1803/DBR/2013

भारत सरकार

जल संसाधन मंत्रालय

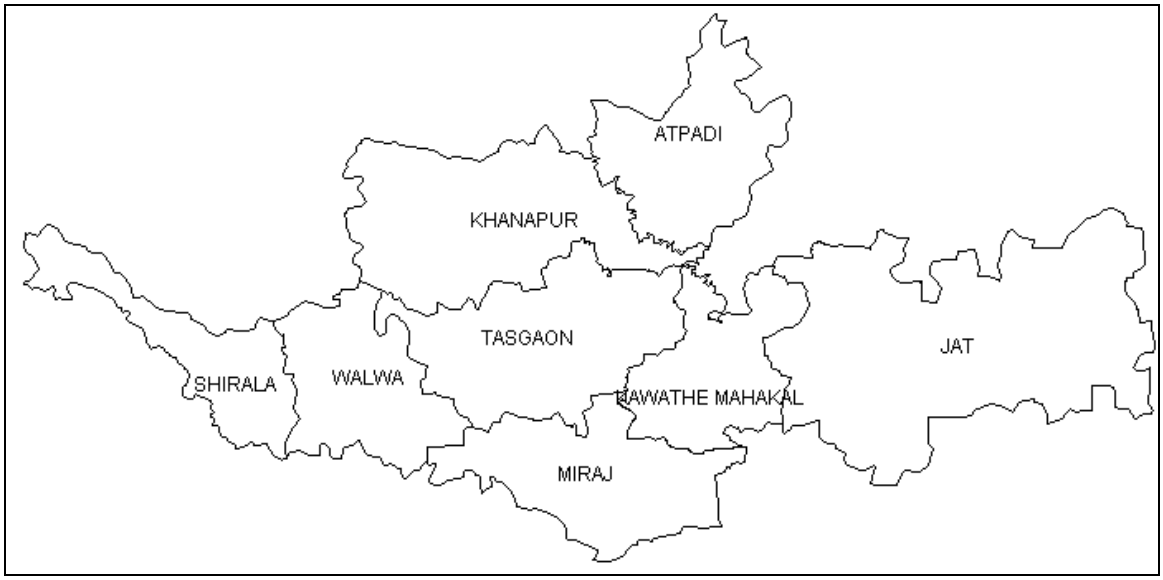
केंद्रीय भूजल बोर्ड

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत सांगली जिले की

भूजल विज्ञान जानकारी

GROUND WATER INFORMATION
SANGLI DISTRICT
MAHARASHTRA



By

Abhay Nivasarkar
Scientist-B

द्वारा

अभय निवसरकर
वैज्ञानिक - ख

मध्य क्षेत्र, नागपुर
CENTRAL REGION, NAGPUR
2013

SANGLI DISTRICT AT A GLANCE

1. General Information

Geographical area	8572 Sq Km
Administrative division	Shirala, Walwa, Palus, Khanapur, Atpadi, Tasgnon Miraj , Kavathe Mahakal, Jat, AND Khadgaon
Villages	724
Population	25,83,524 (Male 13,20,088 , Female12,63,436)
Normal rainfall	550 mm

2. Geomorphology

Major Physiographic unit	Hills and ghat, Foot hill, Pleatodleb, ,Plains

3. Landuse (As on 2010-11)

Fprest area	47593 ha
Net sownarea	597700 ha
Cultivable area	768685ha

4. Soil type

Medium black and deep black soil

5. Principal crops (As on 2010-11)

Jawar	272765 ha
Wheat	30965 ha
Ceral	97003 ha
Sugarcane	51016

6. Irrigation by different sources (2010-11)

		Benefited area (ha)		Actual Irrigated area (ha)
Major irrigation project	84725		82786	
Medium irrigation project		15075		6919
Small irrigation project	35614		13486	
Dugwell (2010-11)		54064 (nos)		102327Ha
Borewell (2010-11)		63 (nos)		

7. Ground Water Monitoring Well (As on Jan 2011)

Dugwell	36
Piezometer	03

8. Geology

Recent	Alluvium
Upper cretaceous to Eocene	Deccan Trap (Basalt)

