



**GOVT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD**

**GROUND WATER INFORMATION
AMRAVATI DISTRICT
MAHARASHTRA**



**CENTRAL REGION
NAGPUR
2007**

AMRAVATI DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	12210 sq. km
Administrative Divisions (As on 31/03/2007)	:	Taluka- 13; Amravati, Morshi, Warud, Tiwsa, Chandur Railway, Nandgaon (Kh), Bhatkuli, Daryapur, Anjangaon, Dharni, Chikhaldhara, Achalpur, Chandur Bazar
Villages	:	1698
Population	:	26,06,063
Average Annual Rainfall	:	700 to 1700 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	Two; Melghat Hill range area and Plain area of the Paynghat
Major Drainage	:	Two; Purna and Wardha

3. LAND USE (2000-01)

Forest Area	:	3171 sq. km.
Net Area Sown	:	7107 sq. km.
Cultivable Area	:	7476 sq. km.

4. SOIL TYPE

Medium to deep black soil and deep brown to red soil (Regur).

5. PRINCIPAL CROPS (1998-99)

Cotton	:	3279.01 sq. km.
Jowar	:	1181.00 sq. km.
Oil Seeds	:	1872.97 sq. km.
Pulses	:	2188.00 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2000-01)-

Nos./Potential Created (ha)

Dugwells	:	63791/147528
Tubewells/Borewells	:	691/1771
Tanks/Ponds	:	313/4603
Other Surface Sources	:	476/1465
Net Irrigated Area	:	65892 ha

7. GROUND WATER MONITORING WELLS (As on 31/05/2007)

Dugwells	:	60
Piezometers	:	9

8. GEOLOGY

Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Basalt (Deccan Traps)
Turonian	:	Lameta Beds
Upper Carboniferous - Permian	:	Gondwana
Archean	:	Metamorphics (Gneisses /Granites)

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.
Premonsoon Depth to Water Level (May-2006)	:	1.80 to 26.90 m bgl

- Postmonsoon Depth to Water : 0.13 to 25.35 m bgl
Level (Nov.-2006)
- Premonsoon Water Level Trend : Rise: Negligible to 0.52 m/year
(1997-2006) Fall: 0.01 to 1.09 m/year
- Postmonsoon Water Level Trend : Rise: 0.01 to 0.68 m/year
(1997-2006) Fall: Negligible to 1.34 m/year
- 10. GROUND WATER EXPLORATION** (As on 31/03/07)
- Wells Drilled : EW-66, OW-21, Pz-19
- Depth Range : 15.15 to 300.10 m bgl
- Discharge : 0.23 to 23.50 lps
- Transmissivity : 1.87 to 835.14 m²/day
- 11. GROUND WATER QUALITY**
- Good and suitable for drinking and irrigation purpose, except the saline areas of Purna Alluvium.
- Type of Water : Basalt- Ca-HCO₃ & Ca-Cl
Alluvium- Na-HCO₃ & Na-Cl
- 12. DYNAMIC GROUND WATER RESOURCES** (As on 31/03/2004)
- Annual Replenishable GW : 944.50 MCM
- Resources
- Total Draft (Irrigation + Domestic) : 732.69 MCM
- Projected Demand (Domestic + Industrial) : 38.63 MCM
- Stage of GW Development : 77.58%
- 13. AWARENESS AND TRAINING ACTIVITY**
- A Mass Awareness Programme : One
- a. Date : 29/12/2000
- b. Place : Warud
- c. Participants : 700
- B Water Management Training : One
- Programme
- Date : 18/02/03
- Place : Amravati
- Participants : 150
- 14. ARTIFICIAL RECHARGE & RAINWATER HARVESTING**
- Projects completed : 2, Warud Taluka
- Projects under technical guidance : Nil
- 15. GROUND WATER CONTROL & REGULATION**
- Over-Exploited Taluka : 3, Morshi, Warud, Daryapur
- Critical Taluka : 1, Chandur Bazar
- Notified Taluka : 2, Morshi, Warud
- 16. MAJOR GROUND WATER PROBLEMS AND ISSUES**
- Drought area has been observed in south-western parts of the district. Deeper water levels of more than 20 m bgl are also observed in small isolated areas in parts of Achalapur, Chandur Bazar talukas, in central part of the district and in part of Chandur Railway in southern part of the district. The areas of Purna River Alluvium covering southern parts of Anjangaon and Achalpur talukas and entire Daryapur taluka are affected by inland salinity problem.

Ground Water Information Amravati District

Contents

1.0	Introduction	1
2.0	Climate and Rainfall	3
3.0	Geomorphology and Soil Types	4
4.0	Ground Water Scenario.....	5
4.1	Hydrogeology.....	5
4.2	Ground Water Resources.....	11
4.3	Ground Water Quality	15
4.4	Status of Ground Water Development.....	17
5.0	Ground Water Management Strategy	18
5.1	Ground Water Development.....	18
5.2	Water Conservation and Artificial Recharge.....	19
6.0	Ground Water Related Issues and Problems	20
7.0	Mass Awareness and Training Activities.....	21
7.1	M.A.P. and W.M.T.P.	21
7.2	Participation in Exhibition, Mela, Fair etc.....	21
8.0	Areas Notified by CGWA/SGWA	21
9.0	Recommendations	21

List of Figures

1. Location
2. Hydrogeology
3. Depth to Water Level (Premonsoon- May 2006)
4. Depth to Water Level (Postmonsoon- Nov. 2006)
5. Ground Water Resources
6. Yield Potential

List of Tables

1. Studies undertaken by CGWB.
2. Salient Features of Ground Water Exploration.
3. Annual Rainfall Data (1996-2005).
4. Water Level Data (2006) with Long Term Trend (1997-06).
5. Taluka wise Ground Water Resources (March 2004).
6. Geochemical Classification of Ground Water Samples.
7. Classification of Ground Water Samples based on BIS Drinking Water Standards (IS-10500-91, Revised 2003).
8. Classification of Ground Water for Irrigation based on SAR and RSC.
9. Nature and Yield Potential of Aquifers.
10. Status of MAP and WMTP.

Ground Water Information

Amravati District

1.0 Introduction

Amravati District is one of the eleven districts of Vidarbha region of Maharashtra. It is situated in the northern part of the State abutting Madhya Pradesh State and lies between north latitudes 20°32' and 21°46' and east longitudes 76°37' and 78°27'. The total area of the district is 12210 sq. km. and falls in Survey of India degree sheets 55 G, 55 H, 55 K and 55 L. The district is bounded on the north by Madhya Pradesh State, on the east by Nagpur and Wardha districts, and on the south and south west by Yavatmal, Akola and Buldhana districts. Wardha River forms the eastern boundary of the district.

The district headquarters is located at Amravati Town. For administrative convenience, the district is divided in 13 talukas viz., Amravati, Morshi, Warud, Tiwsa, Chandur Railway, Nandgaon, Bhatkuli, Daryapur, Anjangaon, Dharni, Chikaldhara, Achalpur and Chandur Bazar. It has a total population of 26,06,063 as per 2001 census. The district has 13 towns and 1698 villages. The major part of the district comes under Purna-Tapi and Wardha River basins. The important rivers flowing through the district are Tapi, Purna, Wardha, Pedhi and Chandrabhaga.

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. No.	Officer	AAP	Type of Survey/Study
1.	Shri Rao. G.N.	1961-62	Systematic Hydrogeological Survey
2.	Shri Mani, V.V.S.	1970-71	-do-
3.	S/Shri Mani, V.V.S and Sharma, S.K.	1973-74	-do-
4.	S/Shri Gajbhiye and Motghare	1987-88	-do-
5.	Shri Sundarshan, S.	1987-88	-do-
6.	Shri Bansal, S.K	1990-91	-do-
7.	S/Shri Anand, A.V.S.S. and Venkateshvaran, D.	1990-91	-do-
8.	Shri Ranjan, Binoy	1991-92	Reappraisal Hydrogeological Studies
9.	Shri G., Sudarshan	1992-93	-do-
10.	Shri A.V.S.S., Anand	1995-96	-do-
11.	S/Shri Mohanta, D. and Shende, Rahul R.	2003-04	-do-
12.	Shri Jain, P.K.	2001-02	Impact Assessment of RTRWH at Panchayat Samiti Office, Warud.
13.	S/Shri. Jain, S.K., Ramaiah, S.N. and Banerjee, K.P.	VIII th 5 year plan	Artificial Recharge Studies in orange growing areas of WR-2 watershed, Warud taluka.

