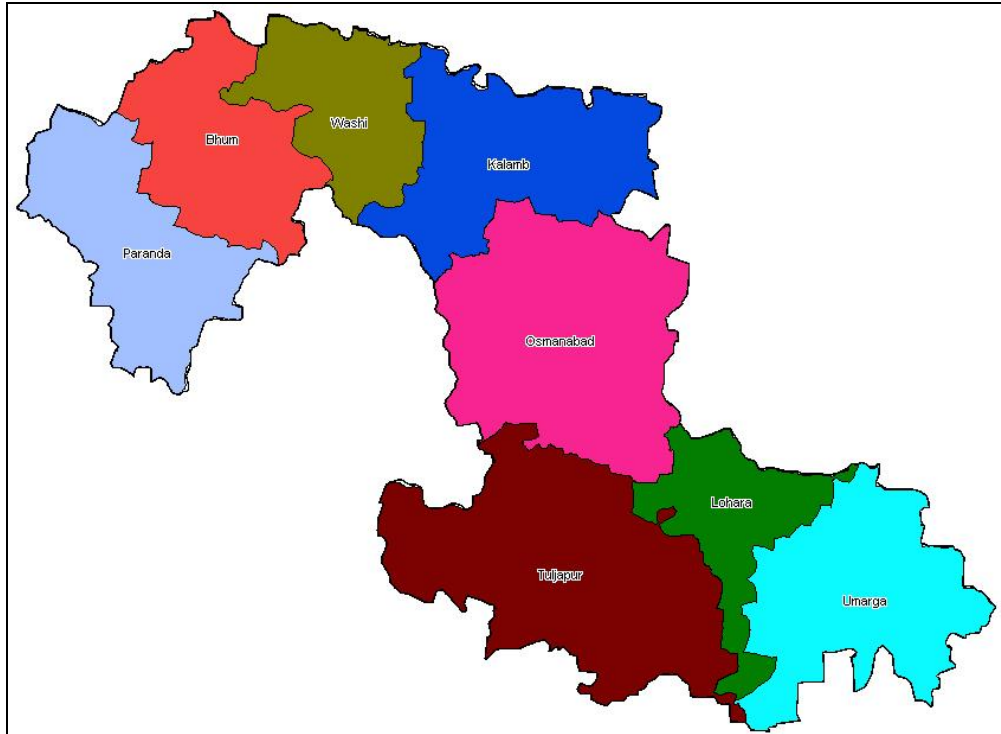


भारत सरकार
जल संसाधन मंत्रालय
केंद्रीय भूजल बोर्ड
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत उस्मानाबाद जिले की
भूजल विज्ञान जानकारी
GROUND WATER INFORMATION
OSMANABAD DISTRICT
MAHARASHTRA



By
Bhushan R. Lamsoge
Scientist-C

द्वारा
भूषण रा. लामसोणे
वैज्ञानिक- ग

मध्यवर्ती क्षेत्र
नागपुर
CENTRAL REGION
NAGPUR
2013

OSMANABAD DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	7512 sq. km.
Administrative Divisions (As on 31/03/2012)	:	Taluka-8; Osmanabad, Tuljapur, Omerga, Lohara, Bhoom, Kallamb, Paranda and Washi.
Villages	:	729
Grampanchayat	:	622
Population (Census, 2011)	:	16,60,311
Normal Annual Rainfall	:	600 mm to 850 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	One; Balaghat Plateau
Major Drainage	:	One; Manjra

3. LAND USE (2010-11)

Forest Area	:	50.53 sq. km.
Net Area Sown	:	6401.80 sq. km.
Cultivable Area	:	7229 sq. km.

4. SOIL TYPE

Shallow, Medium and Medium deep soils.

5. PRINCIPAL CROPS (2010-11)

Cereals	:	4120 sq. km.
Pulses	:	2200 sq. km.
Total Oil Seeds	:	1310 sq. km.
Sugarcane	:	240 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2006-07)

	Nos.	Potential Created (ha)
Dugwells	: 47982	133535
Borewells	: 15834	40258
Surface Flow Schemes	: 3428	6238
Lift Irrigation Schemes	: 4708	11682
Net Irrigated Area	:	191713

7. GROUND WATER MONITORING WELLS (As on 31/03/2012)

Dugwells	:	25
Piezometers	:	2

8. GEOLOGY

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
Premonsoon Depth to Water Level (May-2011)	:	4.15 to 17.35 m bgl
Postmonsoon Depth to Water Level (Nov.-2011)	:	1.2 to 7 m bgl
Premonsoon Water Level Trend (2002-2011)	:	Rise: 0.2 to 0.55 m/year Fall: Negligible to 0.3 m/year
Postmonsoon Water Level Trend	:	Rise: 0.01 to 0.83 m/year

- (2001-2011) Fall: Negligible to 0.32 m/year
- 10. GROUND WATER EXPLORATION** (As on 31/03/12)
- Wells Drilled : EW-48, OW-11, Pz-12, Total=71
 Depth Range : 30.00 to 204.15 m bgl
 Discharge : 0.22 – 20.24 lps
 Transmissivity : 0.22 to 20.24 m²/day (Basalt)
- 11. GROUND WATER QUALITY**
 Good and suitable for drinking and irrigation purpose, however localized fluoride contamination is observed in deeper aquifer and nitrate contamination in some parts of urban areas of Osmanabad town and localized places in rural areas.
- Type of Water : Ca-HCO₃ and Ca-Cl
- 12. DYNAMIC GROUND WATER RESOURCES-** (As on 2007-08)
- Net Annual GW Availability : 267986 ham
 Annual GW draft : 73828 ham
 (Irrigation+Domestic)
 Allocation for Domestic and Industrial requirement up to next 25 years : 3945 ham
 Ground water availability for future irrigation : 37245 ham
 Stage of Ground Water Development : 53.33 %
- 13. AWARENESS AND TRAINING ACTIVITY**
- Mass Awareness Programme : Yet to taken up
 Water Management Training Programme: : Yet to taken up
- 14. ARTIFICIAL RECHARGE & RAINWATER HARVESTING**
- Projects Completed : Nil
 Projects under Technical Guidance : Nil
- 15. GROUND WATER CONTROL & REGULATION**
- Over-Exploited Taluka : None
 Semi-Critical Taluka : None
 Notified Taluka : None
- 16. MAJOR GROUND WATER PROBLEMS AND ISSUES**
 The severe drought conditions were experienced in all talukas except at Tuljapur, while moderate drought ranges from 11% at Kallamb to 28% at Tuljapur. It is coupled with declining trend of water levels in major part of the district. The ground water exploration reveals that the ground water quality in deeper aquifer is adversely affected by fluoride contamination in Osmanabad, Tuljapur and Omerga talukas. Some parts of urban areas of Osmanabad town and localized places in rural areas are also adversely affected by the nitrate contamination.

