



भारत सरकार
जल संसाधन मंत्रालय
केंद्रीय भूजल बोर्ड

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत बीड जिले की
भूजल विज्ञान जानकारी

GROUND WATER INFORMATION
BEED DISTRICT
MAHARASHTRA



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नागपुर
CENTRAL REGION
NAGPUR
2009

BEED DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	: 10615 sq. km.
Administrative Divisions (As on 31/03/2008)	: Taluka- 11, Beed, Georai ,Ashti , Patoda, Shirur (Kasar), Wadwani , Ambajogai, Majalgaon, Kaij, Dharur and Parli.
Villages	: 1282
Population	: 21,61,000
Normal Annual Rainfall	: 600 mm to 800 mm

2. GEOMORPHOLOGY

Major Physiographic unit	: 3; Lowland Beed- Part of Godavari valley, Highland Beed- Part of Balaghat Plateau and Sina basin
Major Drainage	: 3; Godavari, Manjra and SIna

3. LAND USE (2006-07)

Forest Area	: 260 sq. km.
Cultivable Area	: 8626 sq. km.
Net Area Sown	: 9726 sq. km.

4. SOIL TYPE

Rocky and thin layered soils except on the banks of Godavari and Sindphana Rivers.

5. PRINCIPAL CROPS (2005-06)

Jowar	: 1073 sq. km.
Oilseeds	: 400 sq. km.
Total Pulses	: 195 sq. km.
Sugarcane	: 354 sq. km.
Cotton	: 92 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2006-07) - Nos./Potential Created (sq.km.)

Dugwells	: 47552/1473
Borewells/Tubewells (2000-01)	: 2133/102
Surface Sources	: NA/504
Net Irrigated Area	: 2079

7. GROUND WATER MONITORING WELLS (As on 30/11/2007)

Dugwells	: 24
Piezometers	: 6

8. GEOLOGY

Recent	: Alluvium
Upper Cretaceous-Lower Eocene	: Deccan Trap Basalt

9. HYDROGEOLOGY

Water Bearing formation	: Basalt-Weathered/fractured/ jointed vesicular/massive, under phreatic and semi-confined to confined conditions. Alluvium- Sand and Gravel under semi-confined to confined conditions.
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Premonsoon Depth to Water Level : 2.70 to 30.00 m bgl (May-2007)
Postmonsoon Depth to Water Level : 0.70 to 12.20 m bgl (Nov-2007)
Premonsoon Water Level Trend : Rise: Negligible to 0.66 m/year
(1998-2007) Fall: 0.03 to 1.24 m/year
Postmonsoon Water Level Trend : Rise: Negligible to 0.19 m/year
(1998-2007) Fall: 0.01 to 1.21 m/year

10. GROUND WATER EXPLORATION (As on 31/03/09)

Wells Drilled : EW-43, OW-5, Pz-14
Depth Range : 18.00 to 200.20 m bgl
Discharge : Traces to 6.00 lps

11. GROUND WATER QUALITY

Good and suitable for drinking and irrigation purpose, except the saline areas of Godavari Alluvium.

Type of Water : Ca-HCO₃, Ca-Cl and Na-Cl

12. DYNAMIC GROUND WATER RESOURCES- (As on 31/03/2004)

Net Annual Ground Water : 1209.06 MCM
Availability

Annual Ground Water Draft : 534.48 MCM
(Irrigation + Domestic)

Allocation for Domestic and : 91.93 MCM
Industrial requirement up to next 25
years

Stage of Ground Water : 44.21 %
Development

14. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka : None
Critical Taluka : None
Notified Taluka : None

16. MAJOR GROUND WATER PROBLEMS AND ISSUES

Ground Water Information Beed District

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Ground Water Information Beed District

1.0 Introduction

Beed is one of the district of Marathwada area of Maharashtra. It is situated flanked by Aurangabad and Jalna districts in the north, Parbhani in the east, Latur in the south east, Osmanabad in in south and Ahmadnagar district in the west and southwest. It is bounded by north latitude 18°28' and 19°28' and east longitude between 74°48' and 76°45'. The district headquarters is located at Beed Town. For administrative purpose the district has been divided in 11 talukas viz., Beed, Georai, Patoda, Ashti, Shirur (Kasar), Ambajogai, Kaij, Majalgaon, Dharur, Parli (V) and Wadwani.

As per census 2001, the population of the district is 21.60 lakh. The district has 6 towns and 1365 villages. The major part of the district comes under Godavari basin. Godavari, Manjra and Sina are the major rivers that drain the district along with their tributaries.

Central Ground Water Board has taken up several studies in the district. A list of studies conducted in the district is presented in **Table-1**.

Table 1: Studies undertaken by CGWB.

S.N	Officer	AAP	Type of Survey/Study
1	N.G. Gajbhiye	1972-73	Systematic Hydrogeological Survey
2	D.Y. Sirsikar	1980-81	-do-
3	D.B. Shetye	1985-86	-do-
4	D.B. Shetye	1986-87	-do-
5	D.B. Shetye	1988-89	-do-
6	AVSS. Anand & S. Marwaha	1989-90	-do-
7	S. Kudesia	1992-93	Reappraisal Hydrogeological Study
8	B. K. Kallapur	1994-95	-do-
9	K.B. Sahoo	1995-96	-do-
10	P.K. Naik	1996-97	-do-
11	B.N. Warke	1997-98	-do-

A report on hydrogeology of the district entitled "Ground Water Resources and Development Potential of Beed District, M.S." was compiled by Shri K.N. Murthy, Scientist-D in the year 1999-2000.

Apart from above studies, ground water exploration in the hard rock areas of the district occupied by Deccan Trap Basalt has also been taken up in various phases since 1979. The salient features of ground water exploration are given in Table-2.