9. Hydrogeology

Water bearing formation	Basalt- Wathered /fractured / jointed / vesicular/ massive/ under phreatic ,Semi confined, Confined	
	Minimum (mbgl)	**Maximum (m.bgl)**
Pre monsoon depth to water level	0.35 (mbgl)	16.45 (mbgl)
Post monsoon water level	0.2 (mbgl)	11.0 (mbgl)
Ground water fluctuation	0.15 m	10.28 m
Pre monsoon Water level Trend	Not any significant decline trend	

10. Ground Water Exploration

Well drilled	52	44 (EW)08 (OW)
Depth range	950.00 to 200 m	
Discharge	Traces to 35 lps	

11. GROUND WATER QUALITY

The ground water quality in the wells monitored in the district is affected because of high NO_3 concentrations.

12. DYNAMIC GROUND WATER RESOURCES(2009)

Net ground Water Availability	89101.95 (ham)
Annual GW draft	68345.00 (ham)
Allocation for future use	20118.00 (ham)
Stage of development	76.72%

13. GROUNDWATER CONTROL AND REGULATION

Over Exploited Taluka	Nil
Critical Taluka	Kawathe Mahakal
Semi-Critical Taluka	Miraj
Notified Taluka	Nil

14. MAJOR GROUND WATER PROBLEM AND ISSUES

Sangli district receives low rain fall as it falls in Rain Shadow Zone. The rain shadow zone is a dry area on the lee side of mountains. The mountains block the passage of rain-producing weather systems casting a "shadow" of dryness behind them. The drought is observed in major part of the district. Kawathe Mahakal and MirajTalukas have been categorised as Critical and semi-critical respectively where the ground water development has reached more than 90%.

GROUND WATER INFORMATION

SANGLI DISTRICT

CONTENTS

List of Figures

List of Tables

GROUND WATER INFORMATION
SANGLI DISTRICT

1.0 Introduction

The Sangli district was earlier known as south Satara district, formed in year 1949 after independence by carving 4 Talukas namely Tasgaor, Khanapur, Walwa and Shivala of Satara district and Miraj and Jat talukas of other part of Maharashtra. The South Satara district was renamed as Sangli on 29th Nov 1960. In year 1965, two more new talukas viz Kawthe Mahakal were added and talukas of Atapadi and Palus were formed in the year 1999. In year 2002 one more new taluka Kadegaon was constituted by carving 13 villages from Palus taluka and 39 villages from Khanapur taluka of the district.

The district is bounded by Satara and Solapur districts in north and Kolhapur and Belgaum districts (Karnataka) in south. On the east it is ablished bounded by Bijapur district of Karnataka state and in the west by coastal district of Ratnagiri. The east west extent of district is 205 km and the extent along north south is 96. Sangli district one of the southern district of Maharashtra is located between North latitudes 16^{0}43' and 17^{0}38' and last longitude 73^{0}41' and 75^{0}41' having an area of 8572 sq km covering parts of survey of India degree sheet Nos 47 K.L, O and P.

The district is mainly an agricultural district falling in Krishna river basin. The Industrial development in the district is mainly restricted to Sangli-Miraj-Madhawagar urban complex, however the district is devoid of major industries except few agro based industries in the rest of district. Farmers in some pockets use quite morden scientific technology and produce bumper crops like sugarcane, seedless grapes vose, mangoes etc. The development of dairy industry has also a notable share in the economy of the district.

The district headquarters is located at Sangli city. It comprises of 10 talukas viz Shirala, Walwa, Palus, Khanapur, Atpadi, Jat, Kadegaon, Tasgaon, Miraj and Kavathe Mahakal. There are 8 towns and 724 villages in the district out of which only 3 villages are not habited. The district has 1 Municipal Corporation, 4 Municipalties, 10 Panchayat Samities and 705 Gram Panchayats. The Administrative setup of the district is shown in **Fig.-1.**