Ground Water Information Osmanabad District

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Ground Water Information

Osmanabad District

1.0 Introduction

Osmanabad is one of the districts of Marathwada Region of Maharashtra and famous for Tuljabhavani temple at Tuljapur. It is situated in the southern part of the State abutting Andhra Pradesh in south and lies between north latitudes 17°37' and 18°42' and east longitude 75°16' and 76°47' and falls in parts of Survey of India degree sheets 47 N, 47 O, 58 B and 56 C. The district has a geographical area of 7512 sq. km.

The district headquarters is located at Osmanabad Town. It has 8 talukas i.e., Osmanabad, Tuljapur, Omerga, Lohara talukas in Osmanabad subdivision and Kallam, Bhoom, Paranda, Washi in Bhoom subdivision. It has a total population of 14,86,586 as per 2001 census. The district has 8 Nagar Parishads, 8 Panchayat Samitis and 622 Gram Panchayats. The district forms part of Godavari Basin and Manjra Subbasin. Manjra, Sina, Terna, Bori, Benitura, Banganga are the main rivers flowing through the district.

Central Ground Water Board has taken up Systematic Hydrogeological Surveys and urban hydrogeological study of Osmanabad town in the district as presented in Table-1.

Table 1: Studies undertaken by CGWB.

S. No.	Officer	AAP	Type of Survey/Study
1.	Ramaiah, S. N.	1995-96	Systematic Hydrogeological Surveys
2.	Bansal S. K.	2000-01	Urban hydrogeology and Impact of Population on GW Regime in Osmanabad Municipal Area, Osmanabad.

Shri S. K. Bansal, Scientist-D, in 2000-01, compiled the report entitled "Ground Water Resources and Development Potential of Osmanabad District, Maharashtra."

Ground water exploration in the district was undertaken in phases since 1977 (Sina-Man Project) to 2003. A total of 71 wells, which includes 48 Exploratory Wells (EW) 11 Observation Wells (OW) and 12 Piezometers (Pz), were drilled. During 1977-78 under Sina-Man Project 9 EW and 6 OW were drilled while in 1994-95 5 EW were drilled to study the post-Killari earthquake effect on ground water scenario in the district. Furthermore, during 1998, 12 Pzs were drilled under Hydrology Project and from 2001 to 2003, 34 EW and 5 OW were drilled under GW Exploration Programme. Pumping tests to determine aquifer parameters, were also conducted at 7 sites. The taluka wise salient features of ground water exploration are given in Table-2.

Table 2: Salient Features of Ground Water Exploration.

S. No.	Taluka	Formation	Wells			Depth (mbgl)	SWL (mbgl)	Discharge (lps)	Draw-Down (m)	Zones (mbgl)
			EW	OW	Pz					
1	Osmanabad	Basalt	8	6	2	30.00-200.00	6.2-97.80	0.14-12.00	10.53-14.71	4.06-162.20
2	Tuljapur	Basalt	9	--	5	75.00-204.15	8.9-74.05	0.38-2.8	NA	5.00-141.40
3	Omerga	Basalt	12	1	1	39.00-200.00	7.72-98.1	0.02-14.89	NA	9.00-120.00
4	Kallam	Basalt	6	1	2	30.00-200.00	5.60-54.85	0.14-14.88	NA	9.00-118.00
5	Bhoom	Basalt	4	--	1	69.00-158.50	17.30-27.05	0.38-4.24	0.75	11.00-99.20
6	Paranda	Basalt	5	3	1	105.30-145.05	3.11-23.40	1.03-8.70	12.51-47.42	9.80-98.85
7	Lohara	Basalt	3	--	--	117.20-130.00	45.77-53.80	0.79-13.7	NA	56.00-114.00
8	Washi	Basalt	1	--	--	200.00	Dry	-	-	-
	Total		48	11	12	30.00-204.15	3.11-98.10	0.02-14.88	0.75-47.42	4.06-162.20

The depth of the wells varies from 30 to 204.15 metres below ground level (m bgl), while discharge varies between 0.02 and 14.88 litres per second (lps). Static water levels ranged from 3.11 to 98.10 m bgl depth. The potential aquifer zones have been encountered from 4.06 to 162.20 m bgl. The deepest water level is recorded at Talmud, Taluka Omerga. i.e., 98.10 m bgl. Deeper aquifer zones have been encountered in many wells beyond 50 m depth, the deepest being at 166 m at Osmanabad exploratory well in Osmanabad taluka.

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

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 8.5°C and mean maximum temperature is 42.5°C.

The normal annual rainfall over the district varies from 600 mm to about 850 mm. It is minimum in the western parts of the district around Parand (576 mm) and increases towards east and reaches a maximum around Kalam (775 mm). The average annual rainfall of the district for the period 2002-2011 is 713 mm and the same is presented in Table-3.

