



भारत सरकार
जल संसाधन मंत्रालय
केंद्रीय भूजल बोर्ड

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत जलगांव जिले की
भूजल विज्ञान जानकारी
GROUND WATER INFORMATION
JALGAON DISTRICT
MAHARASHTRA



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मध्य क्षेत्र, नागपुर
CENTRAL REGION
NAGPUR
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JALGAON DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	11,765 sq. km.
Administrative Divisions	:	Taluka-15; Jalgaon, Bhusaval, Yaval, Raver, Edilabad, Amalner, Chopda, Erandol, Parola, Chalisgaon, Jamner, Pachora, Bhadgaon, Dharangaon, Bodwad.
Villages	:	1519
Population (2011)	:	4,224,442
Average Annual Rainfall	:	690 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	Three; Satpuda hill range, Ajanta hill range and Tapi plain
Major Drainage	:	One; Tapi

3. LAND USE (2011)

Forest Area	:	1559 sq. km.
Net Area Sown	:	9710 sq. km.
Cultivable Area	:	8442 sq. km.

4. SOIL TYPE

: Deep black and Medium black soils

5. PRINCIPAL CROPS (2011)

Cotton	:	3561 sq. km.
Sorghum	:	1721 sq. km.
Maize	:	584 sq. km.
Black gram	:	358 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2006)

Nos. / Potential Created (sq.km)

Dugwells	:	122221 /2315.64
Tubewells (Shallow and Deep)	:	13227 /303.33
Surface flow Schemes	:	236/195.28
Surface Lift Schemes	:	273/36.94

7. GROUND WATER MONITORING WELLS (As on 2011)

Dugwells	:	39
Piezometers	:	07

8. GEOLOGY

Recent	:	Alluvium
Quaternary to Recent	:	Bazada (Talus and Scree), Younger Alluvium, Older Alluvium
Upper Cretaceous-Lower Eocene	:	Basalt (Deccan Traps)

9. HYDROGEOLOGY

Water Bearing Formation	:	Basalt (Deccan Traps) weathered, vesicular fractured, jointed. Under phreatic and confined conditions. Alluvium- Coarse Sand, Pebble and Gravel, Under water table to confined conditions.
Premonsoon Depth to Water Level (May-2011)	:	3.20 to 62.50 m bgl
Postmonsoon Depth to Water Level (Nov.-2011)	:	0.80 to 27.1 m bgl
Premonsoon Water Level Trend (2001-2010)	:	Rise: 0.0059 (Vakdi) to 3.3594 (Shendurni) m/year Fall: 0.0001 (Naseerabad) to 1.679 (Sakli) m/year

Postmonsoon Water Level : Rise: 0.0047 (Shendurni) to 1.4227 (Raver)
Trend (2001-2010) m/year
Fall: 0.0100 (Pimpri Akarant) to to 0.4672
(Kekat Nimbhora) m/year

10. GROUND WATER EXPLORATION (As on 31/03/2011)

Wells Drilled : EW-80, OW-31, Pz-09, Total -120
Depth Range : 22.70 to 318.45 m bgl
Discharge : Traces to 47.00 lps
Storativity : 1.65×10^{-2} to 1.05×10^{-4}
Transmissivity : 82.5 to 2314 m²/day

11. GROUND WATER QUALITY

The quality of ground water is alkaline and generally suitable for drinking and irrigation purpose, however localized nitrate contamination is observed in rural areas.

Type of Water : Ca-HCO₃ and Ca-Cl

12. DYNAMIC GROUND WATER RESOURCES- (2009)

Net Annual Ground Water : 269543 ham
Availability
Annual Ground Water Draft : 188720 ham
(Irrigation+Domestic)
Allocation for Domestic and : 8855 ham
Industrial requirement up to
next 25 years
Av. Stage of Ground Water : 70 %
Development

13. AWARENESS AND TRAINING ACTIVITY

A Mass Awareness : 3
Programme
Date : 16/02/2000, 30/01/2011,28/01/2011
Place : Yaval, Khanapur, Jalgaon
B Water Management Training : Nil
Programme

14. ARTIFICIAL RECHARGE & RAINWATER HARVESTING

Projects Completed : Two, TE-11 and TE-17 watersheds
Projects under Technical : Nil
Guidance

15. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka : Two, Raver and Yaval
Semi-Critical Taluka : Four, Bodwad, Chopda, Pachora and Parola
Notified Taluka : Two, Raver and Yaval

16. MAJOR GROUND WATER PROBLEMS AND ISSUES

Major part of the district, during both pre and postmonsoon periods show declining trends. Deeper water level areas have been observed in parts of Yaval, Raver and Chopda talukas. Ground water quality is adversely affected at many places due to high concentration of nitrate. Fluoride contamination is also observed at two places, i.e., Mondhale (2.24 mg/L) and Hingone (2.00 mg/L).

Ground Water Information Jalgaon District

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Ground Water Information

Jalgaon District

1.0 Introduction

Jalgaon district is one of the district of Khandesh Region and situated in north western part of Maharashtra. It is situated in the northern part of the State abutting Madhya Pradesh and lies between north latitudes 20°15' and 21°25' and east longitudes 74°55' and 76°28'. The total area of the district is 11,765 sq.km. and falls in parts of Survey of India degree sheets 46 K, 46 L, 46 P, 55 C, 55 D, and 56 O. The district is bounded on the north by Madhya Pradesh, on the east by Buldhana, on the west by Nashik and Dhule districts and on the south by Aurangabad district.

The district headquarters is located at Jalgaon Town. For administrative convenience, the district is divided into 15 talukas viz., Jalgaon, Bhusaval, Yaval, Raver, Muktainagar, Amalner, Chopda, Erandol, Palora, Chalisgaon, Jamner, Pachora, Bhadgaon, Dharangaon and Bodwad. It has a total population of 4,224,442 as per 2011 census. The district has 16 towns and 1519 villages. Population density as per 2011 census is 359 persons/Sq.km. The major part of the district comes under Tapi basin. Tapi is the main river flowing through the district.

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.	Gajbhiye, N.G.	1971-72	Systematic Hydrogeological Survey
2.	Bhatnagar, S.K.	1987-88	Systematic Hydrogeological Survey
3.	Sahoo, K.B.	1990-91	Systematic Hydrogeological Survey
4.	Naik, P.K.	1995-96	Reappraisal Hydrogeological Studies
5.	CGWB	1994-97	Artificial Recharge Project, W/s TE-17
6.	Sahoo, K.B.	1997-98	Reappraisal Hydrogeological Studies
7.	CGWB	1998-02	Artificial Recharge Project, W/s TE-11
8.	Toppo, Sunil	2003-04	Reappraisal Hydrogeological Studies
9.	Davithuraj, J	2003-04	Reappraisal Hydrogeological Studies
10.	Jain, S. K.	2004	Ground water utilization in Yaval taluka
11.	Naik, P.K.	2004	Ground water utilization in Raver taluka.