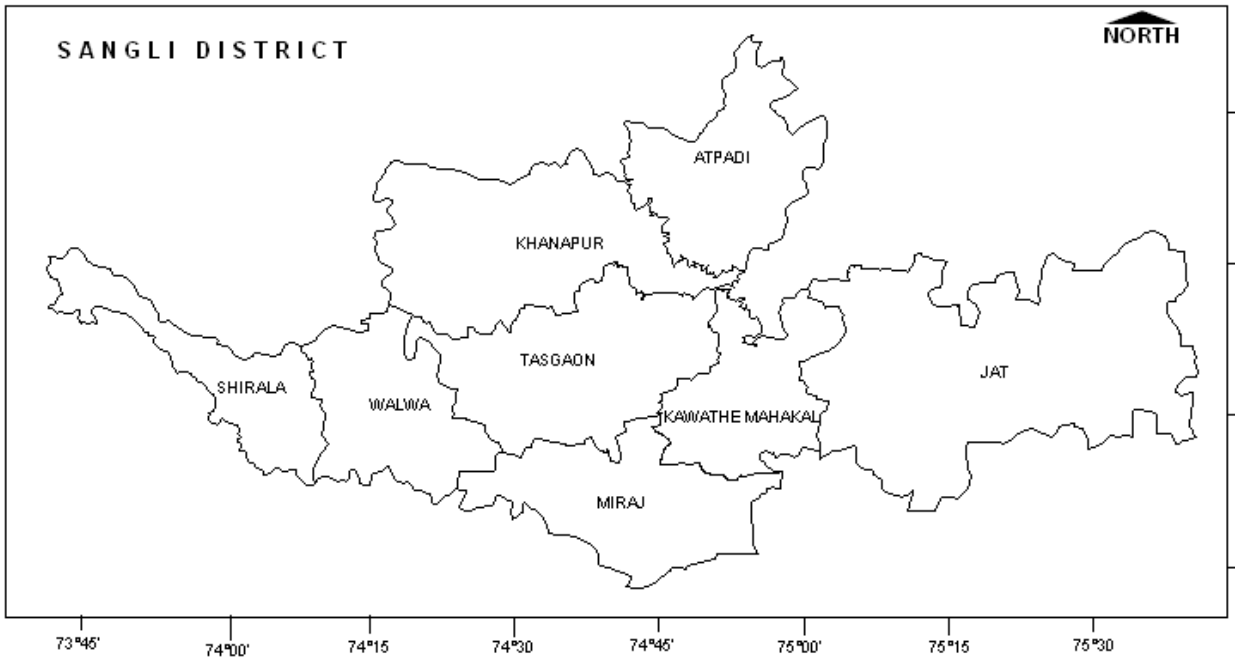


Figure 1: Administrative Map

As per 2001 census, the total population of the district is 25,83,524. out of which 13,20,088 are male and remaining 12,63,436 are female indicating 957 female for every 1000 male population. The rural population recorded in 2001 census was 19,50,000 (75%) and urban was 6,33,000 (25%) out of which 69% of urban population are residing in Sangli Miraj Kupwad Municipal Corporation area. The scheduled tribe population of the distant was 18000 which is 0.69% of total population, the scheduled caste population was recorded as 3,13,000 which is 12% of total population of the district. The population density in the district is 301 persons per sq km against the 315 persons per sq km of state. The literacy ratio of the district is 76.69% (86.25% in male and 66.88% in female population).

The Central Ground Water Board, Central Region has taken up several studies in the district since year 1973. The systematic Hydrogeological Surveys were carried out by D.K. chadha (1975-76), NG Gajbhiye and D.K Chadha (1976-77), NG Gajbhiye (1978-79), A R Bhaisare (1978-79, S K Jain (1987-88), P.K. Naik and B.K. Kallapur (1988-89). In addition to this reconnaissance hydro geological studies were undertaken in the distt. By J.P. Dias in 1973. The District report was compiled by S. Das and D.B. Shetyc in 1981. The ground water exploration was also carried out in parts of district under Sina-Man project of CGWB during year 1975-80. Apart from this,

subsequently ground water explorations covering the entire district is taken up by the Central Region, Nagpur. The salient Features of ground water exploration are given in table 1.