Ground water exploration in the district has been taken up in different phases. The ground water exploration has been done in Alluvial and hard rock areas occupied by Deccan Trap Basalt. A total of 66 Exploratory Wells (EW), 21 Observation Wells (OW) and 19 Peizometers (Pz) were constructed till March 2007.

Table 2: Salient Features of Ground Water Exploration.

S. No.	Taluka	Formation	Wells			Depth (mbgl)	SWL (mbgl)	Discharge (lps)	Draw-Down (m)	Zones (mbgl)
			E W	O W	Pz					
1.	Amravati	Alluvium	2	-	3	37.6 – 79.00	0.7 – 1.37	0.38 – 1.37	-	-
		Basalt	3	2	0	123.25 – 195.00	0.05 – 9.10	0.65 – 12.18	9.85	7.00 – 20.00
2.	Warud	Alluvium	1	-	-	150.55	4.35	0.38	-	10.35 – 13.35
3.	Morshi	Basalt	3	1	-	166.85– 202.45	6.78 – 35.00	0.56 – 7.78	-	24.00– 31.65
4.	Tiwsa	Basalt	3	-	-	184.25– 201.45	13.30	0.24– 0.56	-	7.00– 34.75
5.	Chandur Railway	Basalt	3	-	-	141.00– 200.00	4.02– 10.00	0.78– 1.37	-	10.35– 15.50
6.	Nandgaon Kh'war	Basalt	3	-	-	141.55– 200	-	0.78	-	-
7.	Bhatkuli	Alluvium	5	1	2	15.15– 128.60	3.65– 18.54	0.38– 16.80	0.75– 11.34	9.45– 35.53
8.	Daryapur	Alluvium	7	-	1	32.00– 236.96	6.96– 13.65	0.78– 6.20	0.16– 15.08	1.83– 177.30
9.	Anjangaon Surji	Alluvium	6	3	3	25.00– 300.10	5.91– 20.00	1.37– 23.50	2.44– 21.45	6.10– 47.85
10.	Dharni	Basalt	4	5	-	80.30– 200.00	2.50– 11.84	0.38– 20.77	8.00– 21.41	-
11.	Chikhaldara	Basalt	6	3	-	74.45– 202.45	6.36– 40.44	0.38– 11.11	3.86– 28.84	10.00– 74.00
12.	Achalpur	Alluvium	6	1	3	39.00– 298.91	9.02– 20.58	1.37– 19.00	7.81– 9.59	6.00– 48.66
		Basalt	1	1	-	80.55– 126.25	20.89	4.43– 16.21	12.90	-
13.	Chandur Bazar	Alluvium	6	2	4	42.00– 177.14	5.31– 17.80	1.37– 10.00	1.92 – 12.70	6.00– 122.32
	Total		66	21	19	15.15– 300.10	0.05 – 40.44	0.24 - 23.50	0.16 – 28.44	1.83 – 177.30

In Deccan Trap Basalt 26 exploratory wells and 12 observation wells were drilled and their depth ranged from 74.45 to 202.45 metres below ground level (m bgl). The discharge from these wells varied from traces to 20.77 litres per second (lps). Static water levels ranged from 0.05 to 40.44 m bgl. Except for the exploratory wells at Dhaga and Nerpinglai, water levels were shallow in other wells. Deeper aquifer zones have been encountered in almost all the wells beyond 100 m depth, the deepest being at 167.0 m at Mahuli Jehangir exploratory well.

In Purna Alluvium 40 exploratory wells, 9 observation wells and 19 Peizometers were constructed. The alluvial area has been divided into fresh ground water belt in the north and saline area in the south, based on the ground water exploration findings. The northern most part of the fresh water zone is underlain by soft weathered boulders of Basalt and this is restricted to

small patches of around 10 km within Achalpur and Anjangaon taluka. This zone is termed as Bazada zone and exploration is yet to be done here. The southern saline area is distributed in parts of Daryapur, Bhatkuli and Amravati talukas and has been explored in detail by drilling. Depth of the wells ranged from 15.15 to 300.10 m bgl. Static water levels vary from 3.65 to 20.58 m bgl. Discharge from exploratory wells ranged from 0.38 to 23.50 lps for drawdowns ranging from 0.16 to 21.45 m. Granular zones have been encountered and screened at various depths. However, it is found that zones down to the depth of 70 m falling in younger Alluvium have better yields and the water is less saline. This zone can be used for agricultural purposes by means of shallow tubewells constructed down to the depth of 65 m and yielding up to 10 lps for 30 m lift.

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

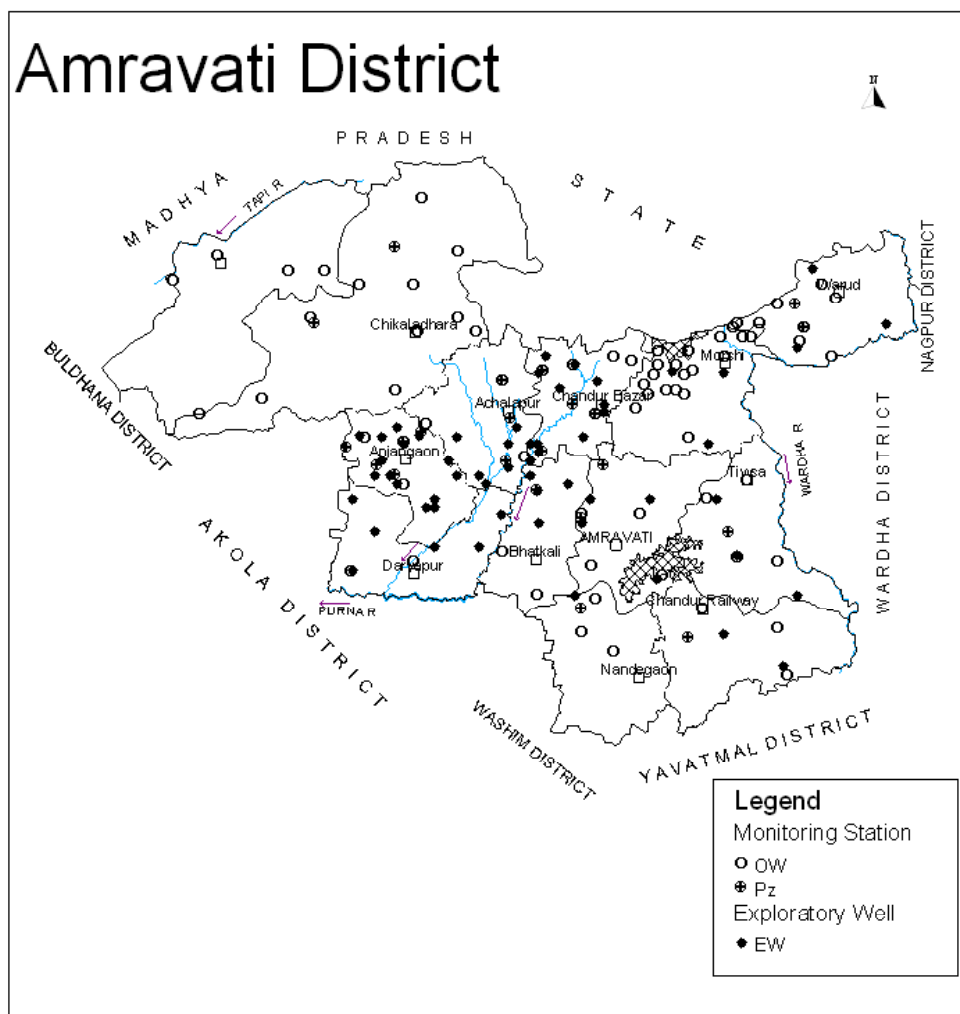


Figure 1: Location

2.0 Climate and Rainfall

The Climate of the district is characterised by a hot summer and general dryness throughout the year except during the south-west monsoon season,

i.e., June to September. The mean minimum temperature is 15.1°C and mean maximum temperature is 42.2°C.

The normal annual rainfall over the district varies from 700 mm to about 1700 mm. It is the minimum in the south western parts of the district around Daryapur (709 mm). This increases towards north and reaches a maximum in the northern part around Chikhaldhara (1647 mm). The average rainfall for the last ten years ranges from 603.8 mm (Anjangaon) to 1374.02 mm (Chikhaldhara) and the same is presented in **Table-3**. The average annual rainfall for the last ten years when compared with the normal annual rainfall, it is observed that the average annual rainfall for the last ten years of the district is much less than the normal annual rainfall. Thus the rainfall has definitely decreased in the district over the period of time.