Shri S.K. Jain (2001) compiled the report on Hydrogeology of the district. Ground water exploration in the district has been taken up in different phases since 1957-58. The ground water exploration has been done in alluvial and hard rock areas occupied by Deccan Trap Basalt. A total of 80 Exploratory Wells (EW), 31 Observation Wells (OW) and 09 Piezometers (Pz) have been constructed till March 2012. Salient features of ground water exploration is given in **Table 2**.

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

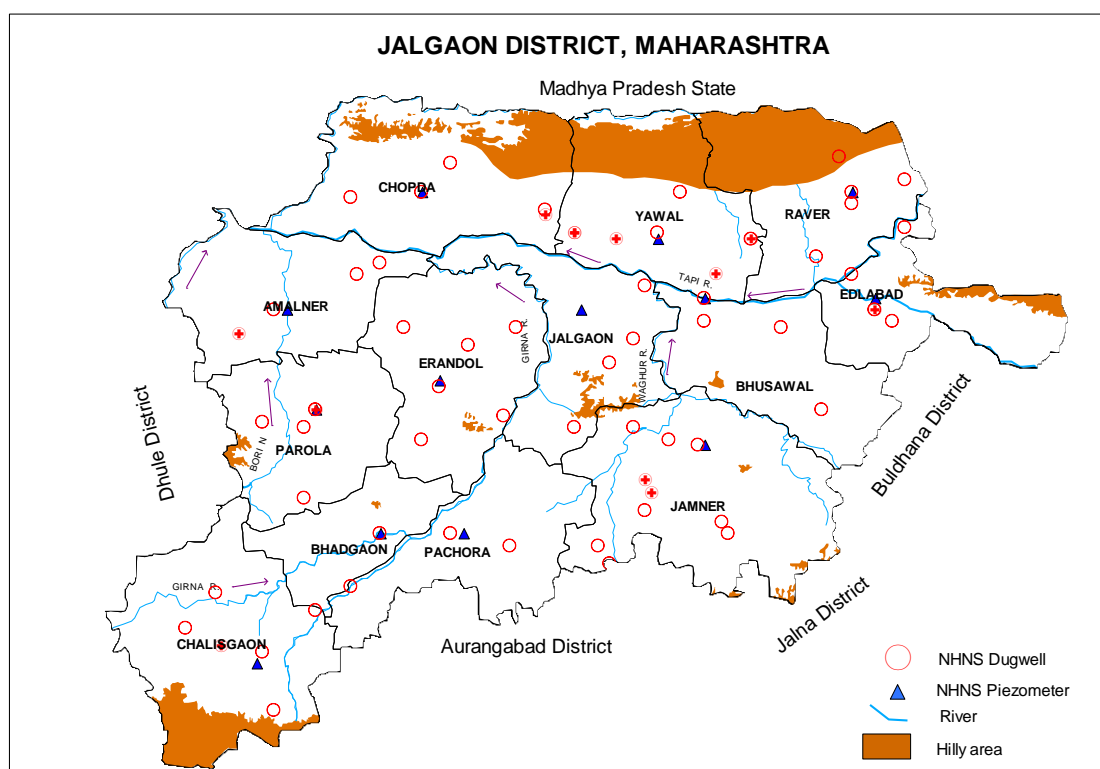


Figure 1: Location

Table 2: Salient Features of Ground Water Exploration. (As on March 2012)

Taluka	Type of Well			Lithology	Depth Range (m bgl)	Static Water Level (m bgl)	Discharge (lps)	Zones (m bgl)
	E W	O W	P Z					
Bhadgaon	3	-	-	Basalt	200.2	6.40- 7.14	0.38-1.41	50.00- 177.00
Chalisgaon	4	-	-	Basalt	200.2	45.00- 99.40	--	--
Pachora	5	-	-	Basalt	175.95- 204.75	5.20- 100.00	0.14- 29.16	9.00- 175
Dharangaon	1	-	-	Basalt	204.75	8.00	0.78	18.2- 143
Jalgaon	3	-	-	Basalt	198-67- 204.75	62.00- 88.00	0.38- 20.00	12.00- 197.00
Raver	18	9	3	Basalt and Alluvium	22.70- 229.00	4.95 to 72.50	Traces to 47.00	9.10-162

Yaval	21	9	4	Basalt and Alluvium	45.50-318.45	18.00 to >100	Traces to 38.00	10.36-271.00
Bhusawal	5	-	-	Basalt and Alluvium	168.35-204.35	6.50-140.00	1.37-7.76	9.00-200.00
Chopda	20	13	2	Basalt and Alluvium	56.00-300.00	4.95 to 20.90	0.81-30.50	7.00-181.40
Total	80	31	9		45.50 – 300.00	4.95 to 140.00	Traces to 47.00	7.00 to 271.00

Out of the 120 wells drilled between depths of 22.70 to 318.45 mbgl, discharge varied from traces to 38.00 lps. Static water levels in these wells varies from 5.20 to more than 100 m bgl. Water bearing zones were encountered between depths of 9.00 to 181.40 mbgl depths. Granular zones have been encountered and screened at various depths in alluvial parts of the district, particularly in Tapi basin area. In most of the wells in alluvium, potential aquifers were restricted to the top 150 m depths whereas in some parts, the granular zones were found upto 300m. The intervening formation between 100 to 250 m is generally clayey and devoid of any significant granular zones with few exceptions.

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 mean minimum temperature is 10.8°C and means maximum temperature is 42.2°C.

Jalgaon District receives an average rainfall of about 690 mm. The average annual rainfall for the last ten years 2002-2011 ranges from 648 (Amalner) to 835mm (Chopda) and the same is presented in **Table-3**. Average annual rain fall in the district during the year of 2011 was 612 mm.