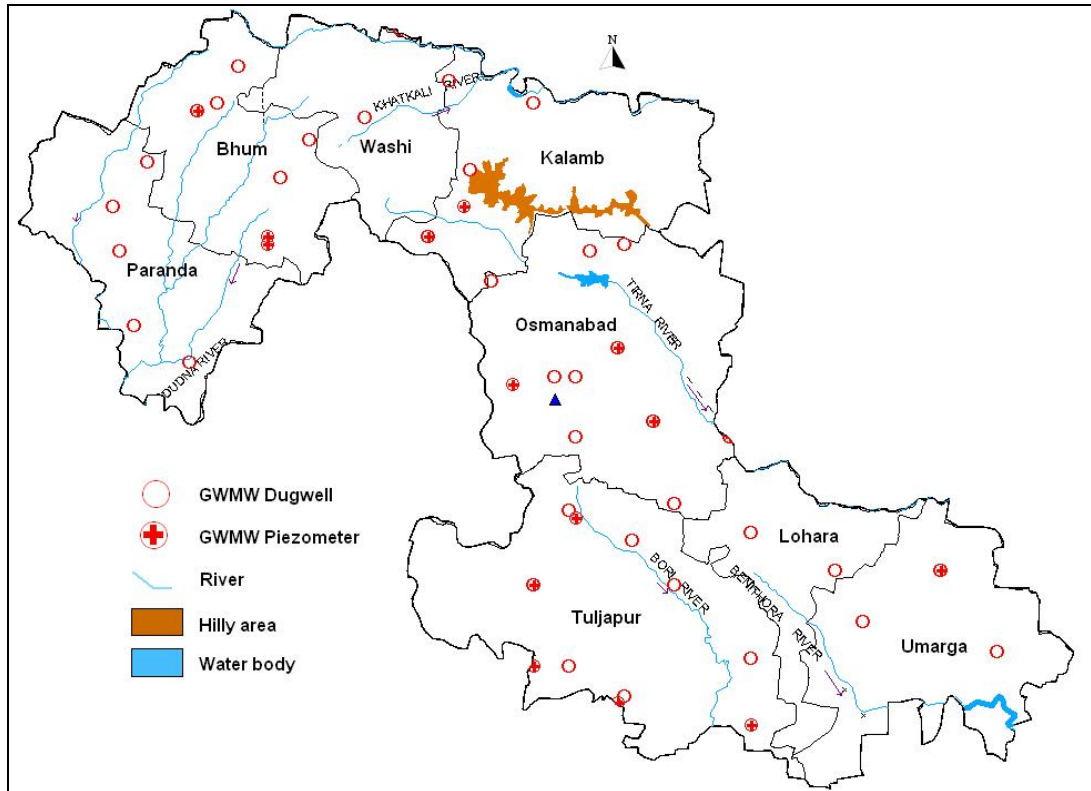


Figure-1: Location

Table 3: Annual Rainfall, Osmanabad District in mm (2002-2011)

S. No.	Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
1	Osmanabad	679.2	431.4	741	857	673.6	979.4	1096	658	1000.7	538	765.43
2	Tuljapur	651.2	498.2	882.4	874.2	857	821	729	767	971.4	568	761.94
3	Paranda	398.5	266	598	508	554	631.8	561	709	1006.8	530.8	576.39
4	Bhum	702.6	473	684.7	690	746	832.7	730	862	1089.3	475.7	728.60
5	Kalamb	668	576	915.5	1049	760	746.88	772	764.3	1044.4	459.8	775.58
6	Omarga	633.4	621	666.9	954.4	642	678.1	648	610	1013.2	534.5	700.15
7	Lohara	626.4	461.8	604.5	817.4	652	705.4	583	601	1131	530.7	671.32
8	Vashi	605.6	383	696.9	747.6	782.6	797.56	720.31	890	1018.6	668.9	731.10
	Average	620.61	463.8	723.73	812.2	708.4	774.10	729.91	732.66	1034.42	538.3	713.81

3.0 Geomorphology and Soil Types

The district forms part of Deccan Plateau, locally known as Balaghat Plateau, with slope towards southwest and south and has a varied topography consisting of hills, plains and undulating topography near river-banks. The district forms a part of Godavari basin. The Balaghat Plateau comprises of low-lying hills forming water divide. Many of the tributaries to Godavari river originate from the Balaghat Plateau. Manjra River is the main river flowing through the district. Other rivers are Sina, Terna, Bori, Benitura and Banganga. Based on geomorphological setting and drainage pattern, the district is divided into 41 watersheds.

The soil of the district is basically derived from Deccan Trap Basalt and the soils occurring in the district are broadly classified into three major types.

Shallow Soils occur in small patches in western and northwestern parts of the district. These soils are light brown to dark grey in colour and loamy to clayey loamy in texture. Medium Soils are found in parts of Bhoom, Kallamb and Osmanabad talukas. They are dark brown to dark grey in colour. Medium deep Soils occur in patches in Tuljapur taluka. The colour of these soils varies from dark grey brown to very dark grey. They are clayey in texture.

4.0 Ground Water Scenario

4.1 Hydrogeology

The entire district is underlain by the Basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow Alluvial formation of Recent age also occurs as narrow stretch along the major rivers flowing in the area but it does not play much important role from ground water point of view. A map depicting the hydrogeological features is shown in Figure-2

