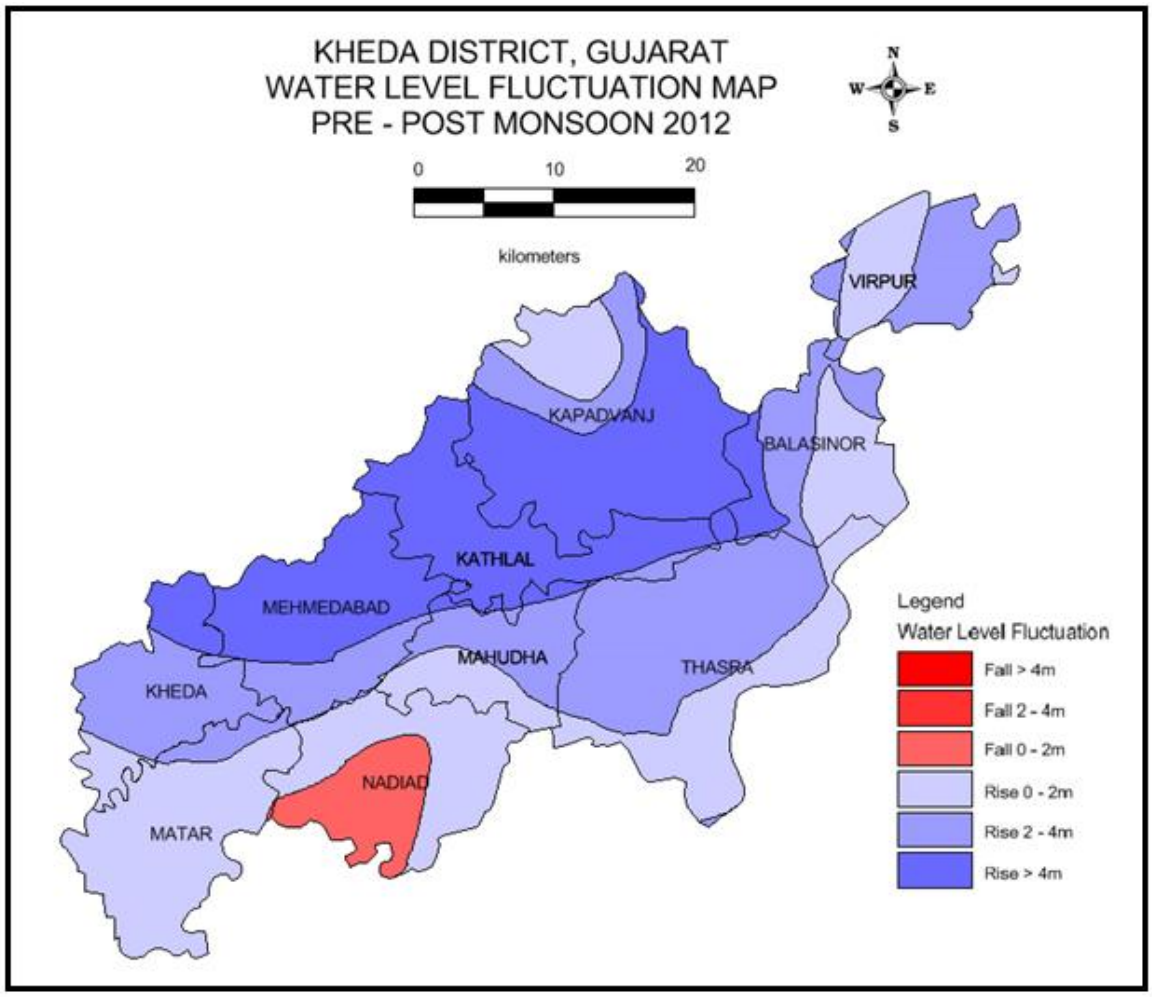
The behaviour of water levels was studied based on the water level data collected from the National Network of Hydrograph Stations (NNHS) established by CGWB and Observation wells established by GWRDC in the district. A composite map combining the data of CGWB & GWRDC (depth to water level map -May -2012) has been prepared.

The water level data of May 2012 was used for preparing the depth to water level maps. The seasonal fluctuations in water levels were calculated between May and November 2012. Historical data of water levels were used for preparing the hydrographs as well as for computing long term trends.