Table 3: Annual Rainfall Data (2002-2011) (mm)

Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Jalgaon	939.70	1192.20	531.50	506.52	1444.10	674.23	422.70	754.10	752.40	735.70	795.32
Bhusawal	788.90	873.90	586.80	535.20	1420.60	565.02	335.00	683.70	821.60	542.20	715.29
Yaval	744.80	970.00	694.00	573.00	1458.40	777.50	458.20	670.00	1057.20	626.60	802.97
Raver	826.20	800.30	728.00	449.00	1232.00	747.30	453.30	614.00	876.20	510.00	723.63
Edlabad	939.50	705.00	732.00	508.00	1306.00	569.70	470.60	757.60	998.80	571.00	755.82
Amalner	530.00	826.00	717.00	398.20	950.80	679.40	506.04	677.60	721.40	478.80	648.52
Chopda	877.40	1064.20	622.00	443.00	1457.00	747.00	555.20	863.80	1025.00	695.20	834.98
Erandol	825.40	950.00	589.00	509.00	1334.10	637.00	663.00	865.00	864.50	686.00	792.30

Parola	691.40	956.30	611.00	562.10	1441.60	627.30	573.00	680.10	817.00	563.90	752.37
Chalisgaon	925.80	1158.00	506.00	379.40	1039.00	531.60	649.80	747.00	823.20	695.80	745.56
Jamner	770.70	994.00	722.00	607.60	1103.60	834.20	585.20	630.20	559.70	516.10	732.33
Pachora	587.20	985.60	566.00	588.90	984.00	536.36	587.10	716.60	886.60	657.20	709.56
Bhadgaon	605.10	1067.00	628.00	662.20	1033.80	481.60	699.20	689.00	773.80	631.80	727.15
Dharangaon	651.50	924.00	745.00	633.80	1425.80	676.10	549.00	752.00	779.00	585.50	772.17
Bodhwada	663.80	765.10	815.50	481.50	1277.20	543.70	556.00	769.00	1064.40	684.90	762.11

(Source: www.agri.mah.nic.in)

3.0 Geomorphology and Soil Types

The district can be divided into three main physiographic divisions i.e., Satpura hill ranges in the northern part with dense forest; Tapi valley consisting of alluvial plain in the central part of the district and Ajanta hill ranges, flanking the hill ridges and small valleys in the southern part of the district.

Tapi is the main river flowing through the district and its major tributaries are Purna in the South and Bhokar, Suki, Morna, Harki, Manki and Gul in the north.

The soils in Jalgaon district are essentially derived from the basaltic lava flows and are classified as, a) Deep black soils, b) Medium black soils, c) Loamy and sandy soils and d) Forest soils. Deep black soils are observed in northern part of Amalner, Erandol, Jalgaon, Bhusaval and Edilabad talukas. Medium black soils occur over large areas in the district viz.; the central belt of the wide Tapi valley and southern hills. In Tapi alluvial basin, soils are black alluvial clay occurring in the southern parts of Yaval, Raver, Chopda, Jalgaon, Bhusaval, Chalisgaon, Amalner, and Bhadgaon. Loamy soils are observed in the southern-most part of Amalner, Erandol, Jalgaon and Bhusaval. Sandy soils are observed on the foothills of Satpura ranges and near southern hillocks. Forest soils are dark brown and occur on slopes mainly in the Satpura ranges.

4.0 Ground Water Scenario

4.1 Hydrogeology

Deccan Trap Basalt of Upper Cretaceous to Lower Eocene age is the major rock formation, covering about 8040 sq. km. area in central and the southern parts of the district. These rocks formations are intruded by the dykes of the same period. Alluvium occurs over an area of 3600 sq. km. in the northern part of the district below the Satpura ranges. A map depicting hydrogeological features is presented as **Figure-2**.

4.1.1 Deccan Trap Basalt

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 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.

The yield of dugwells tapping upper phreatic aquifer ranges between 21 and 337 m³/day, which have 5-15 m bgl depth range. Borewells drilled down to 60-150 m depths, tapping weathered and vesicular basalt are found to yield 1.8 to 52 m³/day.

4.1.2 Alluvium

Northern part of the district is underlain by Tapi Alluvium. Tapi Alluvium can be subdivided into two sub units, i.e., the upper younger alluvium extending down to 70-80 m depth and the deeper older alluvium attaining a maximum depth of 450 m. However, only upper 70-80 m of younger alluvium, having 2 to 5 layers of granular zones of sand and gravel ranging in thickness from 2 to 20 m, forms the potential aquifer. At deeper levels the alluvium is mostly clayey and does not form potential aquifer.

Ground water in alluvium occurs under water table, semi-confined and confined conditions. The dugwells in these formations are deep ranging from 25 to 50 m bgl in depth with yield varying from 120 to 200 m³/day in winter and from 100 to 150 m³/day in summer. In Bazada aquifers, the yield of dugwells varies from 160 to 200 m³/day in winter and 100 to 180 m³/day in summer.