Table 2: Salient Features of Ground Water Exploration. (As on March 2009)

S. No.	Taluka	Wells			Depth (m bgl)	SWL (m bgl)	Discharge (lps)	Draw-Down (m)	Zones (m bgl)
		EW	OW	PZ					
1.	Ambejogai	-	-	4	31.75 - 50.00	4.35 - 10.20	-	-	20-42
2.	Ashti	8	2	-	122.10 - 200.00	3.40 - 28.95	0.38 - 5.80	-	5 - 159

3.	Beed	6	1	3	30.00 – 200.00	6.80 - >100.00	Traces – 5.90	2.16 – 23.50	18 - 125
4.	Gevrai	12	1	3	18.00 – 200.00	3.11 - >60.00	Traces – 17.92	11.87 – 21.82	9 - 125
5.	Majalgaon	5	-	2	18.00 – 200.20	14.10 – 50.00	3.17 – 4.43	-	16 – 195
6.	Parli	3	-	-	200.20	37.40 – 90.10	-	-	18 - 127
7.	Patoda	1	1	2	30.00 – 200.00	5.60 – 5.62	3.17	-	15 - 80
8.	Shirur	5	-	-	200.00	4.10 - >100	Traces – 2.43	13.40	6 – 165
9.	Wadvani	3	-	-	200.20	41.10	-	-	8 - 182
	Total	43	5	14	18.00 – 200.20	3.11 - >100	Traces – 17.92	2.16 – 21.82	5 - 195

In the Deccan Trap Basalt area of the district, 43 exploratory wells (EW), 5 observation wells (OW) and 14 Piezometer (PZ) were drilled. The depth of the wells ranged from 18.00 to 200.20 metres below ground level (m bgl). The discharge from these wells varied from Traces to 17.92 litres per second (lps), and 13 wells (27%) were found to be high yielding with discharge > 3 lps. The static water levels ranged from 3.11 to > 100 m bgl. The aquifer zones were encountered in the depth range of 5 m bgl to 195 m bgl, thus indicating the presence of water bearing zones even at deeper depths beyond 100 m bgl.

A map of the district showing the taluka boundaries, taluka headquarters, and location of monitoring wells is presented as Figure-1.

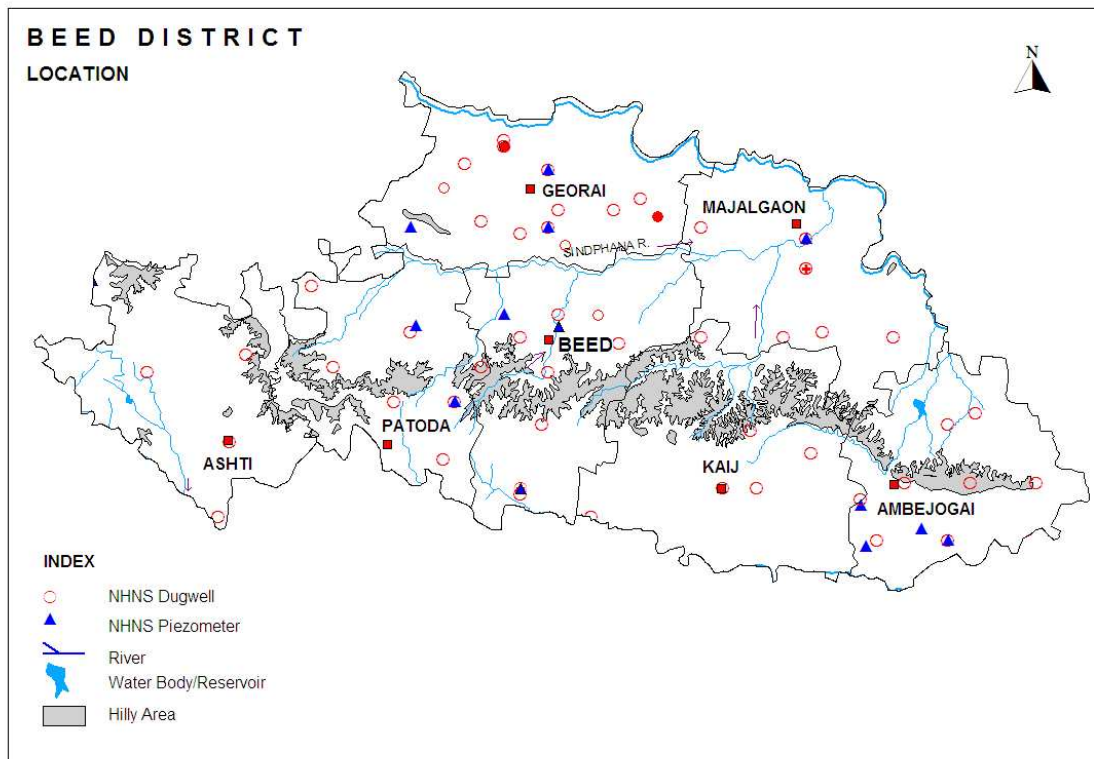


Figure-1: Location

2.0 Climate and Rainfall

The Climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The temperature rises rapidly after February till May, which is the hottest month of the year. The mean daily maximum temperature during May is 42.0°C and the mean daily minimum temperature during December is 12.0°C

The normal annual rainfall (1901-1996) varies from about 600 to 800 mm. It is minimum in the western part around Ashti and gradually increases towards east and reaches maximum around Majalgaon. The study also reveals that except the western part of the district around Ashti, the entire district experienced moderate and severe drought conditions for more than 20% of the years and can be categorized as “drought area”.

The average annual rainfall of period 1998-2007 in the district varied from 642 mm (Shirur) to 795 mm (Ashti) and the same is presented in Table-3.

Table 3: Annual Rainfall Data (1998-2007). (mm)

S. No.	Taluka	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Avg.
1	Ambejogai	1160.40	779.10	645.30	746.30	649.20	758.40	709.60	914.00	825.00	706.20	789.35
2	Ashti	958.60	979.40	938.90	635.60	783.80	620.90	1026.6	406.50	860.00	748.00	795.83
3	Beed	1158.80	504.20	741.50	746.20	556.00	502.20	695.00	878.90	677.60	673.90	713.43
4	Dharur	1146.00	599.30	613.70	641.20	639.60	869.60	747.00	1049.0	579.00	690.00	757.44
5	Gevari	1100.70	684.00	552.40	644.00	749.70	660.00	638.50	900.00	777.00	607.00	731.33
6	Kej	1290.20	752.30	584.40	492.90	468.50	624.20	610.60	1118.1	818.80	510.80	727.08
7	Majalgaon	1120.50	510.00	559.60	792.70	649.00	740.70	597.50	906.40	719.90	965.60	756.19
8	Parali	1256.00	719.80	523.90	650.70	728.80	743.50	467.70	604.50	563.70	926.00	718.46
9	Patoda	1155.00	615.00	613.00	765.90	559.80	356.00	740.00	741.00	868.20	701.60	711.55
10	Shirur Kasar	1155.00	NA	295.80	728.00	431.00	540.00	687.00	675.00	697.00	573.00	642.42
11	Wadavani	958.60	NA	287.50	580.10	550.50	692.00	469.00	1048.3	634.30	747.00	663.03

3.0 Geomorphology and Soil Types

The district can be broadly divided into 3 physiographic units namely; Lowland Beed, Highland Beed and Sina basin.