Table 3: Annual Rainfall Data (1996-2005). (mm)

S. No.	Taluka	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Avg.
1	Achalpur	720.40	695.40	913.40	724.00	516.00	472.90	646.50	625.00	572.00	654.00	653.96
2	Amravati	637.70	671.70	759.96	999.36	766.80	619.60	672.50	681.80	511.62	886.40	720.74
3	Anjangaon	570.20	645.80	902.40	691.50	349.90	466.10	687.40	604.10	492.20	628.40	603.80
4	Bhatkuli	790.10	607.80	675.40	646.60	535.20	672.20	582.50	519.40	538.62	711.60	627.94
5	Chandur bazar	790.80	774.70	778.32	695.20	398.80	585.00	777.20	608.60	549.30	578.00	653.59
6	Chandur Railway	746.20	599.60	599.62	938.30	688.90	788.60	859.70	850.90	418.03	1048.5	753.84
7	Chikhaldhara	1710.40	1568.90	1776.80	1396.00	938.00	1207.00	1254.00	1373.20	1157.70	1358.2	1374.02
8	Daryapur	587.80	638.20	846.90	780.90	686.40	617.10	603.80	415.20	510.30	696.20	638.28
9	Dhamangaon Railway	-	-	1158.00	1070.90	709.10	721.60	851.30	750.80	630.60	1116.4	876.09
10	Dharni	570.20	886.60	1161.40	1065.80	471.50	409.70	841.90	915.00	677.90	907.20	790.72
11	Morshi	574.00	514.00	707.70	690.40	420.10	534.20	763.10	750.00	659.80	696.30	630.96
12	Nandgaon-khandeshwar	642.10	764.90	743.98	1040.40	599.00	725.00	768.40	520.40	441.40	1194.4	744.00
13	Tiwsa	721.40	647.40	766.88	949.05	400.10	708.00	642.20	618.50	568.05	964.00	698.56
14	Warud	635.70	836.70	666.81	972.90	455.90	619.20	581.30	734.40	608.30	783.20	689.44
	Average	745.92	757.82	889.83	904.38	566.84	653.30	752.27	711.95	595.42	873.06	745.08

3.0 Geomorphology and Soil Types

The district can be broadly divided into two physiographic units i.e., the Melghat Hill range and the plain area of the Paynghat. The Melghat hills are made up of Gawilgarh hills, which are a part of the Satpura hill ranges. The eastern part of the district falls under Godavari basin and consists of 20 watersheds, whereas the western and north western parts falls in Tapi basin and consists of 23 watersheds.

Two types of soils have been observed in the district namely medium to deep black soil and deep brown to red soil (Regur).

4.0 Ground Water Scenario

4.1 Hydrogeology

Basaltic lava flows are the major rock formations along with Alluvium, Lameta beds, Gondwana Sediments and unclassified metamorphic rocks. About 70% of the area is underlain by Deccan Traps and remaining by other soft rock formations, particularly the Alluvium. A map depicting the hydrogeological features is presented as **Figure-2**.

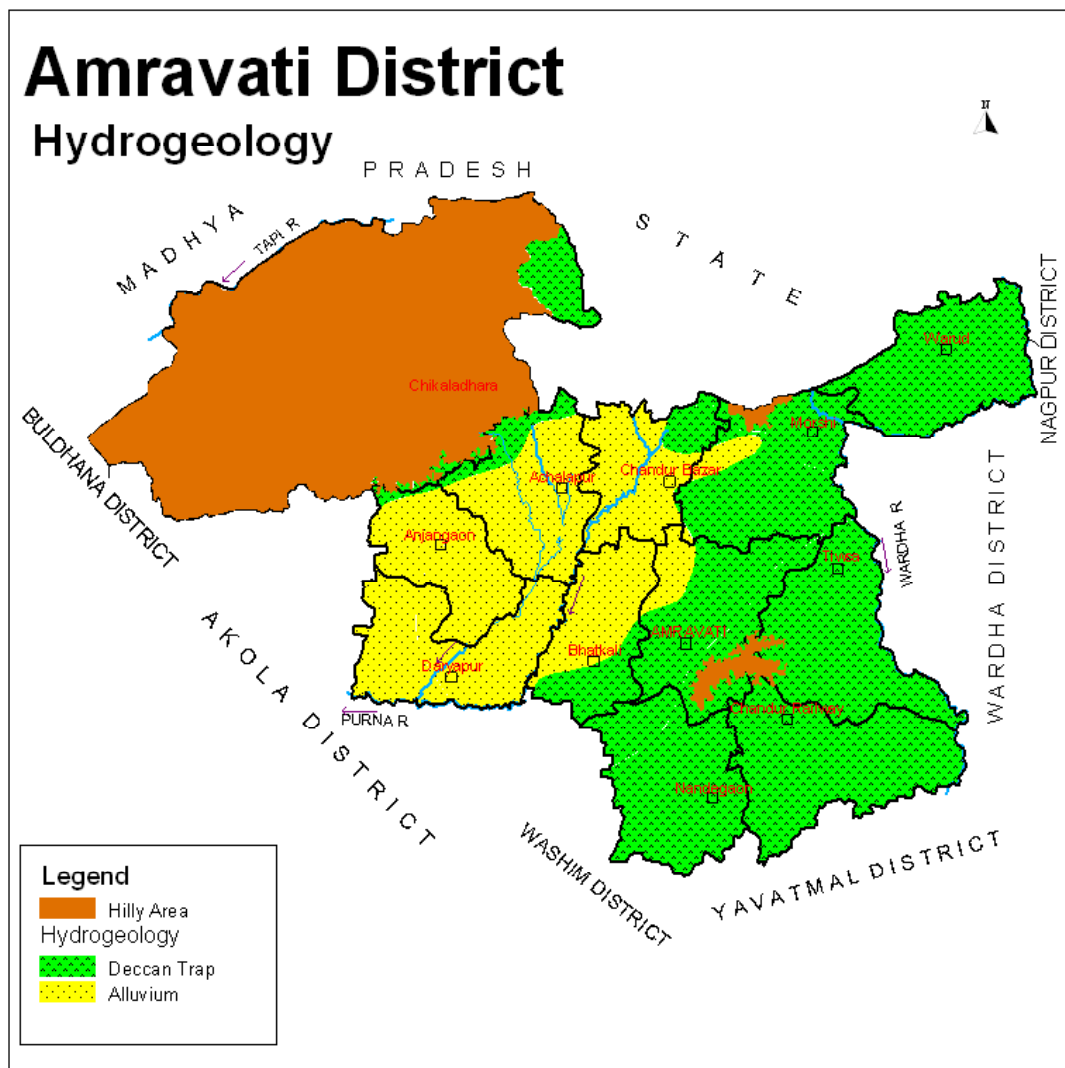


Figure 2: Hydrogeology

4.1.1 Deccan Trap Basalt

Deccan Trap Basalt belonging to upper Cretaceous to lower Eocene age occurs in the northwestern, southeastern and eastern parts of the district. The northwestern part, i.e., Dharni and Chikaldhara talukas, is hilly and rugged terrain where Basalt does not form potential aquifer due to limited thickness of weathered mantle. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 15-20 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. At deeper levels, the ground water occurs under semi-confined conditions.

4.1.2 Alluvium

The Alluvial deposits are termed as Purna Alluvial deposits, as they have been deposited in the Purna valley during Pleistocene to Recent period. Alluvium occupies nearly a third of the district on the northern side along Purna River system stretching over a width of 55 km and an area of 3500 sq. km. Alluvium thickness ranges from 10-350 m and is divided into younger and older Alluvium with the younger one being more granular and the older more clayey. Ground water occurs under phreatic and semi-confined conditions down to a depth of 80 m i.e., in the younger Alluvium consisting of alternate beds of clay and sand. Two to five beds of coarse sand and gravel are encountered within the younger Alluvium, which form the productive aquifer. The older Alluvium is mostly clayey with only one or two thin beds of gravel at the base near the trap basement. In the deeper aquifers, ground water occurs in confined state. Younger Alluvium is lacustrine and older is marine in nature. The basement for Alluvium is Basalt met with at different depths, which may be due to pre-trappean topography or due to faults with up thrown and down thrown blocks. Predominant slope of trap basement is northwards.

Hydraulic gradient is towards south in the northern part of Purna River and towards north in the southern part of Purna River. Hydraulic gradient is 3.5 m/km in north and about 2.5 m/km in south of Purna River.

4.1.3 Water Level Scenario

Central Ground Water Board periodically monitors 64 National Hydrograph Network Stations (NHNS) stations in the Amravati district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon). The data on premonsoon and postmonsoon water levels along with fluctuation during 2006 and long term water level trends (1997-06) is given in **Table- 4**

Table 4: Water Level Data (2006) with Long Term Trend (1997-06).