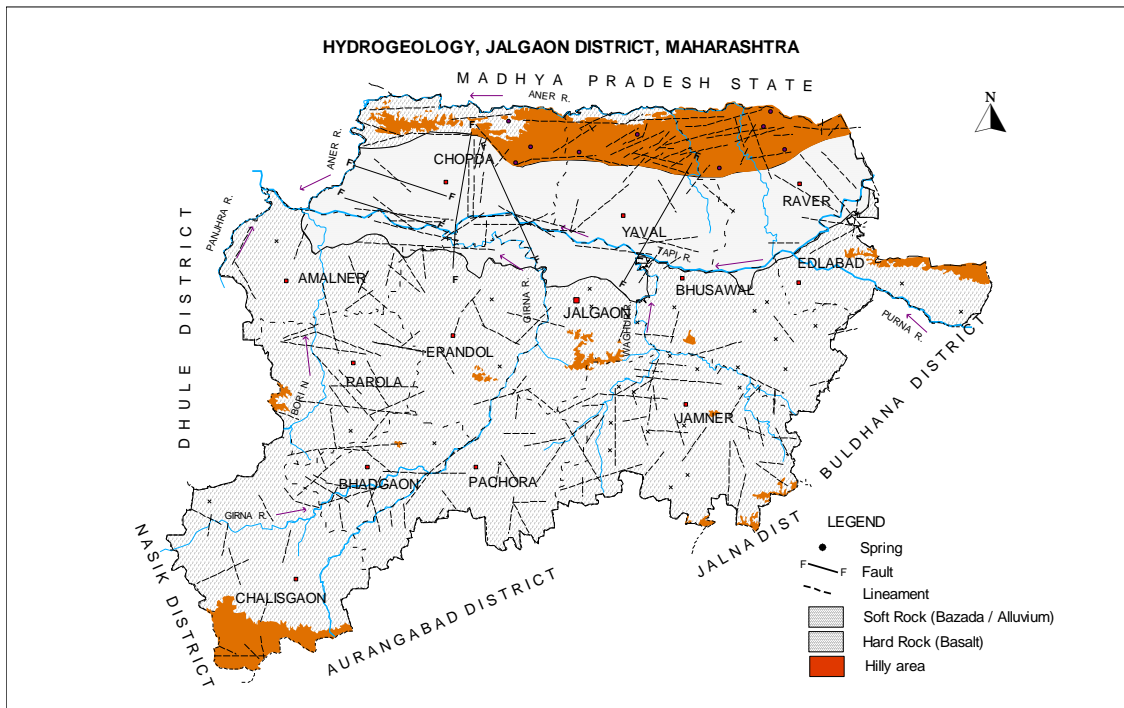


Figure 2- Hydrogeology

4.1.3 Water Level Scenario

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

4.1.3.1 Depth to Water Level – Premonsoon (May-2011)

The depth to water levels in the district ranges from 3.20 to 62.50 m bgl during May 2011. Depth to water levels during pre-monsoon (May 2011) has been depicted in **Figure-3**. Shallow water levels, within 5 to 10 m bgl are seen in the southern and central parts of the district, i.e., Amalner, Palora, Bhadgaon, Chalisgaon, Pachora, Erandol, Jamner and in southern part of Bhusawal taluka. Deeper water levels of more than 40 m bgl are observed in some part of Chopda, Raver, Yaval and Jalgaon talukas. Out of the total 32 NHNS wells data analysed, 9.40 % showed water levels between 2-5mbgl; 56.30 % in 5-10 mbgl water level depth range; 21% in 10-20 mbgl water level depth range; 6.3% in 20-40 mbgl water level depth range and 6.3% in >40 mbgl water level depth range.

4.1.3.2 Depth to Water Level – Post monsoon (May-2011)

The depth to water levels during postmonsoon ranges from 0.80 to 27.1 m bgl. Spatial variation in postmonsoon depth to water levels is shown in **Figure-4**. Shallow water levels within 2 m bgl are observed in SW part of the district in parts

of Pachora. Water levels are between 5 and 10 m bgl in south central parts of the district in parts of Yaval, Bhusawal, Chopda, Raver, Bodwad, Amalner, Jamner, Jalgaon, Pachora, Bhadgaon, and Chalisgaon. Water levels between 5-10 mbgl are observed in parts of Chopda, Dharangaon, Jalgaon, Jamner, Bodhvad, Bhusawal and Raver talukas. Water levels between 10 and 20 m bgl are seen in parts of Dharangaon, Chopda, Jalgaon, Bhusawal and Yaval talukas. Deeper water levels of more than 20 m bgl are observed as isolated patches in Chopda, Yaval, Jalgaon, Bhusawal and Raver talukas.

Out of the total 32 NHNS wells data analysed, 16.00% showed water levels between <2.00 mbgl; 44.40% in 2-5 mbgl water level depth range; 19.4% in 5-10 mbgl water level depth range; 16% in 10-20 mbgl water level depth range; 2.80% in 20-40 mbgl water level depth range and.

4.1.4 Seasonal Water Level Fluctuation (May-Nov. 2011)

Parts of the talukas like Pachora, Jalgaon, Bhusawal, Bodwad and Muktainagar have shown fluctuation of 0-2 m. In entire district, rise in water level has been observed except in Muktainagar taluka where in some parts fall of 0-2 m was observed. Major parts of the district is characterised by fluctuations of 2-4 m viz. Chalisgaon, Bhadgaon, Parola, Erandol, Dharangaon, Jalgaon, Chopda, Amalner, Yaval, Raver and Parts of Muktainagar (Edlabad). In parts of Bhadgaon, Chalisgaon, Yaval and Raver taluka, fluctuation more than 4 m is observed.

4.1.5 Water Level Trend (2001-2010)

Trend of water levels for pre-monsoon and post-monsoon periods for last ten years (2001-2010) have been computed for 46 NHNS. Analysis of trend indicates that during premonsoon period, rise in water levels has been recorded at 28 stations and it ranges between 0.0059 and 3.36 m/year. Fall in water levels has been observed from 0.0001 to 1.6 at 15 stations. During post-monsoon period rise was observed from 0.0047 to 1.42 for 27 stations and fall was observed between 0.01 to 0.46 m/ year in the rest of stations.

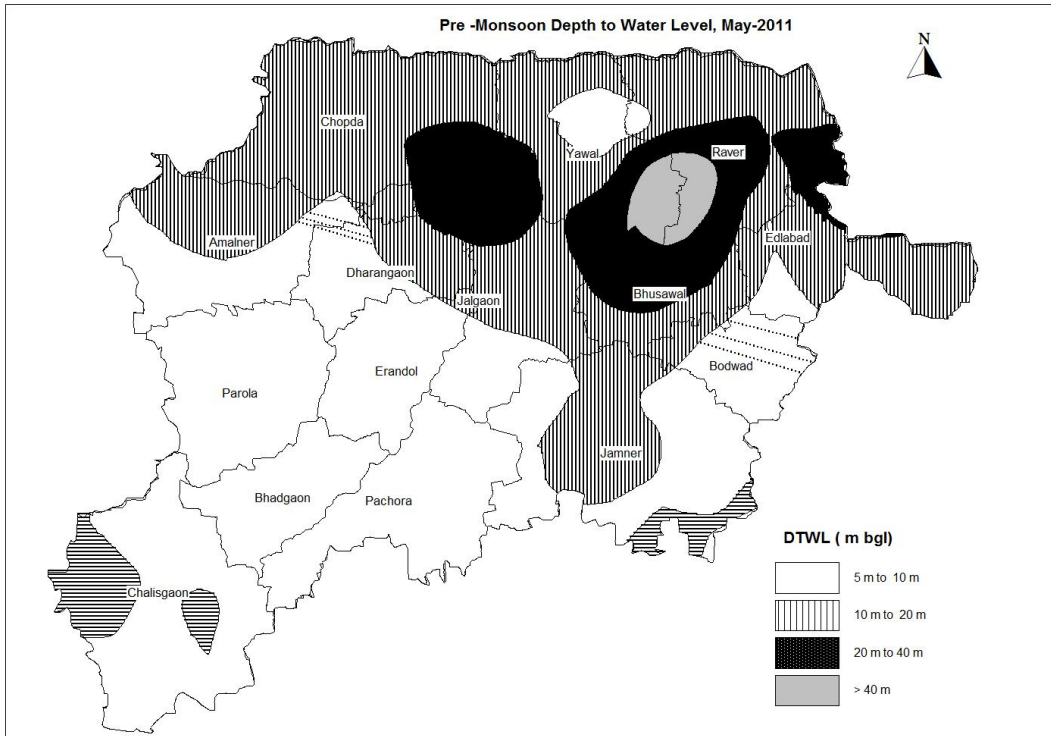


Figure 3- Depth to Water Level (Premonsoon- May 2011)