Lowland Beed is the low lying northern part comprising a part of Godavari valley and is also known as Gangathari. It has a general elevation ranging from 400 metre above mean sea level (m amsl) in the east to 500 m amsl in the west with number of residual hills reaching upto 600 m amsl. Highland Beed occupies the southern part forming a part of Balaghat Plateau. This dissected series of hills extending from west to east divides the district into two parts. Sina basin is low lying undulating area southwest and west of Highland Beed comprising almost whole of Ashti taluka. It is interspersed with many low lying residual hills. The district is drained by Godavari, Manjra and Sina rivers and their tributaries. Godavari River flows from west to east along the northern boundary of the district. Manjra River starts from the mountains of Patoda taluka and flows west to east forming the southern boundary of the district. Sina River flows along the south-western boundary of the district.

In the district, rocky and thin layered soils are observed in major part of the

district except on the banks of Godavari and Sindphana Rivers, where dark brown to black and clayey loamy to loamy soils are observed. The nutrient levels in almost all the soils are low.

4.0 Ground Water Scenario

4.1 Hydrogeology

The major part of the district is covered by Basaltic flows commonly known as Deccan Traps of Upper Cretaceous-Lower Eocene age. Alluvial deposits of Recent to Sub-Recent age are observed along the river courses of Godavari and Sindphana. A map depicting the hydrogeological features is shown in **Figure-2**.

4.1.1 Hard Rock Areas

4.1.1.1 Deccan Trap Basalt

The Deccan Trap includes several flows of Basalt which are supposed to have extruded from fissure volcanoes. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 20-25 m depth. At places potential zones are encountered at deeper levels in the form of fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. This aquifer is tapped by mainly dugwells in the depth range of 3.00 to 29.60 m bgl and their yield ranges between 5700 and 72900 lph. At deeper levels, the ground water occurs under semi-confined conditions. These are tapped by Dug-cum-Borewell (DCB) ranging in depth from 11 to 50 m bgl.

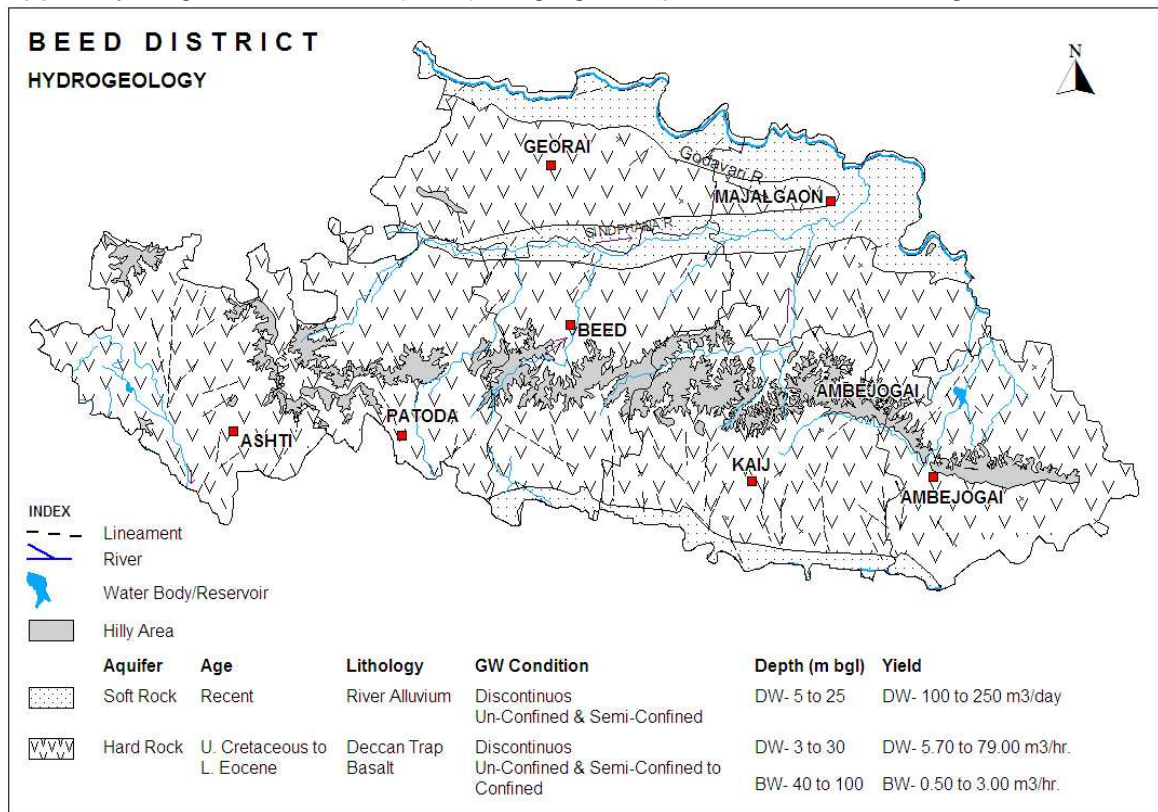


Figure-2: Hydrogeology

The confined aquifers in Basalt are encountered at depth of more than 40 to 50 m and are tapped by borewells ranging in depth from 40 to 100 m bgl. Borewells drilled down to 70 m depth, tapping weathered and vesicular basalt are found to yield 500 to 3000 lph. As per Ground Water Exploration data deeper potential aquifers below 100 m bgl have been observed in Gevrai and Ashti talukas.

4.1.2 Soft Rock Areas

4.1.2.1 Alluvium

Alluvial deposits occur in long narrow basin along Godavari and Sindphana rivers. About a 10% area of the district is occupied by Alluvium. It consists of sand, gravels and boulders with intercalations of clays and silt. The beds of sand and gravels are discontinuous and lenticular and pinch out laterally within short distance. Ground water occurs under phreatic and semi-confined conditions in inter granular pore spaces of gravel and sand. This aquifer is tapped mainly by dugwells ranging in depth 5 to 25 m bgl with 2 to 3 m diameter and the yield varies from 100 to 250 m³/day.

4.2 Water Level Scenario

Central Ground Water Board periodically monitors 30 National Hydrograph Network Stations (NHNS) stations in Beed district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon).

4.2.1 Depth to Water Level – Premonsoon (May-2007)

The depth to water levels in the district during May 2007 ranges between 2.70 (Wadwani) and 30.00 m bgl (Bardapur-2). Depth to water levels during premonsoon (May 2007) has been depicted in **Figure-3**.