Rise and Fall in Water Levels

Rise and fall in water levels between May 2012 and November 2012 has been shown in Figure-4. The rise of water level from is greater than 4 meters is seen in major parts of the district.

Figure-4



Nearly 28% of the area in isolated patches shows a rise up to 2 meters. 25 % of the area in isolated patches shows rise of 2m to 4m in the district .There are one isolated pockets in south of the district which shows decline of water level up to 2m is observed . It covers nearly 7% of the district.

Table –III Long Term Trend of Water level

(Period 1St January 2001 to 30th November 2012)

S.No	Location	Pre Monsoon	Post Monsoon

		Data Points	Rise (m/year)	Fall (m/year)	Data Points	Rise (m/year)	Fall (m/year)
1	Balasinor	18	.0754		16	0.0229	
2	Kapadvanj	8	.1488		5		
3	Kheda	10		0.0268	10		0.0387
4	Matar-I	19		.1410	19	0.1249	
5	Matar-II	19	.1331		19	0.4047	
6	Mahudha	21	.2979		20	0.0546	
7	Mehmedabad						
8	Nadiad	21	.3987		19		0.1182
9	Thasra	19		. 0.2202	19	0.2298	
10	Virpur	7		.4034	8	0.7122	
Max		**21**	**.3987**	**.4034**	**20**	**0.7122**	**0.1182**
Min		**7**	**.0754**	**0.0268**	**5**	**0.0229**	**0.0387**

Pre-monsoon water level trend shows that the hydrograph stations indicate a rise of water level ranging from**.0754** m/year to **.3987** m/year where as a decline of water level ranging from**0.0268** m/year to **.4034** m/year.During post- monsoon period water level trend shows that the hydrograph stations indicate a rise of water level ranging from**0.0229** m/year to **0.7122** m/year where as a decline of water level ranging from**0.0387** m/year to **0.1182**m/year. The details are tabulated above.Pre-monsoon and post- monsoon long term rising and declining trend of water level of various hydrograph stations established by CGWB are also studied in graphic form. Majority of the hydrographs are showing rising trend during the pre and post monsoon period. However, declining trend in few hydrographs is also observed.

GROUND WATER RESOURCES

The Ground Water Resources and Irrigation Potential of the district were calculated as on March 2012 in collaboration with the Government of Gujarat using the methodology suggested by "Ground Water Estimation Committee (GEC-97). These resources were computed after reorganisation of the districts. The ground water resources for different Talukas of the district are given in the Table – IV & V.

The annual ground water recharge varies from 2486.17ha m. in Virpur Taluka to 13180.65ha m. in Thasra Taluka and total gross recharge for the district is 78037.32ha m. The net available recharge, after leaving natural discharge for non-monsoon period varies from 129.09(Balasinor) to 659.03ha m. (Thasra), the recharge for district is 4026.17ha m.

Ground Water Draft

The Table –V also shows the draft from Irrigation and Domestic/Industrial uses. The gross draft in the district for all uses (Domestic, Industrial and Irrigation uses) is47210.35 ha m. and varies from 656 ha m. (Uchchhal) to 3268 ha m. (Vyara).