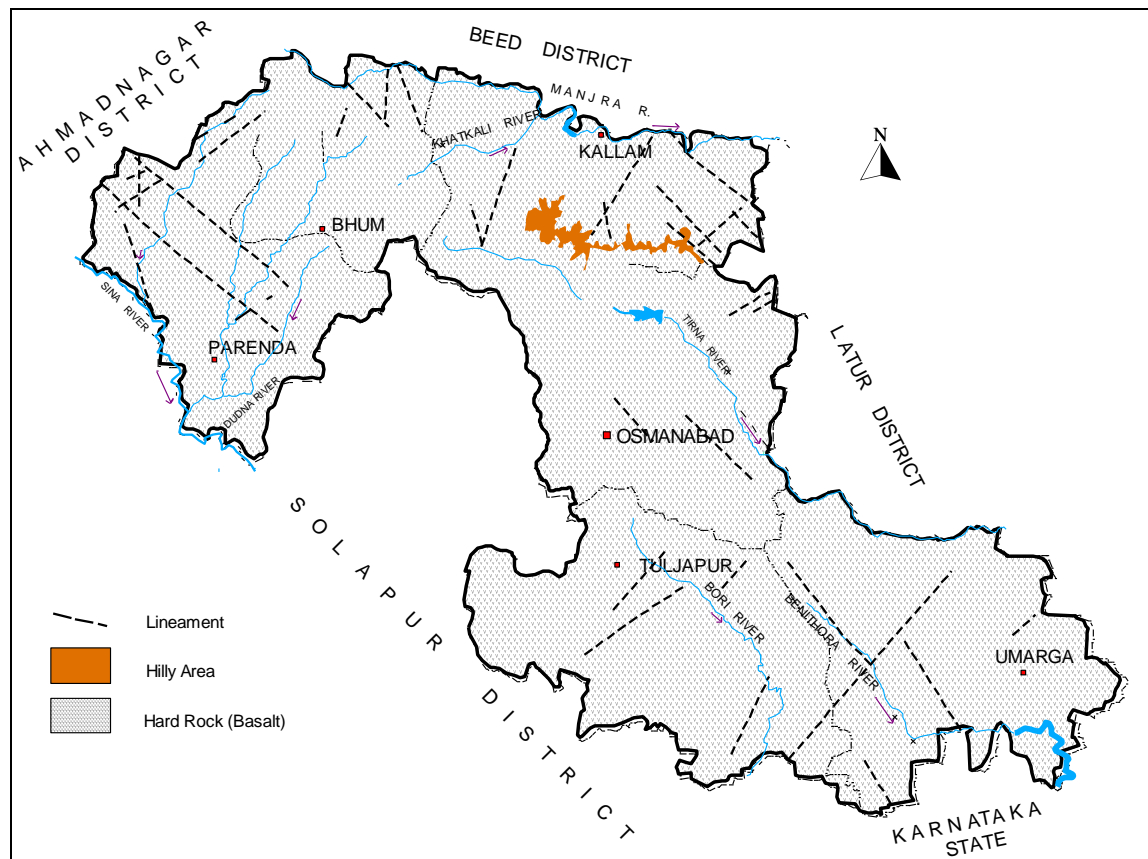


Figure-2: Hydrogeology

4.1.1 Deccan Trap Basalt

Deccan Traps occurs as Basaltic lava flows, which are around 280 m thick, normally horizontally disposed over a wide stretch and give rise to tableland type of topography on weathering also known as plateau. These flows occur in layered sequence ranging in thickness from few metres to 55 m. Flows are represented by massive portion at bottom and vesicular portion at top and are separated from each other by marker bed known as bole bed.

Ground water in Deccan Trap Basalt occurs under phreatic and semi-

confined conditions. The weathered and fractured trap occurring in topographic lows form the main aquifer in the district.

4.1.2 Water Level Scenario

Central Ground Water Board periodically monitors the Ground Water Monitoring Wells (GMMW) in Osmanabad district, four times a year i.e., in January, May (Premonsoon), August and November (Postmonsoon). There are 25 dugwells and 2 piezometers being monitored regularly, out of which active wells are presented as under

Table 4: Water Level Data (2011) with Long Term Trend (2002-2011)

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	Takiwiki	9.2	5.65	3.55	0.0463	--	0.2825	--
2	Massa (Khurd)	--	3.3	--	0.0014	--	0.4476	--
3	Pimpalwandi	4.3	1.4	2.9	0.5572	--	0.5364	--
4	Anala	--	3.7	--	--	0.3279	0.1287	--
5	Mouje Barul	9.4	6.2	3.2	0.0936	--	0.1483	--
6	Sonari	5.65	2.5	3.15	0.032	--	0.011	--
7	Wakwad	4.15	1.2	2.95	0.4563	--	0.0227	--
8	Yermala2	11.6	7.0	4.6	--	0.0408	0.7199	--
9	Gandora	10.85	6.6	4.25	0.2959	--	0.8342	--
10	Sancha	7.6	2.4	5.2	--	0.0054		0.3269
11	Turori	5.15	2.05	3.1	0.0236	--	0.0463	--
12	Itkal	4.85	4.7	0.15	--	--	--	--
13	Lohara Buzurg	5.3	3	2.3	0.0713	--	0.1539	--
14	Vadgaon Siddheswar	7.15	2.5	4.65	0.3885	--	0.237	--
15	Dhoki	--	4.5	4.5	0.077	--	0.7566	--
16	Yedshi	9.25	--	--	0.0323	--	0.4282	--
17	Sarola	17.35	--	--	0.1617	--	0.7736	--

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

The depth to water levels in the district during May 2011 ranges between 4.15 m bgl (Wakvad) and 17.35 m bgl (Sarola (Mandwa)). Depth to water levels during premonsoon (May 2011) has been depicted in Figure-3. Shallow water levels within 10 m bgl are seen in almost entire district, i.e., major parts of Bhoom, Paranda, Washi, Osmanabad, Tuljapur, Lohara, Omerga and eastern part of Kallamb talukas. Water levels in the range of 10-20 m bgl are observed in major part of the Kallamb and eastern part of the Washi talukas. Also, it is observed as isolated patches in Tuljapur, Lohara and Omerga talukas. Small patches of shallow water level range of 2-5 m bgl are observed in the north of Osmanabad.