S. No.	Location	Pre monsoon Water Level (m bgl)	Post monsoon Water Level (m bgl)	Fluctuation (m)	Premonsoon Trend		Postmonsoon Trend	
					Rise (m/yr)	Fall (m/yr)	Rise (m/yr)	Fall (m/yr)
1	2	3	4	5	6	7	8	9
1.	Ambada	13.85	12.67	1.18		1.09		0.75
2.	Anjansingi	5.10	2.28	2.82	0.30		0.49	
3.	Arao	2.80	0.92	1.88	0.35			0.04
4.	Ashtagaon	5.27	2.27	3.00		0.16		0.01
5.	Badnera	11.81	4.57	7.24		0.41		0.06
6.	Barukheda	3.31	0.13	3.18	-	-	-	-
7.	Behali	4.30	3.10	1.20		0.24		0.02
8.	Belora	8.60	8.98	-0.38		0.02		0.08
9.	Benoda (WT)	-	-	-	0.12			0.07
10.	Bhatkulijain	7.66	2.68	4.98	0.10		0.05	
11.	Bhokarbardi	8.03	1.64	6.39		0.44		0.09
12.	Chandur Bazar	25.50	24.40	1.10		0.77		0.78

1	2	3	4	5	6	7	8	9
13.	Chandur Railway	4.15	2.65	1.50		0.05	0.05	
14.	Chicholi	8.97	4.11	4.86		0.02		0.06
15.	Chinkhedi	1.80	2.07	-0.27	-	-	-	-
16.	Dapori1	13.10	4.34	8.76	0.09			0.31
17.	Dargarh	4.78	2.28	2.50	0.01			0.004
18.	Daryapur	19.31	15.73	3.58	0.008		0.23	
19.	Devgaon	4.65	3.55	1.10	0.28		0.27	
20.	Dharni	5.85	2.80	3.05		0.05	0.10	
21.	Gadegaon1	17.20	16.49	0.71		0.66		0.53
22.	Ghat larki	13.04	13.04	0.00		0.01		1.00
23.	Ghodadev	14.60	14.60	0.00		0.36		0.72
24.	Harisal	10.34	5.73	4.61		0.37		0.04
25.	Hatru	2.03	0.82	1.21	-	-	-	-
26.	Hiwarkheda	11.90	9.50	2.40		0.04		0.08
27.	Jamgaon	9.87	4.50	5.37	0.52		0.02	
28.	Karasgaon	12.55	12.55	0.00	0.06		0.10	
29.	Khanapur	8.45	4.68	3.77	0.01			0.23
30.	Kher	10.35	4.35	6.00		0.26		0.28
31.	Khopra	12.34	12.34	0.00		0.05		0.35
32.	Kolkaz	7.62	6.84	0.78		0.02		0.05
33.	Kurha	5.00	3.37	1.63	0.002		0.68	
34.	Lawada	6.23	2.62	3.61	0.17			0.04
35.	Loni	17.60	16.17	1.43	0.13			0.32
36.	Lontek	6.70	-	-		0.12		0.38
37.	Lotwada	11.40	-	-		0.18		
38.	Mahuli	7.98	2.77	5.21		0.26		0.03
39.	Manjarkhed Kasba	24.80	7.19	17.61	-	-	-	-
40.	Morshi	11.40	-	-		0.41		0.008
41.	Nandgaon	10.35	5.18	5.17		0.37		0.28
42.	Nimbhari	9.50	8.91	0.59				
43.	Pala	13.15	8.92	4.23		0.35		0.17
44.	Pathrot	20.30	20.30	0.00		0.73		1.25
45.	Pathrot1	26.90	25.35	1.55	-	-	-	-
46.	Pimpri	5.28	5.28	0.00	0.001			0.29
47.	Pohra	2.65	2.02	0.63		0.15		0.12
48.	Rithpur	9.65	5.96	3.69		0.40		0.25
49.	Saiwada	8.67	8.67	0.00		0.16		0.27
50.	Sawarkheda	11.20	11.20	0.00		0.04		0.34
51.	Shendurjana (Kh)	9.74	9.74	0.00		0.06		0.56
52.	Shivni1	6.60	1.80	4.80	-	-	-	-
53.	Silona	4.44	0.15	4.29		0.33		0.02
54.	Sindola	7.10	5.83	1.27		0.17		0.10
55.	Sirasgaon	18.08	18.08	0.00		0.77		1.27
56.	Temburkheda1	9.80	4.34	5.46		0.23		1.34
57.	Teosa	3.45	2.05	1.40	0.241		0.02	
58.	Umarched	12.58	7.67	4.91		0.16		0.07
59.	Wadgaon	8.20	6.08	2.12		0.08		0.02

1	2	3	4	5	6	7	8	9
60.	Wadner gangai	9.54	8.26	1.28	-	-	-	-
61.	Walgaon	6.65	4.00	2.65	0.042		0.01	
62.	Warud	14.15	10.15	4.00		0.29		0.30
63.	Wishroli1	16.80	15.23	1.57		0.42		1.13
64.	Yavali	10.20	10.20	0.00		0.13		0.42

4.1.3.1 Depth to Water Level – Premonsoon (May-2006)

The depth to water levels in the district during premonsoon ranges between 1.80 (Chinchkhedi) and 26.90 (Pathrot) m bgl. Depth to water levels during premonsoon (May 2006) has been depicted in **Figure-3**. Shallow water levels within 10 m bgl are observed in major parts of the district i.e., in southern part of the district in parts of Bhatkuli, Amravati, Teosa, Chandur Railway and Nandgaon Khandeshwar talukas and in northwestern part of the district in parts of Dharni and Chikaldhara talukas. In central and southern parts of the district comprising major parts of Daryapur, Anjangaon, Achalapur, Chandur Bazar, Morshi and Warud and small parts of Bhatkuli, Amravati, Nandgaon (Kh) and Chandur Railway talukas the water levels rests between 10 and 20 m bgl. Deeper water levels, i.e., more than 20 m bgl are observed in small isolated areas in parts of Achalpur, Chandur Bazar talukas in central part of the district and in part of Chandur Railway in southern part of the district.

4.1.3.2 Depth to Water Level – Postmonsoon (Nov.-2006)

The depth to water levels during postmonsoon (Nov. 2006) ranges between 0.13 m bgl (Barukheda) and 25.35 m bgl (Pathrot-1). Spatial variation in postmonsoon depth to water level is shown in **Figure-4**. Shallow water levels within 10 m bgl are observed in major parts of the district i.e., in southern part of the district in entire Teosa, Chandur Railway and Nandgaon Khandeshwar talukas and in major parts of Bhatkuli, Amravati, Morshi and Warud talukas. Very shallow water levels of less than 5 m bgl are observed in northern part of the district in almost entire Chikaldhara and Dharni talukas. In major parts of Darayapur, Anjangaon and south eastern part of Warud taluka, the water levels are between 10 and 20 m bgl. The deeper water levels of more than 20 m bgl are observed in north central part of the district in major parts of Achalpur, and Chandur Bazar talukas.

Amravati District

Depth to Water Level (May 2006)