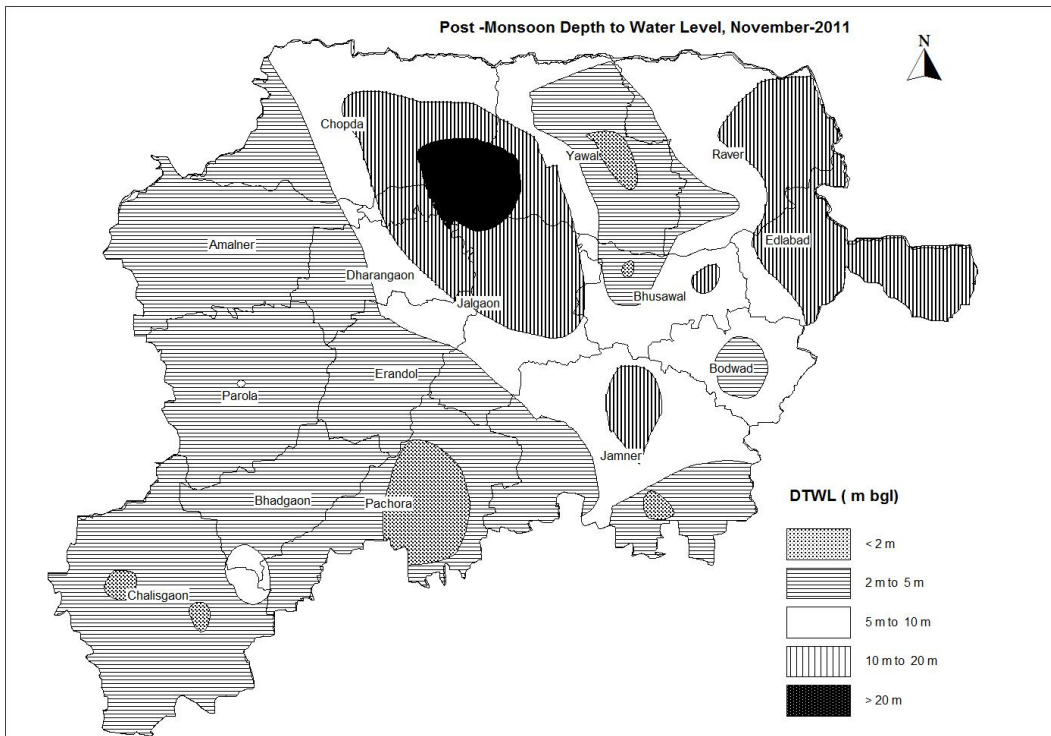


Figure 4- Depth to Water Level (Post Monsoon- Nov. 2011)

4.1.6 Aquifer Parameters

Aquifer parameters are available from ground water exploration carried out in the alluvial area of the district. The specific capacity ranges between 0.07 and 21.6 lps/m of drawdown and the transmissivity ranges from 82.5 to 2314 m²/day. The storativity varies from 1.6×10^{-2} and 1.057×10^{-4} while permeability varies from 0.19 and 154.62 m/day.

The results of pumping test analysis of dugwells in basalt show that the permeability and specific capacity ranges from 1.104 to 274.08 m/day and 12.14 to 1818.18 lpm/m respectively.

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 Jalgaon district based on GEC-97 methodology. The same are presented in **Table-4**, whereas the graphical representations of the resources on the map are shown in **Figure-5**. Ground Water Resources estimation was carried out for 11378.83 sq. km. area out of which 1635.84 sq. km. is under command and 9742.99 sq. km. is non-command. The average stage of development of the district is 70%.

Stage of ground water development varies from 43 % (Dharangaon) to 117 % (Raver). The overall stage of ground water development for the district is 70%, which is borderline high for "Semi-Critical" category. Taluka wise assessments indicate that Raver and Yawal talukas fall under "Over- Exploited" category while Bodwad, Pachora, Parola and Chopda talukas fall under "Semi-Critical" category. All the remaining talukas are falling in safe category. Net ground water availability for future irrigation development is 39575 ham.

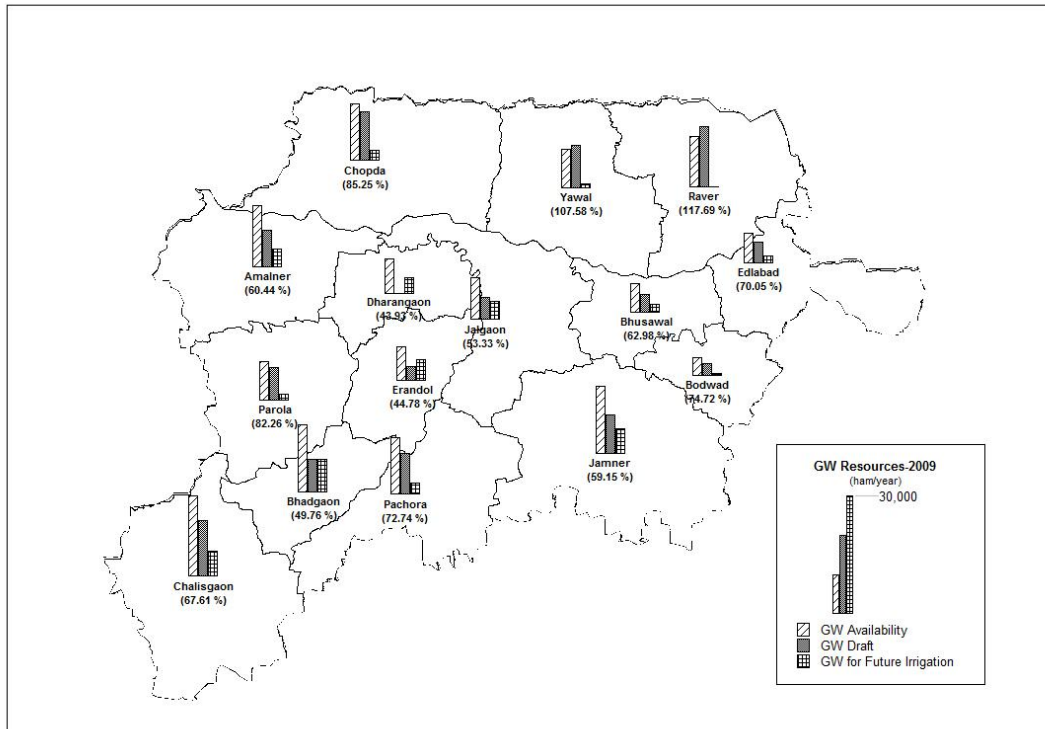


Figure 5 – Ground Water Resources (March 2009)

4.3 Ground Water Quality

In the district, 30 water samples were collected during May 2010. The summary of the analysis is as follows. pH of the analysed samples varies from 7.3-8.3; EC from 470 to 4700 microsiemens/cm; TA from 60 to 805 mg/l; TH from 95 to 1335 mg/l; Nitrate from 0.2 to 462 mg/l; Fluoride from 0.26 to 1.02 mg/l and RSC from -18.8 to 1.1.