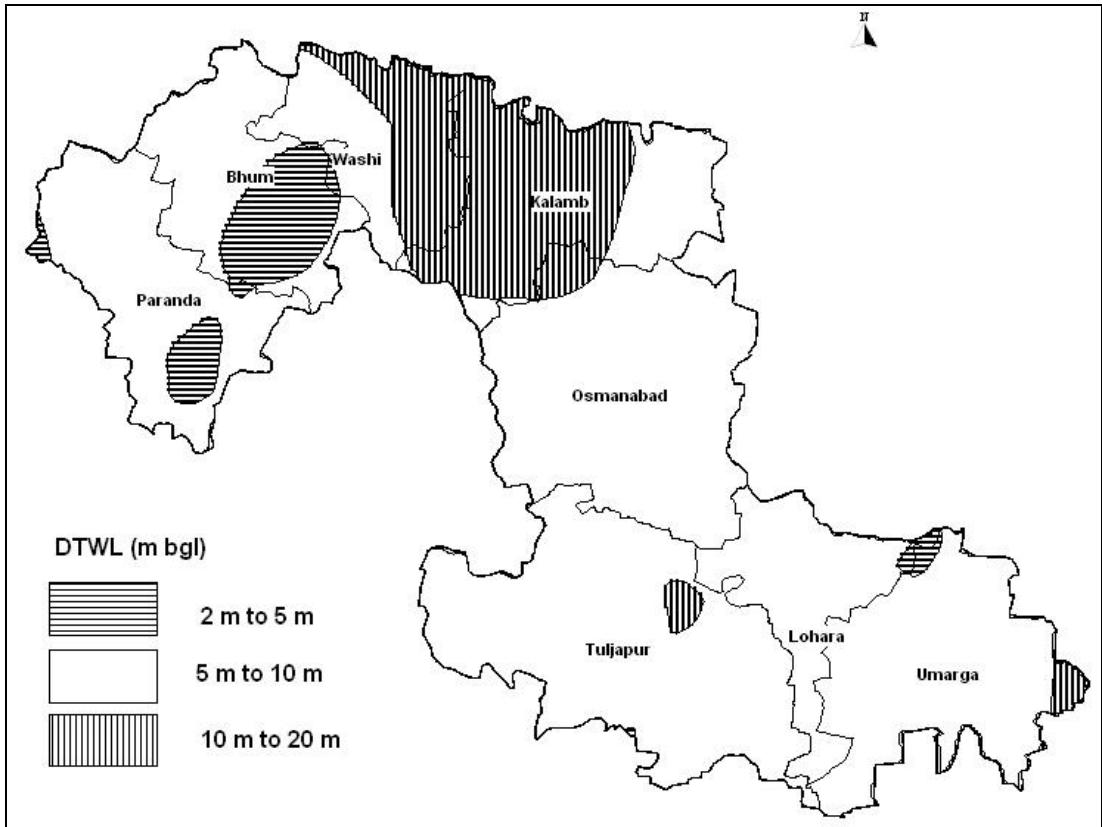


Figure-3: Depth to Water Level (Premonsoon- May 2011)

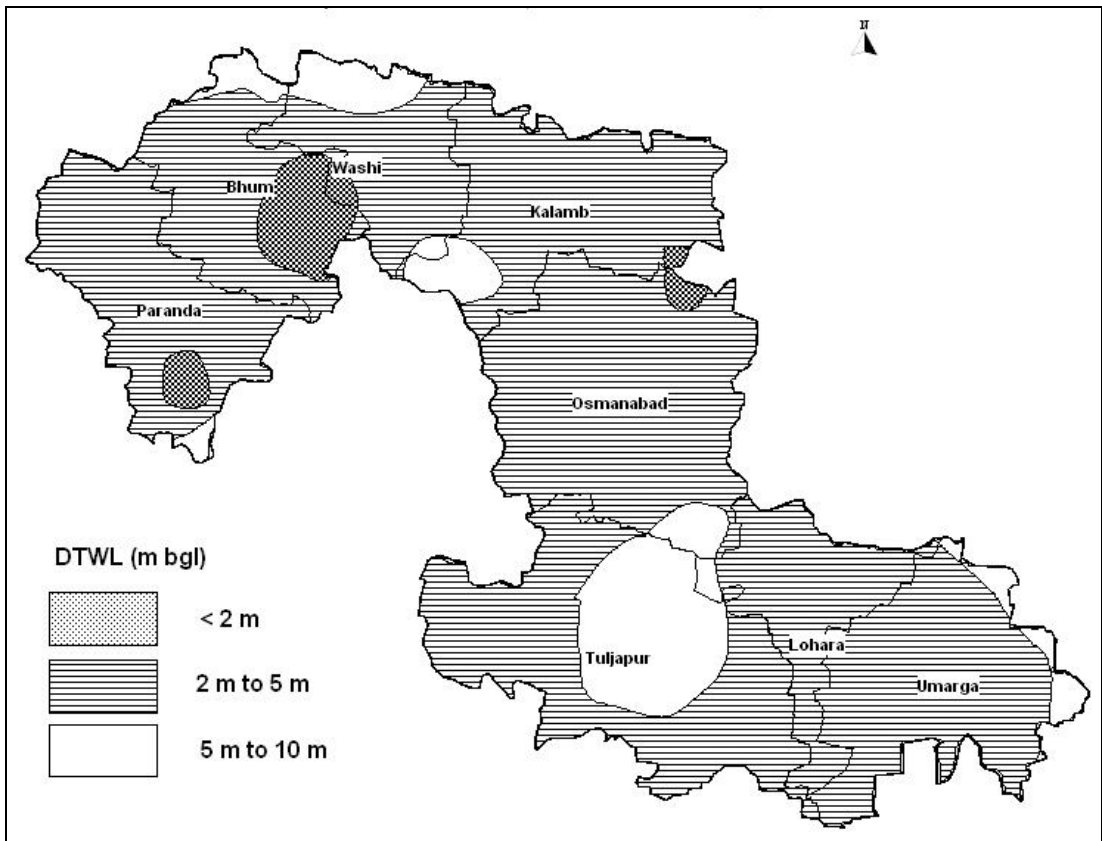


Figure-4: Depth to Water Level (Postmonsoon- Nov.2011)

4.1.3 Depth to Water Level – Postmonsoon (Nov.-2011)

The depth to water levels during Nov. 2011 ranges between 1.2 m bgl (Wakvad) and 7.00 m bgl (Yermala). Spatial variation in postmonsoon depth to water levels is shown in Figure-4. In the entire district the water levels are shallow within 2 to 5 m bgl with few exceptions. Water levels of < 2 m bgl depth is the most dominant range occupying almost entire Bhoom, Paranda, Kallamb, Osmanabad and Omerga observed as small isolated patches in southern part of Paranda, eastern part of Bhoom, NE part of Osmanabad talukas. The water level varying between 5 to 10 m bgl is observed in major part of central Tuljapur taluka, NE border of Omerga taluka, SW part of Kalamb taluka and N-NW part of Washi and Bhoom taluka.