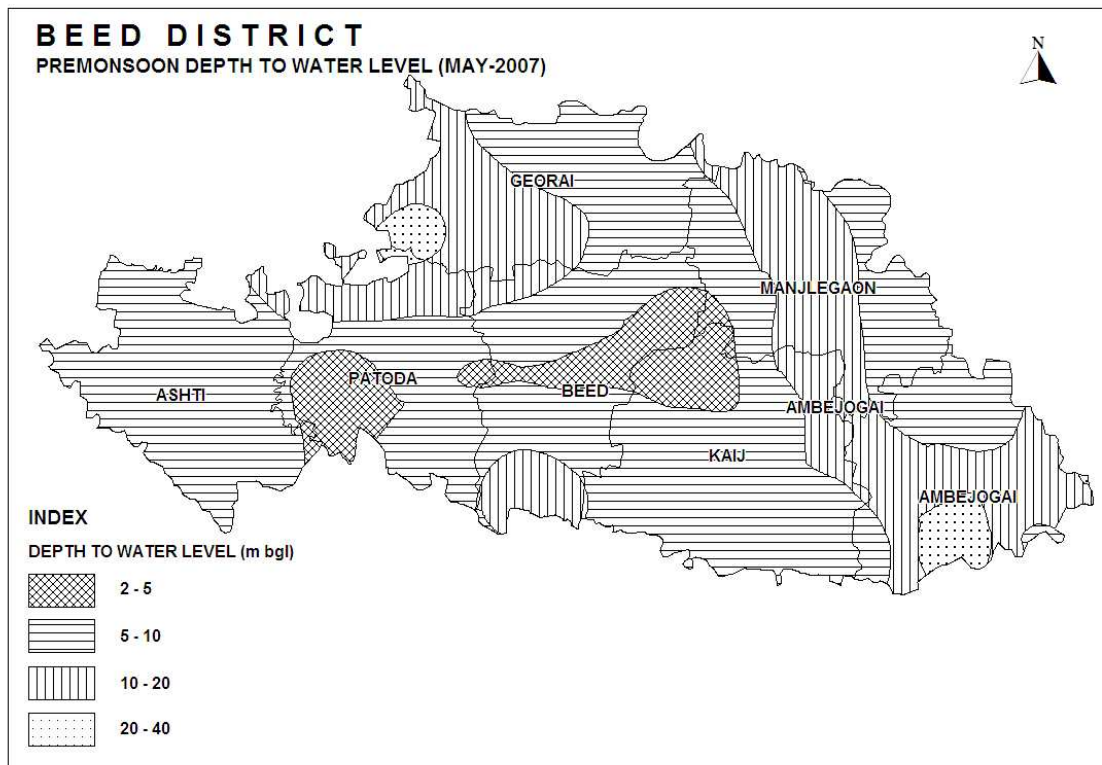


Figure-3: Depth to Water Level (Premonsoon- May 2007)

Shallow water levels within 5 m bgl are observed in 2 isolated patches in central part of the district. The water levels between 5 and 10 m bgl are observed in major parts of the district in north-central, south-central, western and eastern fringe parts. The moderate to deeper water levels of 10 to 20 m bgl are observed in elongated patch extending from northeastern to south eastern part of the district, occupying major parts of Ambejogai and Majalgaon talukas. The water levels between 20 to 40 m bgl are observed in 2 small isolated patches, one in south eastern part of the district in Ambejogai taluka and another one in north western part of the district in part if Georai taluka.

4.2.2 Depth to Water Level – Postmonsoon (Nov.-2007)

The depth to water levels during postmonsoon (Nov. 2007) ranges between 0.70 m bgl (Dharur) and 12.20 m bgl (Pendgaon). Spatial variation in postmonsoon depth to water levels is shown in **Figure-4**. In major parts of the district water levels are between 2 and 5 m bgl, occupying almost entire Ashti and major parts of Patoda, Beed, Kaij, Ambejogai and Georai. The water levels, between 5 and 10 m bgl are seen 3 patches i.e., southern (southern parts of Beed, Kaij and Ambejogai talukas), north-western (western part of Georai, northern parts of Patoda and Beed talukas) and north-eastern parts (major part of Majalgaon taluka) of the district. The deeper water levels of 10-20 m bgl are observed in 2 small isolated patches in parts of Georai and Majalgaon talukas.

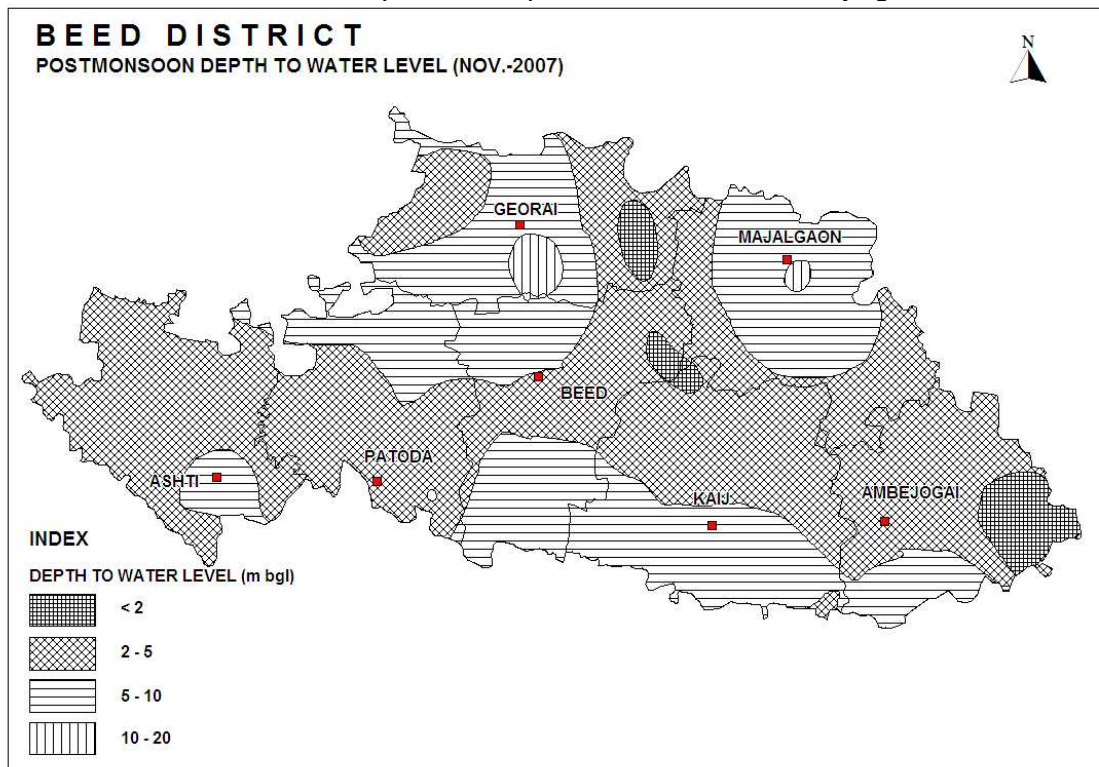


Figure-4: Depth to Water Level (Postmonsoon- Nov. 2007)