Table 1: Salient feature of Exploratory wells drilled in Sangli District

Taluka	Atpadi	Jath	Khed gaon	Kavathe Mahankal	Khanapur	Miraj	Palus	Shirala	Tasgaon	Walva
No of well	EW 8 OW 1	EW 6 OW -	EW 1 OW 1	EW 7 OW 4	EW 9 OW 1	EW 2 OW 0	EW 1 OW -	EW 2 OW -	EW 3 OW -	EW 6 OW -
Discharge (lps)	Traces-6.6	0.78-4.77	1.37-4.43	0.431-33.63	0.38-10.39	0.78	2.16	0.5	0.6	0.65-3.0
Water zones (m.bgl)	25.70-34.80, 152.00 – 153.00	77.00-78.00 138.00-139.00	41.00-41.50 99.00-100.00 117.00119.00 135.00-136.50 159.90-160.90	7.40-8.40 98.00-99.00 156.80-157.	8.00 – 8.50 60.00-60.90 144.00-144	172.00-173.00	7.00-7.40 80.00-83.60 159.90-162.90	13.50-16.50 38.80-39.90	10.25-13.35 181.05-184.05	13.50-16.50 38.80-39.90
Formation	Fractured massive Basalt	Fractured massive Basalt	Vesicular Basalt	Fractured Vesicular Basalt	Fractured massive Basalt	Fractured Vesicular Basalt	Fractured massive Basalt	Fractured massive Basalt	Weathered Vesicular basalt	Fractured massive Basalt
Transmissivity (T) m^2/day	-	-	13.32-14.45	5.85-177.34	2.8-51.86	-	6.57	-	-	-

52 bore wells have been drilled in the district with 45(EW) and 07 (OW). It is observed from the table that the maximum no of bore wells were drilled in Kawathe Mahakal taluka where discharge ranges between 0.43 lps and 33.63 lps. Discharge in Khanapur Taluka ranges between 0.38 lps and 10.39 lps. In the remaining talukas it ranges between traces to 4.77 lps.

2.0 Climate and Rainfall

The climate of the district is characterised by general dryness during the major part of the year. Winter season is from November to end of February followed by summer season which is from March to May. The South-West monsoon season is from June to October. Talukwise annual rainfall is given in table 2.

Table 2: Taluka wise Annual Rainfall data of Sangli District (mm)					
Year	2008	2009	2010	2011	2012
Taluka Name	Rainfall (mm.)	Rainfall (mm.)	Rainfall (mm.)	Rainfall (mm.)	Rainfall (mm.)
Miraj	433.6	823	757.6	522.8	280.8
Jath	406.2	811.7	813.2	524	431
Khanapur Vita	709	893.5	840.5	364	437
Valva Islampur	669.2	791	816.4	611	331.1
Tasgaon	451.7	591.3	666	304.1	717
Shirala	977	1070	1014	1136	285
Atpadi	420	698	656	404	312.5
Kavthemahankal	463	608.1	584.5	403.5	224
Palus	246.5	385.7	483	262	425.2
Kadegaon	650	783	797.8	453.3	630

It is observed from above table that average rainfall for a period of five years (2008-2012) varies from 360.48mm at Palus taluk to 896.4 at Shirala Taluk. Hoever average rainfall for the entire district for above period is 587.38 mm.

The climate of the district is dry except during south west monsoon period that is from June to Sept. The normal annual rainfall over the district ranges from 558.8 mm (Jath) to 938.9 mm (Shirala). The percentage of probability of receiving exec rainfall (That is 25% or more in excess of the normal) varies from 18% at shirala to 23% at Vita. The probability of occurrence of moderate drought ranges from 11% (Shirala) to 20% (Islampur). Severe drought conditions were experienced at all stations for 1% to 7% of the years. As major parts of the district have experienced moderate to severe and acute drought conditions for more than 20% of the years except extreme western pasts around Shirala and a small area in the contract part around Tasgaon. The remaining area of the district can be classified as drought area".

3.0 Geomorphology and Soil Types

The district falls in Krishna basin and has undulating topography. The elevation in the district ranges between 550 and 1600 amasl . The district is located in the Deccan Plateau and extends west to east from Western Ghat section in Shirala taluka to relatively flatter area of eastern Jath taluka. The land forms present are erosional broad valley separating flat topped remnant hills, displaying characteristic step like appearance. The area of the district can be broadly divided into four physiographic units namely.