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 carried out based on the desirable and maximum permissible limits for the parameters is given in **Table-5**.

Out of these 30 samples, 20% are having high TH values above maximum Permissible limits(MPL) and 53% are having nitrate above MPL. None of the water samples show Fluoride contamination.

Table-4: Taluka wise Ground Water Resources (March 2009).

Figures in HAM

District	Administrative Unit	Command / Non-Command / Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development
Jalgaon	Amalner	Command	3856.173	1014.858	103.1716	1118.03			
Jalgaon	Amalner	Non Command	7830.325	5488.96	456.3134	5945.273			
Jalgaon	Amalner	Total	11686.5	6503.818	559.485	7063.303	1115.501	3561.077	60.43986
Jalgaon	Bhadgaon	Command	10938.82	4948.053	161.559	5109.612			
Jalgaon	Bhadgaon	Non Command	1823.85	1203.847	37.78932	1241.636			
Jalgaon	Bhadgaon	Total	12762.67	6151.9	199.3483	6351.248	417.5804	6334.47	49.76426
Jalgaon	Bhusawal	Command	316.5658	473.7888	11.5215	485.3103			
Jalgaon	Bhusawal	Non Command	5078.813	2648.504	264.2774	2912.782			
Jalgaon	Bhusawal	Total	5395.378	3122.293	275.7989	3398.092	552.229	1731.91	62.98153
Jalgaon	Bodwad	Command	63.00988	30.348	2.092	32.44			
Jalgaon	Bodwad	Non Command	3362.644	2311.654	215.5865	2527.241			
Jalgaon	Bodwad	Total	3425.654	2342.002	217.6785	2559.681	436.2079	620.1708	74.72094
Jalgaon	Chalisgaon	Command	3923.775	3538.9	116.5869	3655.487			
Jalgaon	Chalisgaon	Non Command	11425.48	6430.495	292.3109	6722.806			
Jalgaon	Chalisgaon	Total	15349.26	9969.395	408.8978	10378.29	788.0417	4723.004	67.6143
Jalgaon	Chopda	Command	5174.71	4482.693	147.437	4630.13			
Jalgaon	Chopda	Non Command	5655.93	4403.219	199.7805	4602.999			
Jalgaon	Chopda	Total	10830.64	8885.912	347.2175	9233.129	631.5695	2001.14	85.25008
Jalgaon	Dharangaon	Command	3708.793	1083.103	84.54757	1167.651			
Jalgaon	Dharangaon	Non Command	3108.45	1702.162	124.9426	1827.105			
Jalgaon	Dharangaon	Total	6817.243	2785.266	209.4902	2994.756	303.1295	3275.792	43.92913
Jalgaon	Erandol	Command	3496.904	1701.684	111.7178	1813.402			
Jalgaon	Erandol	Non Command	2887.759	983.7737	62.00418	1045.778			
Jalgaon	Erandol	Total	6384.663	2685.458	173.722	2859.18	368.2907	4099.419	44.782
Jalgaon	Jalgaon	Command	808.305	535.7994	30.22068	566.0201			
Jalgaon	Jalgaon	Non Command	7214.461	3494.202	218.1331	3712.335			
Jalgaon	Jalgaon	Total	8022.766	4030.001	248.3538	4278.355	501.9913	3475.69	53.32768
Jalgaon	Jamner	Command	965.9951	972.864	103.09	1075.954			
Jalgaon	Jamner	Non Command	11711.24	5867.8	554.6775	6422.477			
Jalgaon	Jamner	Total	12677.23	6840.664	657.7675	7498.431	1229.607	4799.627	59.14881

District	Administrative Unit	Command / Non-Command / Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development
Jalgaon	Muktainagar	Command	269.3016	231.66	6.588	238.248			
Jalgaon	Muktainagar	Non Command	5568.725	3623.159	228.1327	3851.292			
Jalgaon	Muktainagar	Total	5838.027	3854.819	234.7207	4089.54	469.7723	1519.232	70.05003
Jalgaon	Pachora	Command	3239.448	3206.862	71.91894	3278.78			
Jalgaon	Pachora	Non Command	7432.385	4188.017	296.3209	4484.338			
Jalgaon	Pachora	Total	10671.83	7394.879	368.2398	7763.118	754.9082	2286.981	72.744
Jalgaon	Parola	Command	2452.286	1705.757	222.8706	1928.627			
Jalgaon	Parola	Non Command	5040.583	4006.905	227.9795	4234.884			
Jalgaon	Parola	Total	7492.868	5712.661	450.8501	6163.511	834.9226	1147.096	82.25837
Jalgaon	Raver	Command	1312.947	3524.42	22.753	3547.173			
Jalgaon	Raver	Non Command	8506.676	7888.644	120.8579	8009.502			
Jalgaon	Raver	Total	9819.623	11413.06	143.6109	11556.68	152.1873	0	117.6896
Jalgaon	Yawal	Command	1187.96	2288.286	52.643	2340.929			
Jalgaon	Yawal	Non Command	6409.378	5666.91	165.1657	5832.075			
Jalgaon	Yawal	Total	7597.338	7955.196	217.8087	8173.004	299.2291	0	107.5772
	District Total	Command	41714.99	29739.08	1248.72	30987.79			-
		Non Command	93056.70	59908.25	3464.27	63372.52			-
		Total	134771.69	89647.33	4712.99	94360.32	8855.17	40536.10	70.01

Table-5 Classification of Ground Water Samples for Drinking 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	11	16	3
TH (mg/L)	300	600	10	14	6
NO ₃ (mg/L)	45	No relaxation	14	--	16
F (mg/L)	1.0	1.5	30	0	0

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

The ground water, in general, is potable with few exceptions and the potability of ground water is mainly affected due to NO₃.

4.3.2 Suitability of Ground Water for Irrigation Purpose

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

4.3.2.1 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 RSC values for its suitability for irrigation purpose is shown in **Table-6**.

Table-6 Classification of Ground water for Irrigation based RSC.