4.2.3 Seasonal Water Level Fluctuation– (May-Nov. 2007)

The seasonal rise in water levels in the district ranges from 0.45 (Pimpalwandi) to 22.15 m (Bardapur-2), however negative fluctuations in water levels is also observed at 3 NHNS and it ranges from 0.05 (Patoda) to 0.25 m (Pendgaon). The rise of more than 2 m being the most dominant range observed in central, south-central and north-central occupying major parts of district. The

next dominant range is 2 to 4 m, followed by more than 4 m range.

4.2.4 Water Level Trend (1998-2007)

Trend of water levels for premonsoon and postmonsoon period for last ten years (1998-2007) have been computed for 31 NHNS. The analysis of trend indicates that during premonsoon period, rise in water level has been recorded at 14 stations and it ranges between negligible (Pali) and 0.66m/year (Pithi). The fall in water level trend has been observed at 17 stations and it ranges between 0.03 (Sirsala & Dindrur) and 1.24 m/year (Manur). During postmonsoon period, rise in water levels has been recorded at 8 stations and it ranges from negligible (Kaij) to 0.19 m/year (Bhend Takli), whereas at 23 stations, fall in water level ranging between 0.01 m/year (Wadwani) and 1.21 m/year (Talkhed) is observed. Thus in major parts of the district, both during pre and postmonsoon periods declining trends of water levels have been observed.

The premonsoon trend map was also prepared and the same is presented in **Figure-5**. It shows that during premonsoon the rise in water level trend of up to 20 cm/year is observed in 2-3 patches in southern part of the district occupying parts of Ashti, Patoda, Beed and Kaij talukas. However in major parts of the district fall in water level trend is observed in almost entire Georai, Majalgaon, Ambejogai talukas and parts of Kaij, Beed and Patoda talukas. Thus the future ground water conservation and recharge structures need to be prioritized in these areas.

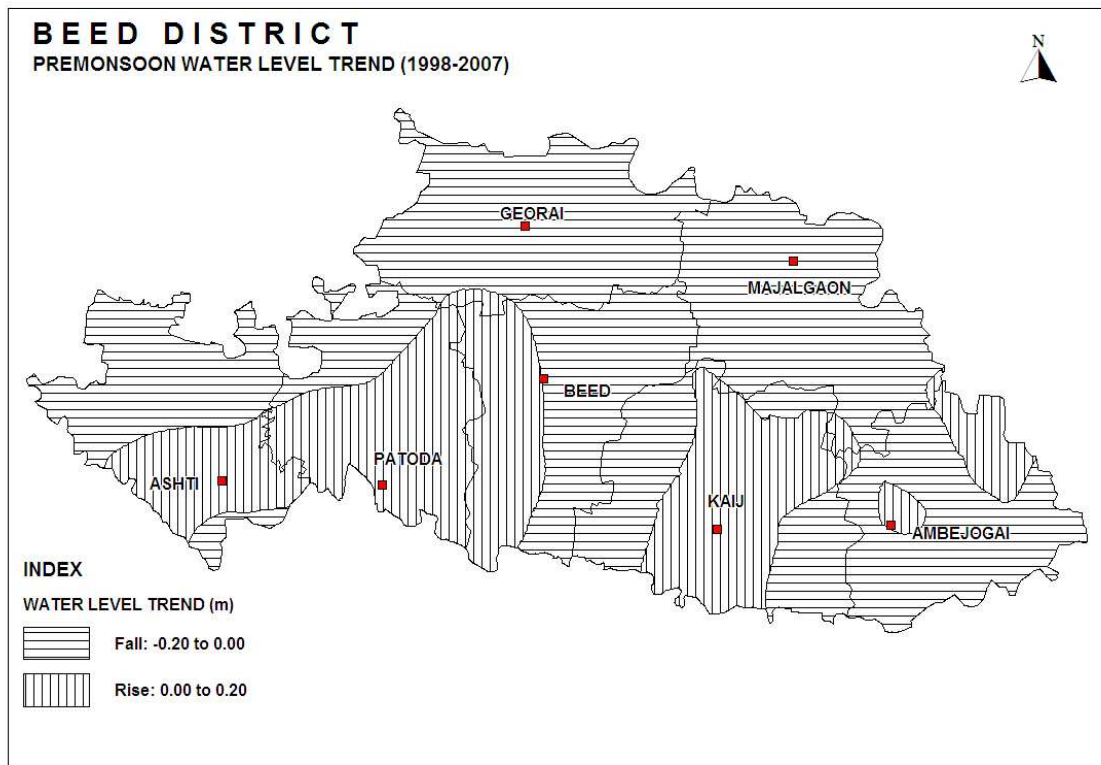


Figure-5: Premonsoon Water Level Trend (May, 1998-2007)

4.3 Aquifer Parameters

The aquifer parameters of shallow aquifer as determined during previous studies carried out by the Board indicate that in Basalt the specific capacity ranges from 35 to 1992 lpm/m of drawdown. The pumping tests conducted on

exploratory wells indicates that transmissivity varies between 20 and 456 m²/day and storativity ranges from 7.6x10⁻³ to 7.4 x10⁻³.

4.4 Yield of Dugwells and Borewells

The yields of the wells are function of the permeability and transmissivity of aquifer encountered and it varies with location, diameter and depth of wells etc. There are mainly two types of ground water abstraction structures in the district i.e., dugwells and borewells, however the yield of wells also vary according to nature of formation tapped and its saturated thickness. Therefore, the dugwells located in the topographic lows, morphological depressions and on or near the lineaments yield comparatively more water than the located elsewhere, which is particularly true in basaltic terrain. The depth of the dugwells varies between 3 and 30 m bgl in Deccan Trap Basalt and its yield varies from 5700 to 72900 lph for drawdown of about 0.30 to 5.50 m. In Alluvial area, the depth of the dugwells ranges from 5 to 25 m bgl and the yield varies from 100 to 250 m³/day.

In the exploratory wells of CGWB the discharge ranges from traces to 17.92 lps, and 13 wells (27%) were found to be high yielding with discharge > 3 lps. The borewells drilled by State ground water department/agency in Deccan Trap Basalt indicate wide variation in the range of 500 to 3000 lph, however in most of the borewells it varies from 500 to 700 lph.