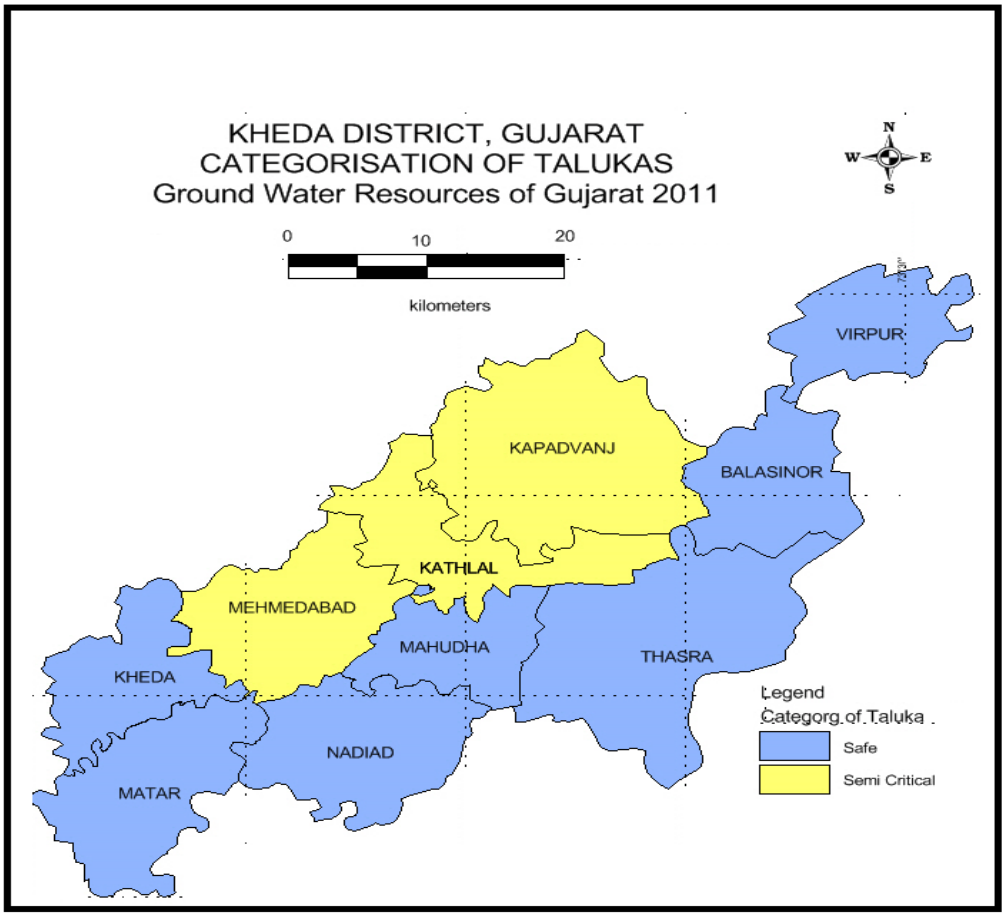
Table –IV Ground Water Resources Potentials

Sr. No	Taluka	Total Annual Ground Water Recharge	Natural Discharge during non-monsoon season (ham) (5 % of 7)	Existing Draft for Domestic and industrial Water Supply	Ground water Draft for Irrigation	Existing draft for all uses
1	Balasinor	2581.89	129.09	246.78	1412.00	1658.78
2	Kapadwanj	9975.17	498.76	695.30	6691.40	7386.70
3	Kathlal	5620.40	281.02	548.90	3481.60	4030.50
4	Kheda	6928.73	346.44	358.67	4266.00	4624.67
5	Mahemdavad	10685.35	534.27	664.00	6575.00	7239.00
6	Mahudha	6964.79	348.24	347.00	3526.00	3873.00
7	Matar	7923.15	396.16	334.60	3683.50	4018.10
8	Nadiad	11691.02	584.55	1478.60	5898.00	7376.60
9	Thasra	13180.65	659.03	928.50	4560.00	5488.50
10	Virpur	2486.17	248.62	263.50	1251.00	1514.50
District Total		**78037.32**	**4026.17**	**5865.85**	**41344.50**	**47210.35**

Table –VStage of Ground Water Development

Sr. No.	Taluka	Net Annual Ground Water Availability (ham)	Projected Demand for Domestic and Industrial uses up to 2025 (mcm)	Net Annual Ground Water Availability for future irrigation (ham)	Stage of Ground Water Development (%) (12/9) * 100	Category
1	Balasinor	2452.80	330.00	710.80	67.63	Safe
2	Kapadwanj	9476.41	932.00	1853.01	77.95	Semi critical
3	Kathlal	5339.38	736.00	1121.78	75.49	Semi critical
4	Kheda	6582.30	480.00	1836.30	70.26	Safe*
5	Mahemdavad	10151.09	890.00	2686.09	71.31	Semi critical
6	Mahudha	6616.55	465.00	2625.55	58.54	Safe
7	Matar	7526.99	449.00	3394.49	53.38	Safe
8	Nadiad	11106.47	1982.00	3226.47	66.42	Safe
9	Thasra	12521.62	1245.00	6716.62	43.83	Safe
10	Virpur	2237.55	353.00	633.55	67.63	Safe
District Total		**74011.15**	**7862.00**	**24804.65**	**63.79**	**Safe**

Figure-5



Quality of Shallow Ground Water

The quality of ground water in the shallow aquifer has been studied based on the chemical analysis of water samples collected from NHS during November 2012. Data for a total number of 6 samples are available.