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

In major part of the district rise in water levels in the range of negligible to 5.2 m (Sancha) is observed. In entire district rise in water levels has been observed. Major part of the district has recorded rise in water level in the range of 2-4 m. Rise of more than 4m is the next major range occupying entire Osmanabad and Kalamb talukas, NW part of Tuljapur and E-SE part of Washi taluka. Rise in 0-2 m range is observed in north part of Omerga and Bhoom, NE part of Lohara, southern part of Tuljapur and Paranda.

4.1.5 Water Level Trend (2002-2011)

Trend of water levels for premonsoon and postmonsoon period for last ten years (2002-2011) have been computed for 17 GWMWs. Analysis of trend indicates that during premonsoon period, rise in water levels has been recorded at 13 stations ranging between 0.02 (Turori) and 0.55 m/year (Pimpalwandi). Fall in water levels has been observed only at 3 stations in the range of negligible to 0.30 m/year (Anala). During postmonsoon period, rise in water levels has been recorded at 16 stations ranging from 0.01 m/year (Sonari) to 0.83 m/year (Gandhora), whereas, fall in water level of 0.32 m/year is observed only at Sancha. Thus, in major part of the district, both during pre and postmonsoon periods rising trend of water levels has been observed.

The premonsoon rising trend up to 20 cm/year is observed in entire district except small patch in southern part of Washi taluka where fall upto – 0.2 m/year has been observed. During post monsoon, entire district is showing rising trend of water level ranging between negligible to 0.2 m/year.

4.1.6 Aquifer Parameters

The aquifer parameters are available from pumping tests conducted on exploratory wells and it is observed that the transmissivity of Deccan Traps varies between 0.22 (Saudana Amba) and 20.24 m²/day (Khanapur).

4.2 Ground Water Resources

Central Ground Water Board and Groundwater Survey and Development Agency (GSDA) have jointly estimated the ground water resources for the year 2007-08 of Osmanabad district based on GEC-97 methodology. The same are presented in Table-4, whereas the graphical representations of the resources are shown in Figure-6. Ground water resources estimation was carried out for 6716.28 sq. km. area.

As per the estimation the annual ground water draft for all uses is

estimated as 73722 ham/year with irrigation sector being the major consumer having a draft of 71830 ham/year. The allocation for domestic and industrial water requirements for next 25 years is 3700.3 ham/year. The net ground water availability for future irrigation is estimated as 35620 ham/year. Stage of ground water development varies from 47 % (Bhum) to 84 % (Osmanabad). The overall stage of ground water development for the district is 65.28 %. All talukas fall under 'Safe' category.

Watershed wise, out of 41 watersheds, 36 watersheds fall under "Safe category" while 5 watersheds fall under "Semi-Critical" category, namely, MR-12, MR-17, MR-21A, MR-22 and MR-36A.

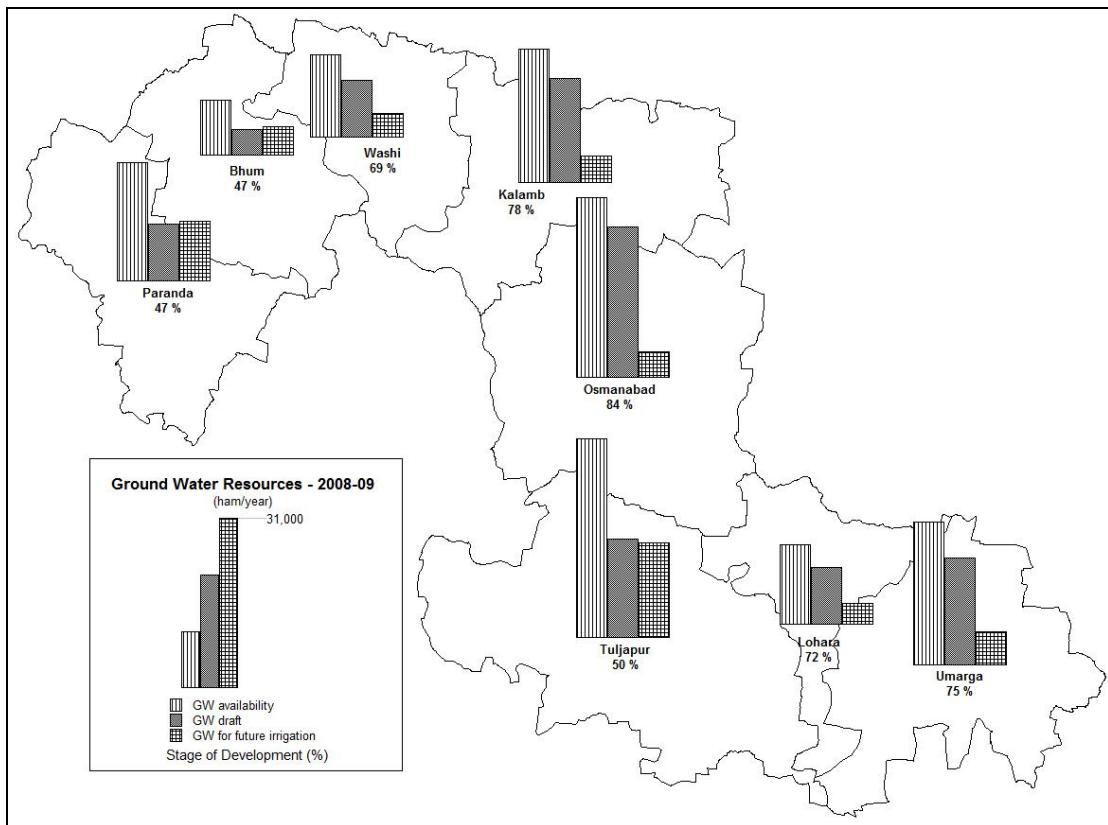


Figure-6: Ground Water Resources

Table-4: Taluka wise Ground Water Resources (2008-09)