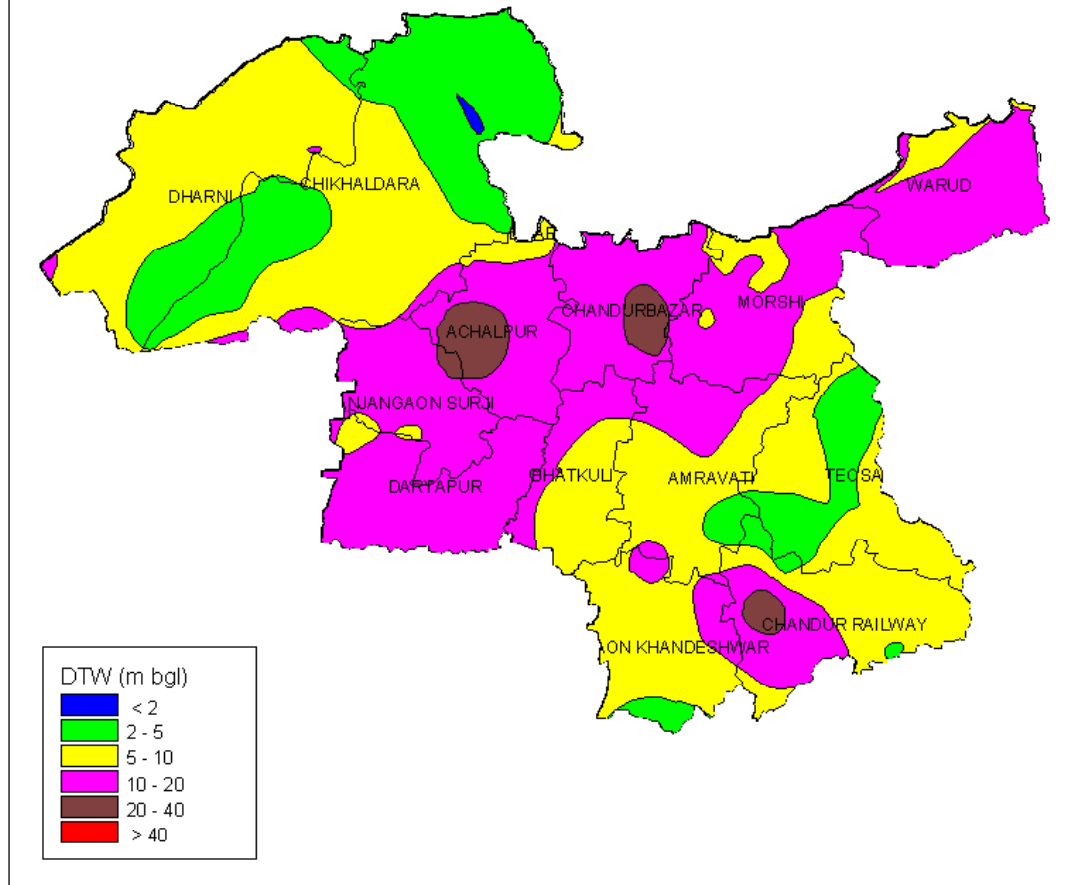


Figure 3: Depth to Water Level (Premonsoon- May 2006)

4.1.4 Seasonal Water Level Fluctuation– (May-Nov. 2006)

In major parts of the district rise in water levels in the range of 0.59 (Nimbhari) to 17.61 m (Manjarkhed Kasba) is observed. In almost entire district rise in water levels have been observed. Rise in water level in the range of 0 to 2 m is the most dominant range observed in the eastern, north central and northern parts of the district. In south western and north western parts, the rise is in the range of 2 to 4 m. Rise of more than 4 m is observed in southern, southeastern and peripheral north western parts of the district in parts of Nandgaon (Kh), Chandur Railway, Bhatkuli, Amravati talukas in southern part of the district and in Morshi and Warud talukas and north western part of the district in Dharni taluka. Fall in the water level is observed in few small isolated areas in the northern part of Chandur Bazar taluka.

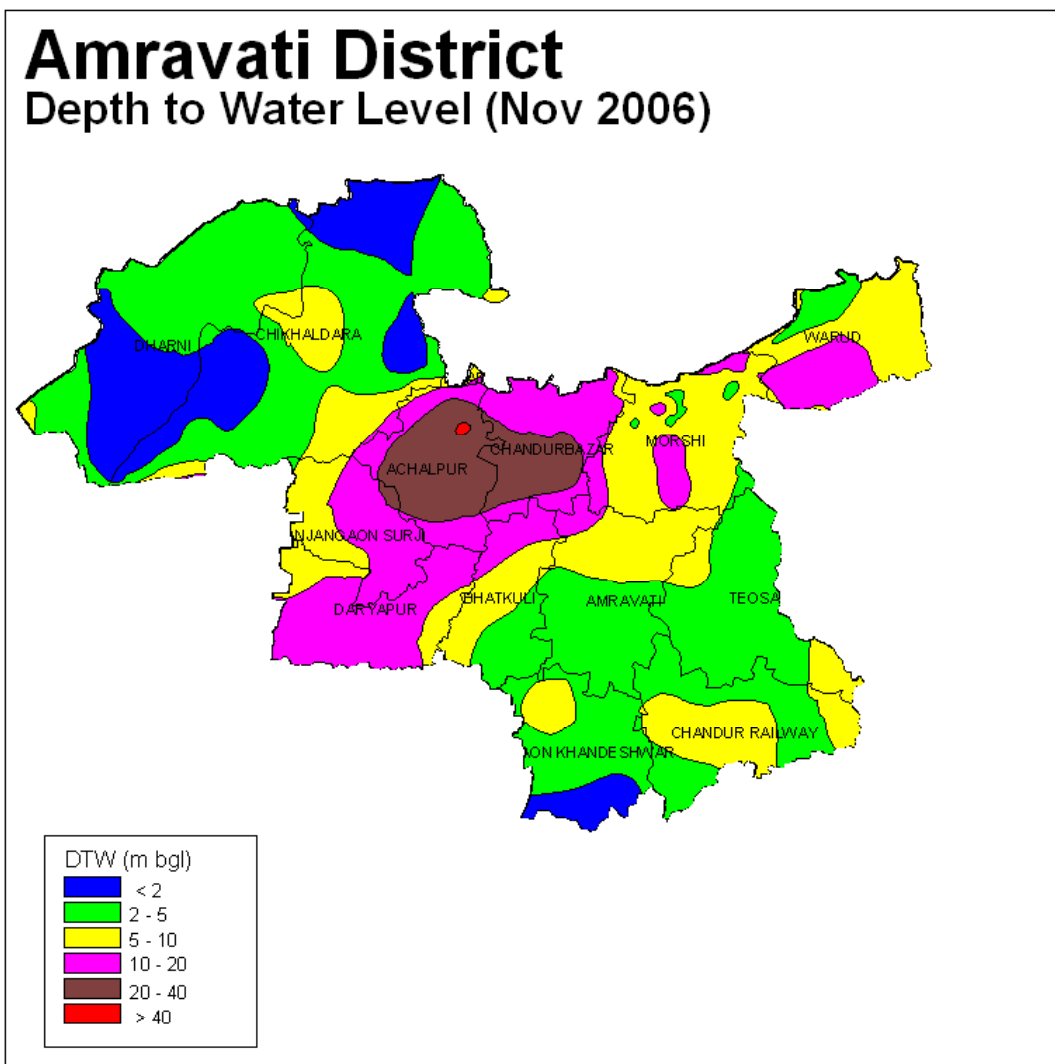


Figure 4: Depth to Water Level (Postmonsoon- Nov. 2006)

4.1.5 Water Level Trend (1997-2006)

Trend of water levels for premonsoon and postmonsoon periods for last ten years (1997-2006) have been computed for 56 NHNS and are given in **Table-4**.

Analysis of trend indicates that during premonsoon period, rise in water levels has been recorded at 17 stations and it ranges between negligible at few stations and 0.52 m/year (Jamgaon). Fall in water levels has been observed at 39 stations and ranges between 0.01 (Ghat larki) and 1.09 m/year (Ambada). During postmonsoon period, rise in water levels has been recorded at 11 stations and it ranges from 0.01 (Walgaon) to 0.68 m/year (Kurha), whereas at 45 stations, fall in water levels ranging between negligible at few stations and 1.34 m/year (Temburkheda) is observed. Thus in major part of the district, both during pre and postmonsoon periods declining trends of water levels have been observed.

4.1.6 Aquifer Parameters

Aquifer parameters for 30 exploratory wells constructed in Alluvial area

are available. In these the transmissivity values ranged from 12.70 to 835.14 m²/day and permeability varied from 10.28 to 668.26 m²/day. It is observed that values of transmissivity and permeability are directly proportionate to the cumulative thickness of the aquifer and the type of aquifer.

4.2 Ground Water Resources

Central Ground Water Board and Ground Water Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Amravati district based on GEC-97 methodology. The same is presented in **Table-5**, whereas the graphical representations of the resources on the map are shown in **Figure-5**. Ground water resource assessment was done for 8392.39 sq. km. area of which 352.53 sq. km. area is under command and 6646.13 sq. km. is non-command area. About 1393 sq. km. area comes under poor ground water quality.