4.5 Ground Water Resources

Central Ground Water Board and Ground Water Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Dhule district based on GEC-97 methodology. The same is presented in Table-4. Ground Water Resources assessment was done for 10352 sq. km. area of which 1042.27 sq. km. is under command and 9309.78 sq. km. is non-command. Taluka wise ground water resources are shown in **Figure-5**.

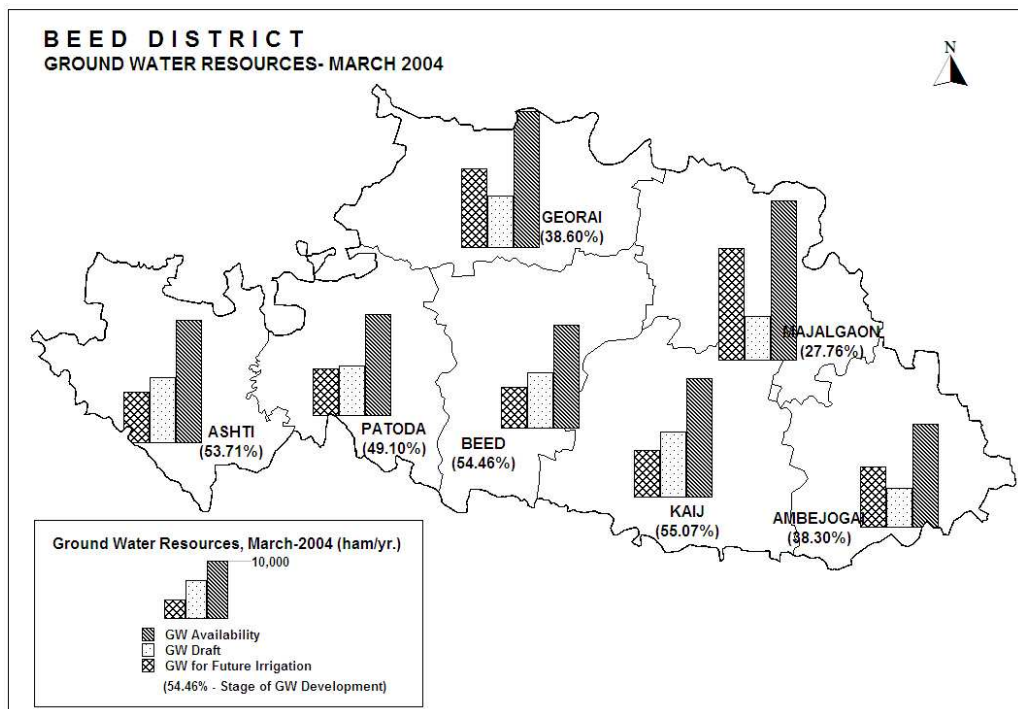


Figure 5: Ground Water Resources (March 2004).

Table 4: Ground Water Resources (March 2004).

Taluka	Area type	Net annual ground water availability (ham/yr.)	Annual ground water draft (ham/yr.)			Allocation for domestic & industrial requirement supply up to next 25 years (ham/yr.)	Ground water availability for future irrigation (ham/yr.)	Stage of ground water development (%)	Category
			Irrigation	Domestic & industrial uses	Total				
BEED	Command	805.21	218.88	15.79	234.68	31.59	554.74	29.14	
	Non command	14037.40	7056.39	791.56	7847.95	1583.13	5397.88	55.91	
	Total	14842.61	7275.27	807.36	8082.63	1614.72	5952.62	54.46	Safe
GEVRAI	Command	6859.36	796.22	111.87	908.09	223.75	5839.39	13.24	
	Non command	12560.85	6054.54	531.84	6586.38	1063.68	5442.63	52.44	
	Total	19420.21	6850.76	643.71	7494.47	1287.43	11282.02	38.59	Safe
PATODA	Command	1552.70	281.44	50.26	331.70	100.51	1170.75	21.36	
	Non command	12973.75	6327.45	473.06	6800.52	946.13	5700.17	52.42	
	Total	14526.45	6608.89	523.32	7132.21	1046.64	6870.92	49.10	Safe
ASHTI	Command	3196.64	646.56	164.59	811.15	329.18	2220.90	25.38	
	Non command	14239.42	7950.33	603.67	8554.00	1207.34	5081.75	60.07	
	Total	17436.06	8596.89	768.26	9365.15	1536.52	7302.65	53.71	Safe
AMBEJOGAI	Command	2725.86	512.27	60.81	573.08	121.63	2091.96	21.02	
	Non command	12135.18	4613.88	504.89	5118.76	939.61	6581.70	42.18	
	Total	14861.04	5126.15	565.70	5691.85	1061.24	8673.66	38.30	Safe
MAJALGAON	Command	12588.30	1813.42	193.47	2006.89	386.94	10387.94	15.94	
	Non command	10287.57	3930.47	412.51	4342.98	825.03	5532.08	42.22	
	Total	22875.87	5743.89	605.98	6349.87	1211.97	15920.02	27.76	Safe
KAIJ	Command	1031.83	198.67	25.73	224.41	51.47	781.69	21.75	
	Non command	15912.59	8415.99	691.64	9107.63	1383.28	6113.32	57.24	
	Total	16944.42	8614.66	717.37	9332.03	1434.75	6895.01	55.07	Safe
DISTRICT	Command	28759.89	4467.46	622.53	5089.99	1245.07	23047.37	17.70	
	Non command	92146.76	44349.05	4009.18	48358.23	7948.20	39849.53	52.48	
	Total	120906.65	48816.51	4631.71	53448.22	9193.27	62896.90	44.21	

As per the estimation, the total annual ground water recharge is 1275.02 MCM with the natural discharge of 65.95 MCM, thus the net annual ground water availability comes to be 1209.06 MCM. The gross draft for all uses is estimated at 534.48 MCM with irrigation sector being the major consumer having a draft of 488.16 MCM. The allocation for domestic and industrial requirements for the next 25 years is worked out at 91.93 MCM, whereas the net ground water availability for future irrigation is estimated at 628.96 MCM. The stage of ground water development varies from 27.76% (Majalgaon) to 55.07% (Kaij) and all the talukas falls in "Safe" category. The overall stage of ground water development for the district is 44.21%. Similarly, the ground water resources were also assessed for all the 48 watersheds and the watersheds have been categorised as "Safe".