Taluka	Net annual ground water availability (ham/yr)	Annual ground water draft (ham/yr)			Allocation for domestic & industrial requirement supply upto next 25 years (ham/yr)	Groundwater availability for future irrigation (ham/yr)	Stage of groundwater development (%)	Is there a significant decline of water levels during		Category
		Irrigation	Domestic & industrial uses	Total				Pre monsoon	Post monsoon	
Osmanabad	20117.87	16527.66	337.14	16864.80	634.65	2935.35	83.83	NO	NO	safe
Tuljapur	22234.9	10723.52	377.81	11101.33	752.07	10738.43	49.93	NO	NO	safe
Omerga	15989.09	11692.66	280.01	11972.67	532.51	3815.22	74.88	NO	NO	safe
Bhoom	6172.91	2791.92	100.98	2892.90	203.93	3205.53	46.86	NO	NO	safe
Kalamb	15047.20	11468.73	299.44	11768.17	584.39	3077.70	78.21	NO	NO	safe
Paranda	13332.40	6109.73	197.34	6307.07	392.39	6791.90	47.31	NO	NO	safe
Washi	9233.49	6213.76	150.17	6363.93	300.64	2728.91	68.92	NO	NO	safe
Lohara	8921.91	6301.79	149.37	6451.16	299.67	2326.92	72.31	NO	NO	safe
Total	111049.8	71830	1892.3	73722	3700.3	35620	65.28	NO	NO	safe

4.3 Ground Water Quality

In the district, 6 water samples were collected during May 2010. The partial chemical analysis of these ground water samples is given in Table-5.

Table-5: Chemical analysis of these ground water samples

SN	Well No.	Village	pH	EC	TA	TH	NO ₃	F	RSC
1	K/OS-003	Gandhora	8.4	730	260	220	10	0.09	0.80
2	K/OS-039	Sonari	8.3	890	200	225	13	0.50	-0.50
3	K/OS-040	Wakwad	8.4	810	255	225	30	0.01	0.60
4	G/OS-044	Kukudgaon	8.8	530	200	55	1	1.10	2.90
5	G/OS-046	Dhoki	8.4	1610	325	350	79	0.35	-0.50
6	G/OS-059	Yedshi	8.2	2200	330	400	80	0.46	-1.40
Average			8.42	1128.33	261.67	245.83	35.50	0.42	0.32

- The overall range and average value of pH of the ground water samples indicates that the ground water in the district is predominantly alkaline in nature. The pH values also indicate that the CO₂ dissolved in water is existing mainly in the form of HCO₃⁻ while it is also occurring as a CO₃²⁻ in those samples where pH is more than 8.3. The high values of pH i.e., > 8.5 was found in Kukudgaon.
- The measurement of EC of water gives an idea about the ions concentration in the water. As the concentration of dissolved ions increases, the water becomes more conductive. The average value of EC of the samples suggests that the groundwater in the monitoring wells is fresh in nature.
- The total alkalinity (TA) of water is its acid neutralizing capacity and primarily a function of carbonate, bicarbonate and hydroxide content of water. It is expressed in terms of CaCO₃. In the ground water samples from monitoring wells the alkalinity is mainly due to bicarbonate ions as most of the samples are having pH less than 8.3. In the district the TA of groundwater is found within maximum permissible limit (300-600 mg/L).
- The total hardness (TH) is the sum of calcium and magnesium concentration expressed in terms of CaCO₃ in mg/L. The carbonate and bicarbonate salts of Ca and Mg give temporary hardness to ground water while chloride and sulphate salts gives permanent hardness. In the district the TH of groundwater is found less than maximum permissible limit of BIS (600 mg/L) indicating the ground water is soft in nature.
- The nitrate concentration observed in ground water is more than the maximum permissible limit of BIS (45 mg/L) only in Dhoki and Yedshi, while rest of the samples falling in safe category.
- The concentration of fluoride is within permissible limit except at Kukadgaon where it is 1.1 mg/L.

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) is given in Table-6.

Table-6: BIS Drinking Water Standards (IS-10500-91, Revised 2003), for Drinking water

Parameters	DL	MPL
TDS (mg/L)	500	2000
TH (mg/L)	300	600
Ca (mg/L)	75	200
Mg (mg/L)	30	100
Cl (mg/L)	250	1000
SO ₄ (mg/L)	200	400
NO ₃ (mg/L)	45	No relaxation
F (mg/L)	1.0	1.5

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

The perusal of Table-5 and 6 shows that ground water from these six places is found potable for drinking except where it crosses the MPL. However, the concentration of nitrate is found more than MPL at Dhoki and Yedshi, indicating high influence of anthropogenic activity in the vicinity of the wells, causing nitrate contamination.

The ground water exploration reveals that the ground water quality in deeper aquifer is adversely affected by fluoride contamination in Osmanabad, Tuljapur and Omerga talukas of Osmanabad district. The details are presented in Table-7.

Table-7: Fluoride Concentration.

S. No.	Location	Taluka	Fluoride Concentration (mg/L)
1.	Yedshi	Osmanabad	1.87-2.71
2.	Takwiki	Osmanabad	1.7
3.	Arli Bk	Tuljapur	8.1
4.	Naldurg	Tuljapur	7.1
5.	Salgara Devti	Tuljapur	1.79
6.	Kaldora	Omerga	1.34
7.	Kasgi	Omerga	3.41

Ground water in deeper aquifers are having low TDS and high fluoride in contrast to the shallow aquifers. Concentration of bi-carbonate ions is found less in the deeper aquifers unlike in the shallow aquifers and has negative relation with fluoride.

Thus it is clear that in shallow aquifer potability of ground water is affected mainly by localised nitrate contamination, whereas in deeper aquifer it is affected by fluoride contamination in few talukas. Thus, in these areas, all the wells used for water supply should be first analysed for fluoride and nitrate

concentration in ground water.

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 suitability 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 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.

RSC	<1.25		1.25-2.50		>2.50	
Category	Good		Doubtful		Unsuitable	
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples	%
6	5	83	Nil	Nil	1	17

The Table-8 shows that the ground water samples from all 5 wells have RSC values below 1.25 and are suitable for irrigation except at Kukadgaon where the RSC value is 2.9, and ground water is unsuitable for irrigation purpose. 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

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. The yields of wells are functions of the permeability and transmissivity of aquifer encountered and vary with location, diameter and depth etc. Ground water in the area is being developed by three types of abstraction structures i.e., dugwells, borewells and dug-cum-borewells. However dugwells are the main ground water abstraction structures in the district. The yield of such structures varies from 10 to 40 m³/day for a drawdown of about 3 to 8m. High yielding dugwells are generally located in weathered and fractured basalt occurring in physiographic depressions. Dug-cum-borewells have vertical bores generally of 30 to 50 m depth from the bottom of the well. The yield of borewells ranges from nil to as high as 40,000 lph.