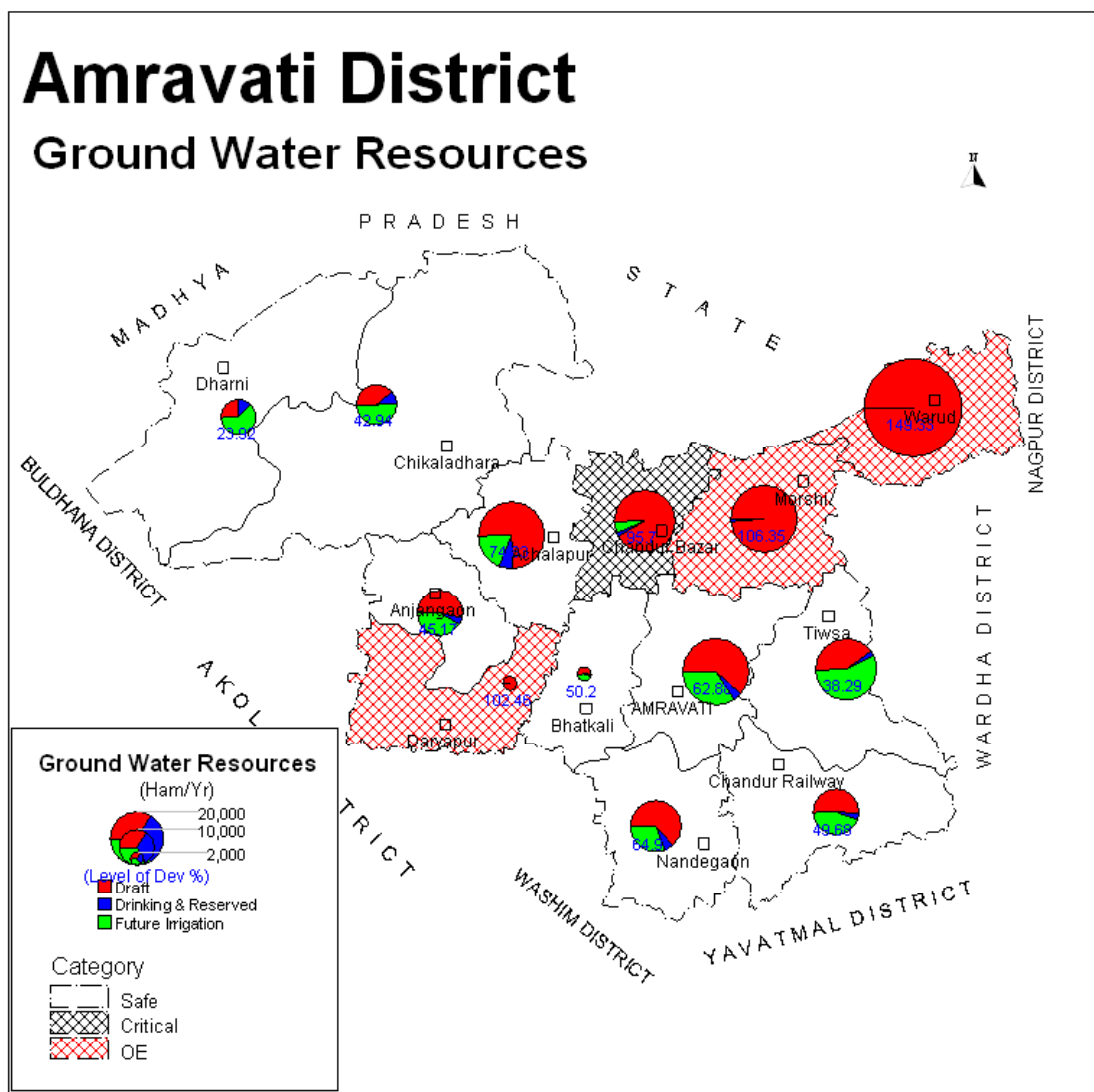


Figure 5: Ground Water Resources

As per the estimation, the total annual ground water recharge is 994.20 MCM with the natural discharge of 49.71 MCM, thus the net annual ground water availability comes to be 944.50 MCM. The gross draft for all uses is

estimated at 732.70 MCM with irrigation sector being the major consumer having a draft of 707.59 MCM. The domestic and industrial water requirements are worked at 38.63 MCM. The net ground water availability for future irrigation is estimated at 259.53 MCM.

Stage of ground water development varies from 32.92% (Dharni) to 149.33% (Warud). The overall stage of ground water development for the district is 77.58%. Out of total 14 talukas, 3 talukas i.e., Morshi, Warud and Daryapur are categorised as "Over-Exploited", 1 taluka i.e., Chandur Bazar falls in "Critical" category whereas remaining 10 talukas i.e., Amravati, Bhatkuli, Nandgaon (Kh), Achalpur, Anjangaon, Chandur Railway, Dharni, Chikhaldhara, Tiwsa and Dhmangaon fall in "Safe" category. Watershed wise resources computation indicate that the watersheds PT-2, PT-20, PTP-2, WR-1, WR-2, WR-3 and WRC-1 watersheds fall in "Over-Exploited", WR-9 in "Critical", PTP-6, WR-8, WRB-2 and WRB-17 fall in "Semi-Critical" category.

Table-5: Taluka wise Ground Water Resources (March 2004).

Taluka	Area Type	Net Annual Ground water Availability (ham/yr)	Existing Gross Groundwater Draft for Irrigation (ham/yr)	Existing Gross Groundwater Draft for Domestic & Industrial water Supply (ham/yr)	Existing Gross Groundwater Draft for All uses (ham/yr)	Allocation for domestic & industrial requirement supply upto next 25 years (ham/yr)	Net Groundwater Availability for future irrigation development (ham/yr)	Stage of Groundwater Development (%)
1	2	3	4	5	6	7	8	9
AMRAVATI	COMMAND	620.32	184.65	7.71	192.36	6.17	135.67	31.01
	NON COMMAND	9500.34	5957.75	213.91	6171.66	440.25	3395.00	64.96
	TOTAL	10120.66	6142.41	221.61	6364.02	446.42	3530.67	62.88
BHATKULI	NON COMMAND	579.21	274.26	16.56	290.82	30.18	264.56	50.21
NANDGAON	COMMAND	257.75	32.24	8.72	40.97	4.86	72.33	15.89
	NON COMMAND	7287.71	4372.91	215.70	4588.60	413.05	2436.25	62.96
	TOTAL	7545.46	4405.15	224.42	4629.57	417.91	2508.59	61.36
ACHLAPUR	COMMAND	1104.26	281.35	23.19	304.54	31.35	138.44	27.58
	NON COMMAND	8651.43	7038.96	307.55	7346.51	645.54	1748.53	84.92
	TOTAL	9755.69	7320.31	330.74	7651.05	676.89	1886.97	78.43
CHANDUR BAZAR	NON COMMAND	8821.99	8227.46	215.11	8442.57	173.53	553.50	95.70
MORSHI	COMMAND	1425.05	283.12	35.83	318.95	7.38	168.31	22.38
	NON COMMAND	7833.91	9346.01	181.80	9527.81	103.50	857.64	121.62
	TOTAL	9258.97	9629.12	217.63	9846.76	110.88	1025.95	106.35

1	2	3	4	5	6	7	8	9
WARUD	COMMAND	1327.70	2793.38	70.19	2863.57	0.00	0.00	215.68
	NON COMMAND	11855.58	16655.33	167.29	16822.63	0.00	0.00	141.90
	TOTAL	13183.28	19448.71	237.49	19686.20	0.00	0.00	149.33
DARYAPUR	NON COMMAND	909.33	915.22	16.44	931.67	0.00	0.00	102.46
ANJANGAON SURJI	COMMAND	2839.02	577.46	56.97	634.42	72.11	459.56	22.35
	NON COMMAND	2966.27	1902.66	84.99	1987.64	192.68	1585.85	67.01
	TOTAL	5805.28	2480.11	141.95	2622.07	264.78	2045.41	45.17
CHANDUR RAILWAY	COMMAND	708.89	133.83	23.47	157.30	14.83	159.75	22.19
	NON COMMAND	4687.26	2414.14	109.63	2523.77	243.40	2213.81	53.84
	TOTAL	5396.15	2547.97	133.10	2681.07	258.23	2373.56	49.68
DHARNI	COMMAND	1055.72	86.12	62.14	148.25	36.48	239.12	14.04
	NON COMMAND	2690.92	571.03	176.95	747.98	409.82	2134.75	27.80
	TOTAL	3746.64	657.15	239.09	896.24	446.30	2373.88	23.92
CHIKHALDARA	NON COMMAND	3514.71	1306.90	202.28	1509.18	421.38	2028.19	42.94
TIWSA	COMMAND	4495.29	858.66	66.97	925.63	47.13	1122.13	20.59
	NON COMMAND	5065.09	2674.11	60.55	2734.66	189.94	4252.50	53.99
	TOTAL	9560.38	3532.77	127.52	3660.29	237.07	5374.63	38.29
DHAMANGAON RAILWAY	COMMAND	46.97	8.35	2.19	10.53	0.82	11.14	22.43
	NON COMMAND	6204.81	3863.28	184.35	4047.63	378.47	1935.63	65.23
	TOTAL	6251.77	3871.63	186.54	4058.16	379.29	1946.77	64.91
TOTAL	COMMAND	13880.95	5239.15	357.37	5596.52	221.13	2506.44	40.32
	NON COMMAND	80568.57	65520.02	2153.11	67673.14	3641.73	23406.21	83.99
	TOTAL	94449.52	70759.17	2510.48	73269.66	3862.86	25912.66	77.58

4.3 Ground Water Quality

In the district, 34 water samples were collected during May 2006, out of which 30 samples were representing Deccan Trap Basalt and 4 were representing Alluvium. The samples were broadly classified into four classes as given in **Table-6**.