4.6 Ground Water Quality

Central Ground Water Board monitors the ground water quality of the district through analysis of water samples collected from its National Hydrograph Network Stations (NHNS) which represent the shallow aquifer of the district only. The objective behind quality monitoring is to understand an overall picture of ground water quality of the district. During year 2007, CGWB has carried out the ground water quality monitoring at 12 NHNS.

The results of chemical analysis show that the ground water in the district is alkaline in nature. The geochemical classification of ground water samples is given in Table-5. It is clear from the Table-7 that the ground water in the district is mainly dominated by Ca-HCO₃ type of water followed by Ca-Cl. However the groundwater in the Basalt is generally of Ca-HCO₃ type, the change in the type of water may be due to the excess amount of strong acids ions getting percolated to ground water from anthropogenic sources.

Table 5: Geochemical Classification of Ground Water Samples.

S. No.	Classification	Type	No. of Sample	% of Sample
1	Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and weak acids (CO ₃ +HCO ₃ > 50%) exceeds strong acids	Ca-HCO ₃	7	58
2	Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and strong acids (Cl+SO ₄ +NO ₃ > 50%) exceeds weak acids	Ca-Cl	5	42
	Total		12	100

4.6.1 Suitability of Ground Water for Drinking Purpose

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TDS, TH, Ca, Mg, Cl, SO₄ and NO₃ prescribed in the standards and is given in Table-6.

Table 6: Classification of Ground Water for Drinking based on BIS Drinking Water Standards (IS-10500-91, Revised 2003).

Parameters	DL (mg/L)	MPL (mg/L)	Samples with conc. < DL	Samples with conc. in DL-MPL	Samples with conc. >MPL
TDS	500	2000	4	8	Nil
TH	300	600	2	5	5
Ca	75	200	4	6	2
Mg	30	100	4	6	2
Cl	250	1000	8	4	Nil
SO ₄	200	400	12	Nil	Nil
NO ₃	45	No relaxation	7	Nil	5
F	1.0	1.5	12	Nil	Nil

(Here, DL- Desirable Limit, MPL- Maximum Permissible Limit.)

The perusal of Table-6 shows that the potability of groundwater in 58% of wells monitored has been affected by the high concentration of nitrate present in ground water. The ground water quality is adversely affected at Ashti, Manur, Dharur, Wadwani and Sirsala as most of the parameters such as Total Hardness (TH), Calcium (Ca), Magnesium (Mg) and Nitrate (NO₃) are beyond permissible limit at these places. Overall, the ground water quality scenario of the wells monitored in the district is not bright.

4.6.2 Suitability of Ground Water for Irrigation Purpose

The water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops. The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Sodium Absorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation.

4.6.2.1 Sodium Absorption Ratio (SAR)

Sodium Absorption Ratio (SAR) is an expression pertaining to cation make up of water and soil solution and is used for characterizing the sodium hazard of irrigation water. SAR value is used to calculate the degree to which irrigation water tends to enter into cation exchange section in the soil. The main problem with high sodium concentration is its effect on soil permeability. Sodium also contributes directly to the total salinity of the water and may be toxic to sensitive crops such as fruit trees. The higher value of SAR indicates soil structure damage.

4.6.2.2 Residual Sodium Carbonate (RSC)

Residual Sodium Carbonate (RSC) is considered to be superior to SAR as a measure of sodicity particularly at low salinity levels. The classification of ground water samples based on SAR and RSC values for its suitability for irrigation purpose is shown below in Table-7.

The perusal of Table-7 clearly indicates that the 94% and 88% of samples have SAR and RSC values respectively in Good category, suggesting that the quality of ground water in the monitoring wells is good for irrigation purpose. Only in 1 sample collected from Dhule town has RSC value more than 2.50 thereby rendering it unsuitable for irrigation.

Table 7: Classification of Ground Water for Irrigation based on SAR and RSC.

SAR	<10		10-18		18-26		>26	
Category	Good		Good to Permissible		Doubtful		Unsuitable	
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples	%	No. of Samples	%
12	12	100	Nil	Nil	Nil		Nil	
RSC	<1.25		1.25-2.50		>2.50			
Category	Good		Doubtful		Unsuitable			
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples	%		
12	12	100	Nil	Nil	Nil	Nil		

4.7 Status of Ground Water Development

Ground water development depends on many factors viz., availability, crop water requirement, socio-economic fabric and on the yield of the aquifers existing in that area. Ground water in the area is being developed by three type of abstraction structures i.e., dugwells, borewells and tubewells. However dugwell is the main ground water abstraction structure in the district.

As per the data available for year 2006-07, the district had 47552 irrigation dugwells, which create an irrigation potential of about 1473 sq.km. There are about 2133 borewells (2000-01) in the district, which create an irrigation potential of about 102 sq.km. Thus the area irrigated by ground water is about 1575 sq.km., whereas surface water is accounting for about 504 sq.km. of area and the net irrigated area stands at 2079 sq.km.

State Government agencies have drilled number of borewells/tubewells fitted with hand pumps and electric motors for rural drinking water purposes in the district. In all till March 2007, GSDA, Government of Maharashtra is operating 9222 successful borewells/tubewells for rural water supply under various schemes in the district. The success rate of borewells drilled by GSDA is about 62%.

4.8 Status of Water Conservation and Artificial Recharge measures

Beed is one of the chronic drought affected district of Marathwada. In most of talukas, villages are getting drinking water supply through tankers. In order to alleviate water problems different types of measures have been taken by various State Government departments. The activities taken under soil conservation in the district since 1992 are given in Table-8.

Table 7: Activities/Structures of Water Conservation.

S. No.	Water Conservation Structure	Unit
1.	C.C.T. (ha.)	15931
2.	Contour Bunding (ha.)	26548
3.	Loose Boulder Structure (No.)	70908
4.	Earthen Structure (No.)	29500
5.	Under Ground Bandhara (No.)	461
6.	Farm Pond (No.)	1202
7.	Nala Bandh (No.)	2260
8.	Cement Nala Bandh (No.)	1575
9.	Sunken Pond (No.)	172

Beside for creating awareness and including peoples participation, programme like “Mahatma Jyotiba Phule Jal-Bhoomi Sandharan Abhiyan” has been implemented in the district from 2002 through district administration. The major works done under this programme during 2004-05 are given in Table-8.

Table 8: Major work done under “Mahatma Jyotiba Phule Jal-Bhoomi Sandharan Abhiyan” 2004-2005.