Table- VI Statistical Analysis of Chemical Constituents (Shallow Aquifer)

Constituents	Units	(Range)
pH		8.10-8.79
EC	(µS/cm)	980-6480
TDS		657-4342
CO3		0-78
HCO3	(mg/l)	138-1000
Cl	(mg/l)	71-1335
NO3	(mg/l)	5-225
SO4	(mg/l)	10-563
F	(mg/l)	0.20-2.80
Alk		113-950
Ca	(mg/l)	24-264
Mg	(mg/l)	7-277
TH	(mg/l)	90-1800
Na	(mg/l)	65-1350
K	(mg/l)	0.0-9.2
Fe		0.00-86
SAR	(mg/l)	1.4-31.8

The limit of chemical constituents should be EC<3200, Cl<1000, NO3<45, F<1.5.But **EC** in **Mahudha ,Nadiad,Matar** is found **3650 µS/cm,4014 µS/cm,6480 µS/cm** of the district are not under permissible limit.**Cl** in **Matar is 1335 mg/l , NO3 in Kheda, Mahudha,Nadiad is 180 mg/l ,85 mg/l ,225 mg/l.** Also **F of Balasinor(Junavasadra),Matar is 2.30 mg/l ,2.80 mg/l and Fe of Balasinor, Kheda is .80,.86.** So it is noticed that the ground water in the district is not potable for drinking and in critical conditions for other uses also. The statistical analysis of these is presented in Table –VI.

Ground Water Management Strategy

Kheda District is occupied by only minor rivers and streams and no major rivers in the district. However, it is bounded by two perennial rivers i.e. Mahi and Sabermati rivers. South part of the district is irrigated in all the three seasons and surface water is applied through a network of canals of MRBC canal system. The ground water is shallow in major parts of the district excepting along the Mahi River and in parts of MehmedabadTaluka ,Kathlal Taluka and Kapadvanj Taluka where deep water levels of about 20 mbgl are observed .Decline in water levels is also is observed in Mehmedabad ,Balasinor,Kapadvanj and Kathlal talukas. Rainwater harvesting in these deep water level area can be adopted to stabilise ground water levels.

Ground Water Related Issues and Problems

The Kheda district faces acute problems of ground water availability as large areas are occupied by unconsolidated formations, availability of consolidated formation is limited to central part and south western part is affected by inherent salinity.

Ground Water Availability:

In eastern part of the district availability of ground water is scarce as the area is underlain by hard rock formation in which ground water is available only in upper weathered part or in fractures and joints if they are interconnected.

Insitu Salinity

The south western area of Kheda district occupying parts of Matar and Nadiad Taluka forms part of BhalArea ,they have inherently saline soil.

Industrial Pollution:

The noteworthy notified industrial areas are Sevaliya,Chaklasi,Nadiad.Sevalia is the Cement industry other industries are mainly agriculture based. Although there are no major polluting industries in the district yet quality of ground water is to be monitored in the industrial areas to avoid any pollution due to industries.

Inadequate sewerage disposal and Industrial waste:

Problems relating to inadequate sewerage disposal and industrial waste are posing great environmental hazards in small urban areas, resulting into degradation and deputation of freshwater resources.

Water-logging & Soil Salinity:

Large areas of south western part of the Kheda district have shallow ground water levels and face problems of water logging and groundwater salinity. Thesearea are formed of fine soil and display poor drainage .Due to over application of canal irrigation there is a gradual shallowing of water table over the years, this has caused increase in salinity of soils.

Recommendations

- There is an urgent need for management of the surface as well as ground water resources available and conjunctive use ofground water is to be adopted in the district.
- Creating awareness among the farmers regarding water conservation through judicious use of water adoption of efficient irrigation techniques like drip/sprinkler irrigation.
- The land holding of the group of farmers under public tube well irrigation should be brought under the provision of the change in crops, irrigation practices and installation of drip/sprinkler irrigation technique. Soft term institutional finances to the farmers and liberal subsidies in equipments are suggested.
- Resorting to artificial recharge practices by diverting surplus run-off during monsoon into ponds, percolationtanks, and spreadingbasins, abandoned dug wells etc.is suggested.
- Taking up artificial recharge at suitable place will help in stabilising the groundwater regime through appropriate techniques with active community participation.
- Institutional finance and appropriate technology should be freely made available to any individual or cooperative group of farmers that undertake resource augmentation and management measures.