Table-6 Geochemical Classification of Ground Water Samples.

Sr. 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	14	41
2	Alkali metal (Na+K > 50%) exceeds alkaline earths and weak acids (CO ₃ +HCO ₃ > 50%) exceeds strong acids.	Na-HCO ₃	3	9
3	Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and strong acids (Cl+SO ₄ +NO ₃ > 50%) exceeds weak acids	Ca-Cl	14	41
4	Alkali metal (Na+K > 50%) exceeds alkaline earths and strong acids (Cl+SO ₄ +NO ₃ > 50%) exceeds weak acids	Na-Cl	3	9
	Total		34	100

It is clear from the **Table-6** that the ground water in the district is not dominated by a particular type of water. The table shows that 41% samples each are of Ca-HCO₃ and Ca-Cl type. These samples are mainly from Basaltic aquifer. The samples, which are dominated by Na-HCO₃ and Na-Cl type of water are only 9% and belongs to Alluvial area. It is observed that the ground water samples representing Basaltic aquifer, which were of Ca-HCO₃ type, have changed to Ca-Cl type. The type of water in Alluvium gives an idea about inland salinity problem existing in the Purna Alluvium basin of the district.

4.3.1 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-7**.

Table-7 Classification of Ground Water Samples based on BIS Drinking Water Standards (IS-10500-91, Revised 2003)

Parameters	DL	MPL	Samples with conc. < DL	Samples with conc. in DL-MPL	Samples with conc. >MPL
TDS (mg/L)	500	2000	10	23	1
TH (mg/L)	300	600	11	18	5
Ca(mg/L)	75	200	19	15	0
Mg(mg/L)	30	100	11	19	4
Cl (mg/L)	250	1000	25	9	0
SO ₄ (mg/L)	200	400	34	0	0
NO ₃ (mg/L)	45	No relaxation	16	No relaxation	18
F (mg/L)	1.0	1.5	31	1	2

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

The classification in **Table-7** shows that concentration of NO₃ is beyond the maximum permissible limit in 53% of samples. In few samples, the concentration of parameter such as TDS, TH, Mg and F have also crossed the maximum permissible limits. Overall, the potability of ground water in the monitored wells has been affected mainly due to high NO₃ in ground water. Therefore, it can be concluded that the ground water quality in majority of the area is good for drinking purpose.

4.3.2 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.

4.3.2.1 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.

4.3.2.2 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-8**.

Table-8 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	%
34	31	91	3	9	0	0	0	0
RSC	<1.25		1.25-2.50		>2.50			
Category	Good		Doubtful		Unsuitable			
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples		%	
34	29	85	1	3	4		12	

The perusal of **Table-8** shows that out of 34 samples, 31 samples are having SAR values less than 10 while 29 samples are having RSC values less than 1.25 indicating that the ground water in 85% of wells is good for irrigation use. However, the RSC values of samples collected from the wells located at Walgaon, Chandur Bazaar, Daryapur and Nimbhori were found to be more than 2.5 and the ground water in these wells is unsuitable for irrigation purpose.

4.4 Status of Ground Water Development

The yields of wells are functions of the permeability and transmissivity of aquifer encountered and varies with location, diameter and depth etc. There are four types of ground water structures i.e. dugwells, borewells, tubewells and dug cum borewells (DCB) in the area. Their yield characteristics are described below.

Dugwells are generally used for both domestic water requirements and for minor irrigation purposes in this area. It is observed that the dugwells varying from 5.60 m to around 30 m in depth in basaltic lava flows can sustain assured water supply for domestic needs of about 500 people throughout the year. The reported yield of dugwells in Basalt for irrigation purposes varies from 20 to 90 m³/day. However, dugwells in Alluvium and wells located in favourable area in Basalt can yield 100 to 250 m³/day. The dug cum borewells (DCB) are the major ground water abstraction structures in the alluvial parts of Chandur Bazar and Achalpur talukas, where deeper water levels exists and the DCB's tap the semi confined to confined zones in the depth range of 25-40 m bgl. Their yield ranges from 5 to 20 m³/hr..

Ground water is predominantly used for irrigation, as it is the major ground water utilising sector. As per the data available for year 2000-01, the area irrigated by ground water is about 607 sq.km., whereas surface water accounts for only 52 sq.km. of area and net irrigated area stands at about 659 sq.km. Thus it is clear that ground water is the major source for irrigation purposes as it accounts for about 92% of net irrigated area. There are about 63791 dugwells in the district which create an irrigation potential of 1475.28 sq.km., out of which 1124.37 sq.km. of irrigation potential is utilised. In addition to this 14.87 sq.km of irrigation potential is utilised through 691 borewells/tubewells during 2000-01.

State government has drilled large number of borewells and tubewells fitted with hand pumps and electric motors for rural drinking water purposes in the district. In all GSDA, Government of Maharashtra has drilled 4855 successful borewells under various schemes for rural water supply in the district of which 598 are reported to be high yielding. Yields of borewells range from 500 to 3000 lph. Shallow tubewells of about 15 to 20 m depth in alluvial area have a yield of around 15 to 22 m³/hour. The ground water development in the district is mostly through dugwells. The success rate of borewells/tubewells drilled by GSDA is about 89%.

5.0 Ground Water Management Strategy

Ground water has special significance for agricultural development in the State of Maharashtra. The ground water development in some parts of the State has reached a critical stage resulting in decline in ground water levels. There is thus 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

A major part of the area is underlain by the Deccan Trap Basalt. The northwestern part of the district, comprising Dharni and Chikhaldhara talukas is primarily hilly and therefore has a poor ground water development potential. In eastern part, i.e., in Warud and part of Morshi talukas, Deccan Traps have low ground water development potential. The ground water in these areas can be developed through dugwells. The southeastern part of the district comprising Nandgaon (Kh), Chandur Railway and Tiwsa talukas occupied by Deccan Traps has medium ground water potential. Ground water in these areas can be developed through dugwells and DCB. Deccan Traps has relatively higher yields in the central part of the district in parts of Amravati, Bhatkuli and Morshi talukas. In these areas the ground water can be developed through dugwells, DCB and borewells. The nature and yield potential of the aquifers occurring in different areas is given in **Table-9**, whereas the map is presented as **Figure-6**.

Table-9: Nature and Yield Potential of Aquifers

S. No.	Taluka	Main Aquifer	Yield Potential	Type of Wells Suitable	Remarks
1.	Achalpur	Alluvium	High	Dugwells Tubewells	
2.	Amravati	Basalt	Medium to High	Dugwells Borewells	
3.	Anjangaon Surji	Alluvium	Medium to High	Dugwells Tubewells	Southern parts are having brackish to saline ground water
4.	Bhatkuli	Alluvium	Low to Medium	Dugwells DCB	Central and southern parts are having brackish to saline ground water
5.	Chandur Bazar	Alluvium	Medium to High	Dugwells Tubewells	
6.	Chandur Railway	Basalt	Medium	Dugwells Borewells	

7.	Chikhaldara	Basalt	Poor	Dugwell	Hilly Area
8.	Daryapur	Alluvium	Medium	Dugwells DCB	Southern parts are having brackish to saline ground water
9.	Dharni	Basalt	Poor	Dugwell	Hilly Area
10.	Morshi	Basalt	Low to Medium	Dugwells Borewells	
11.	Nandgaon	Basalt	Medium	Dugwells Borewells	
12.	Tiwsa	Basalt	Low to Medium	Dugwells Borewells	
13.	Warud	Basalt	Low	Dugwells DCB	