S. No.	Taluka	Vanrai Bandhara (No.)	Farm Pond (No.)	Well/Bore Recharging (No.)	Silt Excavation	
					No. of Water bodies	Silt Excavated (m ³)
A.	Agriculture Department					
1.	Beed	42	103	307	99	1,998
2.	Patoda	90	78	211	68	3,789
3.	Shirur	64	46	240	64	7,530
4.	Ashti	175	49	383	122	5,855
5.	Georai	30	41	650	98	9,642
6.	Majalgaon	38	73	400	72	4,250
7.	Ambajogai	40	251	243	75	33,400
8.	Parali (v)	60	230	379	126	29,600
9.	Kaij	39	255	399	106	4,420
10.	Dharur	15	37	194	32	1,857
11.	Wadwani	15	39	145	32	1,858
	Total (A)	608	1,202	3,581	894	104,199
B.	Other Agencies					
	Total (B)	452	337	7,413	226	473,612
C.	Grand Total (A+B)	1,060	1,539	10,994	1,120	577,811

Thus so far in the district, about 1060 Vanrai Bandharas, 1539 Farm Ponds, 11000 Well/Borewell Recharging and silt excavation in 1120 water bodies have been taken up.

5.0 Ground Water Management Strategy

Ground water has special significance for agricultural development in the district. The ground water development in some parts of the district has reached a critical stage resulting in decline of ground water levels over a period of time. Thus, there is a need to adopt an integrated approach of development of ground water resources dovetailed with ground water augmentation to provide sustainability to ground water development.

5.1 Ground Water Development

Major part of the district is underlain by Deccan Trap Basalt. The development potential of ground water in Deccan Trap Basalt is low to medium and ground water in the district can be developed through dugwells and dug-cum-bored wells (DCB) and borewells. However, the dugwells are the most feasible structures and borewells should normally be avoided as they generally tap deeper fractures, which may not be sustainable. Besides, the borewells should only be used for drinking water supply and not for irrigation. The sites for borewells also need to be selected only after proper scientific investigation so as to minimise the rate of failure.

In the northern parts of the district along Godavari and Sindphana rivers, mainly occupied by Alluvium, the groundwater potential is medium to high and groundwater can developed through dugwells and shallow tubewells.

The overall stage of ground water development for the district is about 44% thus there is plenty of scope for further development of ground water resources. However, the ground water development needs to be carried out with proper care and planning, since in these areas falling water level trends are observed.

5.2 Water Conservation and Artificial Recharge

A number of water conservation structures in the form of check dams, percolation tanks, and KT weirs have already been constructed in the district. In Basaltic area, the artificial recharge structures feasible are check dams, gully plugs, percolation tanks, nalla bunds, etc. The structures like gully plugs, contour bunds are most favourable in the hilly areas, occurring in the central part of the district. Existing dugwells can also be used for artificial recharge, however, the source water should be properly filtered before being put in the wells. The artificial recharge structures suitable for alluvial areas are percolation tanks and recharge wells/shafts.

The farm ponds are also suitable water conservation cum artificial recharge structures feasible in the district. The farm pond is beneficial to the individual farmer as well as it helps in artificial recharge to ground water. Under special drive through district administration farm ponds were taken up on farmers field in the village Bramhanath Yelamb located in Shrirur taluka. In the village nine works of farm ponds were completed through Employment Guarantee Scheme (EGS). Due to this nine farm ponds, major part of the area in the filed was brought under irrigation and the intensity of drinking water problem was reduced to some extent in the village due to artificial recharge. This created good awareness in the farming community and they are taking active parts in implementing Govt. Scheme. Thus people need to be educated and made aware of the beneficial effects of the water conservation and artificial recharge structures and their participation needs to be involved in implementing Govt. schemes.

The sites for water conservation and artificial recharge need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of de-saturated/unsaturated aquifer exists and water levels are more than 5 m deep. Such areas are observed in southern parts of Beed, Kaij and Ambejogai talukas, western part of Georai, northern parts of Patoda and Beed talukas and major part of Majalgaon taluka of the district as seen from postmonsoon water level scenario.

6.0 Ground Water Related Issues and Problems

The drought area has been observed in entire district except the western part of the district around Ashti. In major parts of the district fall in water level trend is observed in almost entire Georai, Majalgaon, Ambejogai talukas and parts of Kaij, Beed and Patoda talukas. Thus the future ground water conservation and recharge structures need to be prioritized in these areas.

Ground water quality is adversely affected by nitrate contamination in 58% of the samples. Continues intake of high nitrate concentration water causes infant methaemoglobinemia, popularly known as Blue Babies. Thus all the wells used for water supply should be first analysed for nitrate and also other constituents and if the contents are found beyond permissible limits then the ground water may be used for other than drinking purpose. Adequate sanitary protection to the

wells may be provided to control the nitrate contamination.

At few places like Manur, Wadwani and Sirsala, the electrical conductivity of ground water is more between 2200 and 2900 $\mu\text{S}/\text{cm}$ at 25°C.

7.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation all the talukas have been categorised as “Safe” and hence none of the taluka has been notified either by CGWA or SGWA.

8.0 Recommendations

1. Major part of the district is underlain by Deccan Trap Basalt, where only dugwells are the most feasible structures for ground water development.
2. The sites for borewells need to be selected only after proper scientific investigation. Borewells generally tap deeper fractures, which may not be sustainable. Besides, the borewells should only be used for drinking water supply and not for irrigation.
3. The overall stage of ground water development for the district is 44.21%, thus there is a scope for further development of ground water resources particularly in all the talukas. However, the ground water development needs to be carried out with proper care and planning, since falling water level trend is observed.
4. The drought area has been observed in entire district except the western part of the district around Ashti. In major parts of the district fall in water level trend is observed in almost entire Georai, Majalgaon, Ambejogai talukas and parts of Kaij, Beed and Patoda talukas. Thus the future ground water conservation and recharge structures need to be prioritized in these areas.
5. The scope exists for construction of suitable artificial recharge structures in the district. The structures recommended for the hilly- Deccan Trap Basalt area in the central part are: contour bunds, gully plugs, nala bunds and check dams. For other basaltic areas, the nala bunds, check dams and KT weirs are suggested. The existing dugwells may also be used for artificial recharge of ground water provided source water is free of silt and dissolved impurities.
6. In Alluvial area of the district, percolation tanks and recharge wells/shafts are suggested.
7. The existing village ponds/tanks need to be rejuvenated to act both as water conservation and artificial recharge structures.
8. Ground water quality is adversely affected by nitrate contamination in 58% ground water samples collected in May 2007. Thus all the wells used for water supply should be first analysed for nitrate and if the content is found beyond permissible limits then the ground water may be used for other than drinking purpose. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.