RSC	<1.25		1.25-2.50		>2.50	
Category	Good		Doubtful		Unsuitable	
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples	%
30	30	100	--	--	0	0

The RSC values of all the samples collected from the wells located in the district are found to be below 1.25. So the ground water can be used for irrigation because these fall in “good” category.

Overall, the ground water quality in the wells monitored is good for irrigation purpose and there is a less possibility of developing sodium hazard.

4.4 Status of Ground Water Development

The yields of wells are functions of the permeability and transmissivity of aquifer encountered and vary with location, diameter and depth etc. There are three type of ground water structures i.e. dugwells, borewells and tubewells in the area. Their yield characteristics are described below.

Dugwells are generally used for both domestic water requirements and for irrigation purposes in this area. The depth of large diameter dugwells in Basaltic areas of the district ranges from 5 to 15 m. The reported yield of dugwells in Basalt for irrigation purposes varies from 21 to 337 m³/day. Unit draft of dugwell in Basaltic areas is estimated to be around 1 ham / year. In Alluvial area, the dugwells are deep ranging from 25 to 50 m bgl in depth with yield varying from 120 to 200 m³/day in winter and from 100 to 150 m³/day in summer. In Bazada yield of dugwells varies from 160 to 200 m³/day in winter and 100 to 180 m³/day in summer. Unit draft of dugwell in Alluvial areas is estimated to be around 2.5 ham / year while Unit draft of dugwell in Bazada areas is estimated to be around 3.5 ham / year. The dugwells occurring in Yaval and Raver talukas are deeper than those of Chopda Taluka.

Many hot springs occur in Tapi basin along the foothills of Satpura Mountains. It is observed that hot springs of higher temperature occur near the junction of faults. The computed base temperature of these hot springs range upto 120 ° C \pm 10° C. Ground water is predominantly used for irrigation, as it is the major ground water utilising sector.

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 1346 tubewells/borewells under various schemes for rural water supply in the district upto march 2006; of which 1263 are fitted with hand pump and 83 are fitted with power pump. The discharge of successful borewells ranged from 1 to 5 lps and yield ranged form 1.8 to 52 m³/hour. Maximum high yielding borewells are encountered in Amalner taluka as 35%.

The ground water development in the district is mostly through dug wells. As per the minor irrigation census data of 2006 the total no dug wells in the district is 122221 with a net irrigation potential of 2315.64 sq.km; for 13227 tube wells it is 303.33; from surface flow schemes (236 Nos.) the total potential

created is 195.28 sq.km and the total potential created from surface lift schemes is 36.94 sq km from 273 schemes.

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

Further ground water development in bazada zone is feasible at those sites wherever additional recharge from percolation tanks all along the foothills of Satpuda takes place. The ground water exploration may be taken up in this zone by percussion rigs keeping in view the bouldary nature of this formation. Further ground water development in Tapi alluvial plains is not feasible, as the stage of development in the taluks of Yaval, Raver and Chopda falling in the are ranging from 85 to 117%. Yawal and Raver are over exploited whereas Chopda is semicritical. Ground water augmentation in this area should be undertaken on large scale through people's participation by utilizing the surplus water, available in Hatnur canal and cooperative lift schemes operating in the area, using existing dugwells.

In parts of Amalner, Jalgaon, Bhusawal, Edilabad, Jamner, Erandol and Pachora talukas, the water levels are declining @ up to 20 cm/year. The aquifers are poor to moderately yielding having low storage capacity. Therefore, ground water development should be permitted very carefully in scarcity areas only. Yaval and Raver talukas and 9 watersheds falling under "Over- Exploited" category, whereas Chopda and Pachora talukas and 17 watersheds falling under "Semi-Critical" and two watersheds falling under "Critical" category are not recommended for any further ground water development except for drinking purpose.

In parts of Chalisgaon, Parola and Bhadgaon talukas it was observed that the depth to water level has rising trend @ 0-20 cm/year during postmonsoon.

These areas have shallow water levels and being hard rock areas, overall ground water availability is poor. The sites for further ground water development in these areas may be identified by applying proper scientific methods.

5.2 Water Conservation and Artificial Recharge

CCT, nala bunding, gabion structures, vegetative bunds, terracing etc., are the feasible water conservation structures in the Satpura hill range. In the Basaltic area, the water conservation and artificial recharge structures feasible are check dams, gully plugs, percolation tanks, nala bunds, etc. 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 most feasible artificial recharge structure suitable for Alluvial areas, are shallow recharge wells/shafts on the river bed of the tributaries. 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.

Two artificial recharge schemes were taken up in the district in watershed TE-17 under VII^h 5 year plan and in watershed TE-11 under IXth 5 year plan as pilot projects under Central Sector Scheme.

The watershed TE-17 covers an area of about 235 sq.kms and is located in Yaval taluka. A total of 10 recharge structures have been constructed, which include 6 percolation tanks, 2 recharge shafts, 1 injection well and 1 dugwell recharge. The impact assessment studies indicated that 856×10^3 cubic meter of rain water was stored in 6 percolation tanks of the scheme and tanks were utilized at its maximum storage capacity. The recharge to ground water was more than 90% and evaporation losses were less than 10%. The percolation rate was 81-500 mm/day with rise of water level witnessed upto 5 meters. Total 120 dug wells were benefited and beneficiaries were mostly tribal villages over a land of around 1000 ha. Recharge shafts recharged 23.6×10^3 cubic meter. Total 5.9 ha of land of local farmers was benefited and rise of water level upto 12 meter in the mother wells was observed. Injection well recharge was 3.767×10^3 cubic meter and 1 ha of land was benefited with a water level rise of 1.25 m. Dug well experiment was very encouraging. A total 6.58×10^3 cubic meter of water was recharged at the rate of 60,000 – 70,000 litres per hour. A rise of 9.9 m was

observed in the mother well, benefiting around 3 ha of additional land.

In watershed TE-11 scheme was taken up in IXth plan. The project was started in year 1998-99 and completed in 2001-02. The watershed TE-11 in Yaval taluka of Jalgaon district covering 28 villages has an area of 371 Sq.kms and falls in Tapi river basin. A total of 10 recharge structures have been constructed, which included 5 percolation tanks and 5 recharge shafts. The impact assessment studies indicated that 8.236 sq. km catchment was brought under rainwater harvesting. Catchment area of tanks varied from 0.425 to 4.2273 sq. km. The storage of 285.89×10^3 cubic meter of rainwater was created in the area. The recharge to ground water due to 5 percolation tanks was 211.19×10^3 cubic meter in spite of very low rainfall of 432.3 mm in 2001-02 against average rainfall of 674 mm. A rise of 2-10 meter water level in 30-50 ha of benefited area was observed. The beneficiaries of the schemes were mostly small and marginal land holders dominated by local tribal population on the foot hills of the Satpura Hills. Five Recharge Shafts constructed at Wadri village in the watershed TE-11 were monitored and the impact of these was very encouraging. More than 30 wells over an area of 50 ha were benefited by a rise of up to 10 m in the water levels. Around 10.50×10^3 cubic metre of recharge was effected in one year in the area benefiting local farmers.