6. IRRIGATION BY DIFFERENT SOURCES (2006-07)

	Nos.	Potential Created (ha)
Dugwells	: 47982	133535
Borewells	: 15834	40258
Surface Flow Schemes	: 3428	6238
Lift Irrigation Schemes	: 4708	11682
Net Irrigated Area	: 191713	ha

Ground water is predominantly used for irrigation, as it is the major ground water utilising sector. As per the data available for year 2006-07, area irrigated by ground water is 1692.59 sq. km., whereas surface water accounts for only 41.08 sq. km. and the net irrigated area is 1917.13 sq.km. Thus it is clear that ground water is the major source of irrigation as it accounts for about 74.50 % of net irrigated area. As per 2006-07 data the district had 63816 irrigation dugwells, which create an irrigation potential of 1737.93 sq.km., out of which 1692.59, of irrigation potential is utilised.

State government has drilled large number of borewells fitted with hand pumps and electric motors for rural drinking water purposes in the district. In all till March 2011, GSDA, Government of Maharashtra was successfully operating 5269 borewells for rural water supply under various schemes in the district, out of which 799 are fitted with electric pumps and the 4470 are fitted with hand pumps. In addition to this, numerous dugwells are also the main source of water supply.

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 of 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 resource development.

5.1 Ground Water Development

The entire district is underlain by Deccan Trap Basalt. Major parts of Omerga, Kallamb and small parts of Bhoom-Paranda talukas have low ground water development potential. The areas with medium ground water development potential are observed in almost entire part of Osmanabad and Tuljapur talukas, central part of Bhoom and Paranda talukas. South-western part of Bhoom taluka, north-eastern part of Paranda taluka, north-western part of Osmanabad taluka, south-western part of Tuljapur taluka and southern part of Omerga taluka have high ground water development potential. In these areas the ground water can be developed through dugwells, dug-cum-bored wells (DCB) and borewells. The yield of dugwells in the district may be expected from 10 to 40 m³/day depending on the local hydrogeological conditions. The nature and yield potential of the aquifers occurring in different talukas are given in Table-9.

Table-9: Nature and Yield Potential of Aquifers.

S. No.	Taluka	Main Aquifer	Yield Potential	Type of Wells Suitable
1.	Osmanabad	Basalt	Low to High	Dugwell DCB
2.	Tuljapur	Basalt	Medium to High	Dugwell DCB
3.	Omerga	Basalt	Low to Medium	Dugwell DCB
4.	Bhoom	Basalt	Low to High	Dugwell DCB

5.	Paranda	Basalt	Low to High	Dugwell DCB
6.	Kallamb	Basalt	Low to Medium	Dugwell DCB
7.	Lohara	Basalt	Low to High	Dugwell DCB
8.	Washi	Basalt	Low to Medium	Dugwell DCB

5.2 Water Conservation and Artificial Recharge

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 located in parts of Bhoom, Paranda, Kallamb, Washi, Tuljapur and Osmanabad talukas. Existing dugwells can also be used for artificial recharge; however, the source water should be properly filtered before being put in the wells.

These sites need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of unsaturated/de-saturated aquifer exists and water levels are more than 5 m deep.

6.0 Ground Water Related Issues and Problems

The rainfall data analysed for the period 1901-1999 indicates that severe drought conditions were experienced in all stations except at Tuljapur, while moderate drought conditions ranges from 11% at Kallamb to 28% at Tuljapur. Thus future water conservation and artificial recharge structures may be prioritised in these parts of the district.

The ground water exploration reveals that the ground water quality in deeper aquifer is adversely affected by fluoride contamination in Osmanabad, Tuljapur and Omerga talukas of Osmanabad district. The urban areas of Osmanabad town are also adversely affected by the nitrate contamination. Hence adequate sanitary protection may be provided to control the nitrate contamination. In shallow aquifer, potability of ground water is mainly affected by localised nitrate contamination, whereas in deeper aquifer it is affected by fluoride contamination in few talukas. Thus, in these areas, 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 2012, MAP and WMTP are yet to be organised in the district.

8.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation all the talukas fall under "Safe" category, hence till March 2012, no area has been notified either by CGWA or SGWA.

9.0 Recommendations

- 1 The entire district is underlain by the Deccan Trap Basalt where only dugwells are most feasible structures for ground water development. The sites for borewell need 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 after proper water quality check and not for irrigation.
- 3 The overall stage of ground water development for the district is 65.28 %, therefore, scope for further development of ground water resources exists with proper ground water development plan.
- 4 South-western part of Bhoom taluka, north-eastern part of Paranda taluka, north-western part of Osmanabad taluka, south-western part of Tuljapur and southern part of Omerga talukas have high ground water potential. In these areas the ground water can be developed through dugwells, dug-cum-bored wells and borewells. The yield of dugwells in the district may be expected from 10 to 40 m³/day depending on the local hydrogeological conditions.
- 5 Considering the future ground water stresses, water conservation and artificial recharge structures needs to be prioritised in Omerga, Tuljapur, Paranda and Bhum talukas and in parts of Kalamb and Osmanabad talukas of the district.
- 6 In shallow aquifer, potability of ground water is affected mainly by localised nitrate contamination, whereas in deeper aquifer it is affected by fluoride contamination in few talukas. Thus, in these areas, all the wells used for water supply should be first analysed for fluoride and nitrate concentration. Likewise, adequate sanitary protection to the wells may be provided to control the nitrate contamination.
- 7 The scope exists for construction of suitable artificial recharge structures in the district. The structures recommended for the hilly-basaltic area in parts of Bhoom, Paranda, Washi, Kallamb, Osmanabad and Tuljapur 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 The existing village ponds need to be rejuvenated to act both as water conservation and artificial recharge structures.