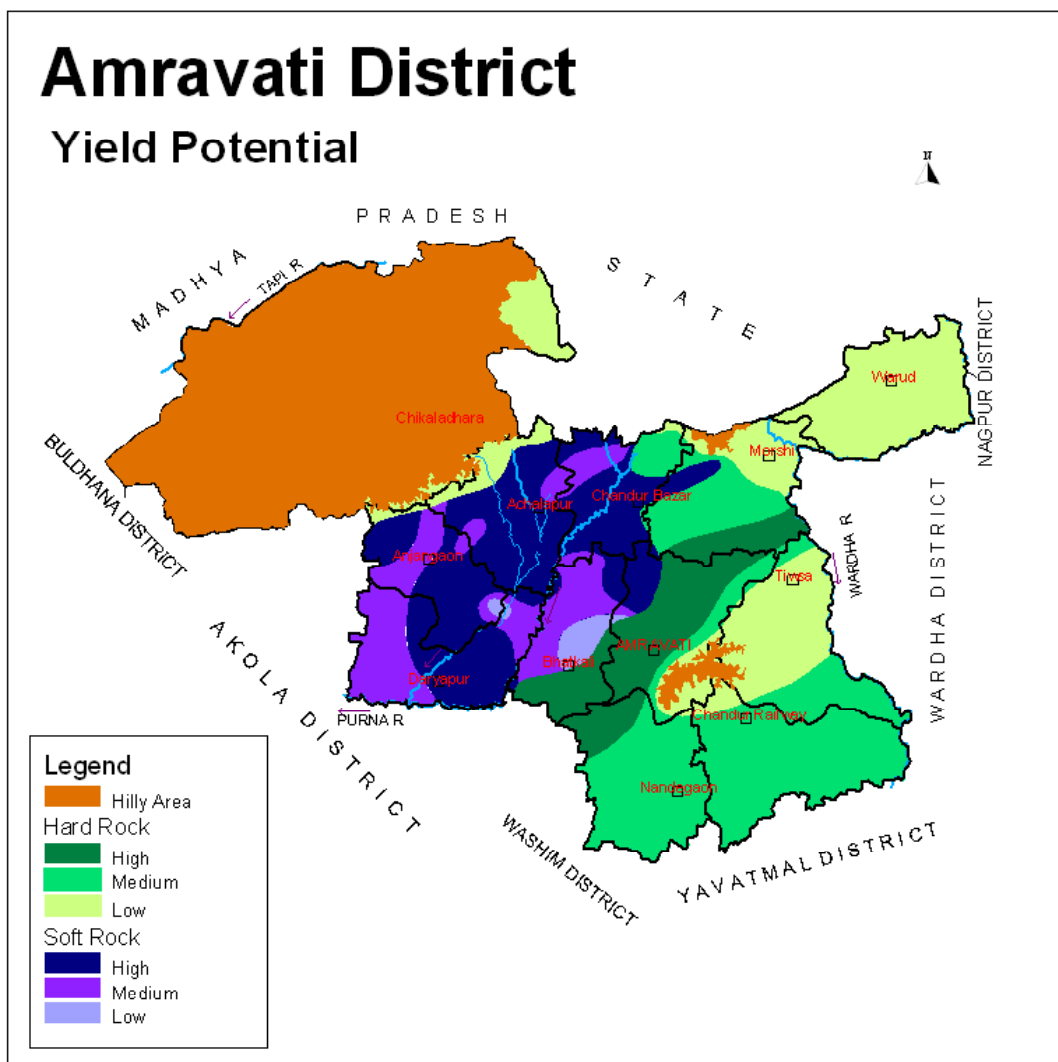


Figure 6: Yield Potential

5.2 Water Conservation and Artificial Recharge

Under Central Sector Schemes for pilot recharge projects, Central Ground Water Board, Central region, Nagpur has constructed three (03) percolation tanks and ten (10) cement plugs during 1997-98. The gross

storage capacity of three percolation tanks was varying from 71 to 221 TCM and a recharge of 49 to 132 TCM took place during 1997-98. Like wise gross storage capacity of ten cement plugs was varying from 22.1 to 7.42 TCM and a recharge of 58.7 TCM took place during 1997-98.

A roof top rainwater harvesting scheme was taken up at Panchayat Samiti office premises, Warud during 2001-02 and construction was completed in March 2002. A total roof area of 550 m² was utilised to harvest the rainwater and estimated volume of rainwater generated at normal annual rainfall of 965 mm was 477.2 m³. However, as per impact assessment study a total of 311.3 m³ of rainwater was generated at the rooftop out of which 280.17 m³ was actually recharged into the dugwell during June to Sept 2002. This reduction in estimated and actual recharge was due to the less rainfall during the period.

A large number of water conservation structures in the form of percolation tanks, under ground bandharas, diversion dams, village tanks and KT weirs have been constructed in the district. As per the data available for year 2006, 94 percolation tanks, 347 under ground bandharas, 68 irrigation tanks, 382 village tanks, 24 diversion dams had been constructed.

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, particularly in the Dharni and Chikaldhara talukas. 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. The ground water in a part of the alluvial area is saline. In such areas, quality of ground water needs to be considered before selecting the site. In the areas with poor ground water quality, the water conservation structures are more feasible.

These sites 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.

6.0 Ground Water Related Issues and Problems

Drought area has been observed in south-western parts of the district i.e., in part of Dharni, Daryapur, Anjangaon, Achalpur, Amravati, Bhatkuli and Nandgaon Khandeshwar talukas. Deeper water levels of more than 20 m bgl are also observed in small isolated areas in parts of Achalpur and Chandur Bazar talukas, in central part of the district and in part of Chandur Railway taluka in southern part of the district. The special study carried out by CGWB in Purna River Alluvial basin indicates that in southern parts of Anjangaon and Achalpur talukas and entire Daryapur taluka brackish to saline ground water has been observed with EC ranging from 2000 to more than 10000 μ mhos/cm at 25°C. Thus it is inferred that these areas of Purna River Alluvium are affected by inland salinity problem due to diagenetically altered meteoric water having longer residence time, high rate of evapotranspiration and it is restricted to the sandy aquifers inter-layered with clayey beds due to which less recharge of ground water is taking place.

7.0 Mass Awareness and Training Activities

7.1 M.A.P. and W.M.T.P.

Till March 2007, one Mass Awareness Programme (MAP) has been organised in the district at Warud. One Water Management Training Programme (WMTP) was also organised at Amravati. The details are given in Table-10.

Table-10: Status of MAP and WMTP.

S. No.	AAP	Item	Venue	Date	No of Persons Attended
1	2000-01	MAP	Warud	29/12/2000	700
2	2002-03	WMTP	Amravati.	18/02/2003	150

7.2 Participation in Exhibition, Mela, Fair etc.

During the MAP at Amravati, an exhibition depicting rainwater harvesting model, various ground water related posters, leaflets, literature and technical reports were displayed along with maps of Amravati district. The models, maps, posters were explained to the visitors in details.

8.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation, three talukas, i.e., Warud, Morshi and Daryapur fall under "Over-Exploited" category, while one taluka, i.e., Chandur Bazar, fall under "Semi-Critical". However, CGWA has notified Warud and Morshi Taluaks in 2006.

9.0 Recommendations

1. Major part of the district is underlain by the Deccan Trap Basalt where only dug wells are most feasible structures for ground water development. The sites for borewell needs to be selected only after proper scientific investigation.
2. 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 ground water is brackish to saline in some parts underlain by Alluvium. In such areas, the wells should be constructed after careful study of local hydrogeological conditions.
4. The overall stage of ground water development for the district is has already reached about 78%. Therefore, further development of ground water resources may be carried out with caution.
5. Morshi, Warud and Daryapur talukas fall under "Over-Exploited" category and Chandur Bazar falls under "Critical" category, therefore, further development of ground water resources is not recommended in these talukas. Also further ground water development is not recommended in watersheds PT-2, PT-20, PTP-2, WR-1, WR-2, WR-3 and WRC-1 falling in "Over-Exploited" category and in WR-9 watershed falling in "Critical"

category. Whereas dual approach of development coupled with artificial recharge measures needs to be adopted in PTP-6, WR-8, WRB-2 and WRB-17 falling in “Semi-Critical” category. Thus future water conservation and artificial recharge structures needs to be prioritised in these parts of the district.

6. The Warud and Morshi talukas have been notified by CGWA in 2006. Further restriction on ground water development may be placed in these talukas.
7. The scope exists for constructing suitable artificial recharge structures in the district. The structures recommended particularly for the hilly-basaltic area in the north (Dharni and Chikaldhara talukas) 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.
8. In the Alluvial area of the district, percolation tanks and recharge wells are suggested wherever the ground water is not saline. In saline areas, water conservation structures may be constructed.
9. The existing village ponds/tanks need to be rejuvenated to act both as water conservation and artificial recharge structures.