Earlier studies have shown that the 17 urban towns of Jalgaon district have total roof area of 7.85 sq. km. and are estimated to receive 5.42 MCM of rain during monsoon and 0.36 MCM during non-monsoon. Jalgaon city itself consists of 2.25 sq. km. roof area and 1.55 MCM rainwater is estimated to be available for harvesting during monsoon and 0.10 MCM during non-monsoon. Other 9 towns of the districts namely, Chopda, Yaval, Raver, Amalner, Edilabad, Bhusaval, Jamner, Chalisgaon and Bhadgaon may also have feasibility of rainwater harvesting for ground water augmentation. The existing dugwells, borewells or tubewells may also be used for recharging the ground water with proper filter media.

6.0 Ground Water Related Issues and Problems

Northern part of the district is underlain by Tapi Alluvium. Only upper 70-80 m of younger Alluvium having 2 to 5 layers of granular zones of sand and gravel

ranging in thickness from 2 to 20 m, forms the potential aquifer. At deeper levels the older Alluvium is mostly clayey and does not form potential aquifer. The ground water levels are quite deep as the ground water is being withdrawn heavily for the banana cultivation. The regional water level is also declining. In addition to this, in major part of the district, declining water level trends have been observed both during pre and postmonsoon periods.

Ground water quality is adversely affected at many places due to high concentration of nitrate. Adequate sanitary protection to the wells may be provided to control the nitrate contamination. Thus, in this area, all the wells used for water supply should be first analysed for fluoride and nitrate concentration.

7.0 Mass Awareness and Training Activities

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

Till March 2011, three Mass Awareness Programmes (MAP) have been organised in the district at Yaval and Raver talukas. Also one WMTP (Water Management Training Programme) was organised at NMU, Jalgaon. The details are given in **Table-7**.

Table-7: Status of MAP

S. No.	Year	Programme	Venue	Date	No. of Persons Attended
1	2001-02	MAP	Yaval	16/02/2000	300
2	2010-11	MAP	Khanapur, Ta- Raver	30/01/2011	300
3	2010-11	WMTP	NMU, Jalgaon	28/01/2011	27

8.0 Areas Notified by CGWA/SGWA

The increase in area under banana cultivation has put undue pressure on the ground water resources due to withdrawal for irrigation purposes resulting in declining trends of ground water levels in Raver and Yaval talukas. Due to which the stage of ground water development reached up to 117.69% and 107.58 % in Raver and Yaval taluka respectively. There is no ground water resources left for future domestic, industrial and irrigation purpose and both the talukas are categorized as "Over-Exploited". Due to the over development of ground water resources, Raver and Yaval talukas of Jalgaon district were notified by Central Ground Water Authority (CGWA) vide Office Memorandum No. 28-2/CGWA/06-

413 dated 16th March 2006 issued by Administrator, CGWA. A public notice dated 13th March 2006 was also published in the leading local and National newspapers regarding the 'Declaration of "Over-Exploited Areas" for registration of ground water abstraction structures'.

9.0 Recommendations

- 1 Further ground water development in Bazada zone is feasible at those sites where additional recharge from percolation tanks all along the foothills of Satpura takes place. Further ground water development in Tapi alluvial plains is not feasible, keeping in view the overall ground water availability scenario.
- 2 The ground water exploration in Bazada may be taken up by percussion rigs keeping in view of the bouldary nature of this formation.
- 3 Northern part of the district is underlain by Tapi Alluvium, which is about 450 m thick. However, upper 70-80 m of Alluvium, i.e., younger Alluvium comprises sand and gravel forming potential aquifer. The ground water in the Alluvium can be developed through dugwells and shallow tubewells.
- 4 Southern part of the district is occupied by Deccan Trap Basalt, where only dugwells are most feasible structures for ground water development. The sites for borewells need to be selected only after proper scientific investigation.
- 5 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.
- 6 In parts of Amalner, Jalgaon, Bhusawal, Edilabad, Jamner, Erandol, and Pachora talukas, the water levels are declining @ up to 20 cm/year. The aquifers are poor to moderately yielding with low storage capacity. Therefore, ground water development may be permitted very carefully in scarcity areas only.
- 7 The overall stage of ground water development for the district is about 70%, which is borderline high for "Semi-Critical" category. Therefore, proper planning should be done for further development of ground water resources.

- 8 Taluka wise assessments indicate that talukas of Raver and Yawal fall under “Over- Exploited” category while Bodwad, Pachora, Parola, and Chopda talukas fall under “Semi-Critical” category. So further groundwater development in Raver taluka is not recommended.
- 9 Deeper water level areas have been observed in parts of Yawal and Raver talukas, which are categorised as “Over-Exploited”. Thus future water conservation and artificial recharge structures needs to be prioritised in these parts.
- 10 The scope exists for construction of suitable artificial recharge structures in the district. CCT, nala bunding, gabion structures, vegetative bunds, terracing etc and construction of minor and medium irrigation projects with lined or pipe canals may be feasible in the Satpuda hill range. The structures recommended for Basaltic areas are nala bunds, check dams and KT weirs. The existing dugwells may also be used for artificial recharge of ground water provided source water is free of silt and dissolved impurities.
- 11 In the Alluvial area of the district, percolation tanks and recharge wells/shafts are suggested. The most feasible artificial recharge structure suitable in such areas, are recharge wells/shafts on the river bed of the tributaries.
- 12 Jalgaon district has 17 urban towns, which have total roof area of 7.85 sq. km. and are estimated to receive 5.42 MCM of rainwater during monsoon and 0.36 MCM during non-monsoon. Jalgaon city itself consists of 2.25 sq. km. roof area and 1.55 MCM rainwater is estimated to be available for harvesting during monsoon and 0.10 MCM during non-monsoon. This huge amount of rainwater may be used for recharging the ground water by using the existing dugwells, borewells or tubewells with proper filter media.
- 13 The existing village ponds need to be rejuvenated to act both as water conservation and artificial recharge structures.
- 14 Ground water quality is adversely affected at many places due to high concentration of nitrate. Adequate sanitary protection to the wells may be provided to control the nitrate contamination. Proper disposal domestic sewerage may be made to avoid nitrate contamination of ground water.