I) The Hills and Ghats

II) The Foot Hills

III) Pleateau

IV) The plains

The hill form the ridges and spurs of the Western Ghats and extend through major parts of Shirala taluka and western parts of Khanapur and Walwa taluka. The highest elevation varies between 70.0 and 1600 m amsl. The other hill ranges extend from north to south, South east, covering eastern parts of Khanapur, Tasgaon and Kavathe Mahakal talukas, and western parts of Atpadi and Jeth talukas. These form part of Mahadeo-Khanapur ranges.

The hill ranges are blanked by relatively lower elevation foothill zones, Characterised by sloping rolling topography, gradually merging in to the plains, extending along the river valleys. The ground elevation in the foot hills generally very from 550 to 600 m amsl. The width at foot hill varies from place to place.

The valley portion occurs at three places in the district. Firstly, a broad relatively low lying valley extends along the Krishna river roughly extending from north to south east, covering major parts of Khanapur, Tasgaon, Walwa and Miraj talukas. The valley plains of river Yerala flowing west north west – east south east and the river Agarni flowing northeast – south west merge in to the Krishna plains of the district. The other two parts of valley plains are 1) along the man river in the north east of Atpadi taluka and b) along the Bor river in the eastern parts at Jath taluka.

A low plateau area is located near Jath taluka covering about 150 sq. km area with another small patch located southwest.

The ground water survey and development Agency (GSDA) Govt. of Maharashtra has worked out taluka wise areal extent of different physiographic units as given is table 3.

Table 3: Taluka wise Areal Extent of different Physiographic units in Sangli district, Maharashtra

S. No.	Taluka	Hill & Ghats (Sq km)	Foot Hills Area (Sq km)	Plains (Sq km)	Plateaua (Sq km)	Total (Sq km)
1	Khanapur	179.78	275.73	870.58	-	1326.09
2	Atpadi	198.97	373.86	298.92	-	871.75
3	Shirala	383.80	213.00	38.14	-	634.95
4	Walwa	95.95	262.60	428.15	-	786.70
5	Tasgaon	111.50	373.70	626.36	-	1111.56
6	K Mahankal	126.25	249.47	331.04	-	706.76
7	Jath	97.97	821.12	1147.07	180.80	2246.96
8	Miraj	53.12	123.22	749.82	-	926.16
	Total	1247.34	2692.70	4490.09	180.80	8601.50
	% of Total	14.5%	31.3%	52%	2%	

Soil

Soil formation in Sangli district has been prominently influenced by climate. The district has three prominent climate zones namely 1) the western zone high rainfall with lateritic soils on Ghat tops and reddish brown soils on hill slopes 2) the transition zone of the Krishna valley with deep black soils and 3) eastern dry zone with largely granular black soils, Shallow small patches of saline-alkaline soils are observed from areas of low rainfall particularly in Jath and Kavathe mahankal.

Deep black soils of the Krishna valley in areas of assured rainfall are located particularly in Walwa. Tasgaon and Miraj talukas. These soils have dark brown colour, clayey texture. Generally these develop along the lowest reaches of valleys and are found along river banks. The total area of such soils is 3,892 sq. km.

Medium deep soils occur in areas of low rainfall. These are reddish brown to medium black in colour, clayey in texture and granular to blocky in structures. These soils have developed along

secondary drainage system and areas of intermediate gradients. The capacity for infiltration of drainage for such soils is fairly good. The total area occupied by such soils is 1,640 sq. km.

Coarse, shallow soils mostly occur in Jath and Atpadi talukas. These are light brown to reddish brown, loamy sand to sandy clay in texture and usually structure less. The total area occupied by such soils is 3,059 sq. km.

4.0 Ground Water Scenario

4.1 Hydrogeology

The major part of the district is underlain by Deccan lava flows of Upper Cretaceous to Eocene Age, Where is restricted alon the banks of the river. A map depicting hydrogeological features is shown in Figure 2 and are discussed below.

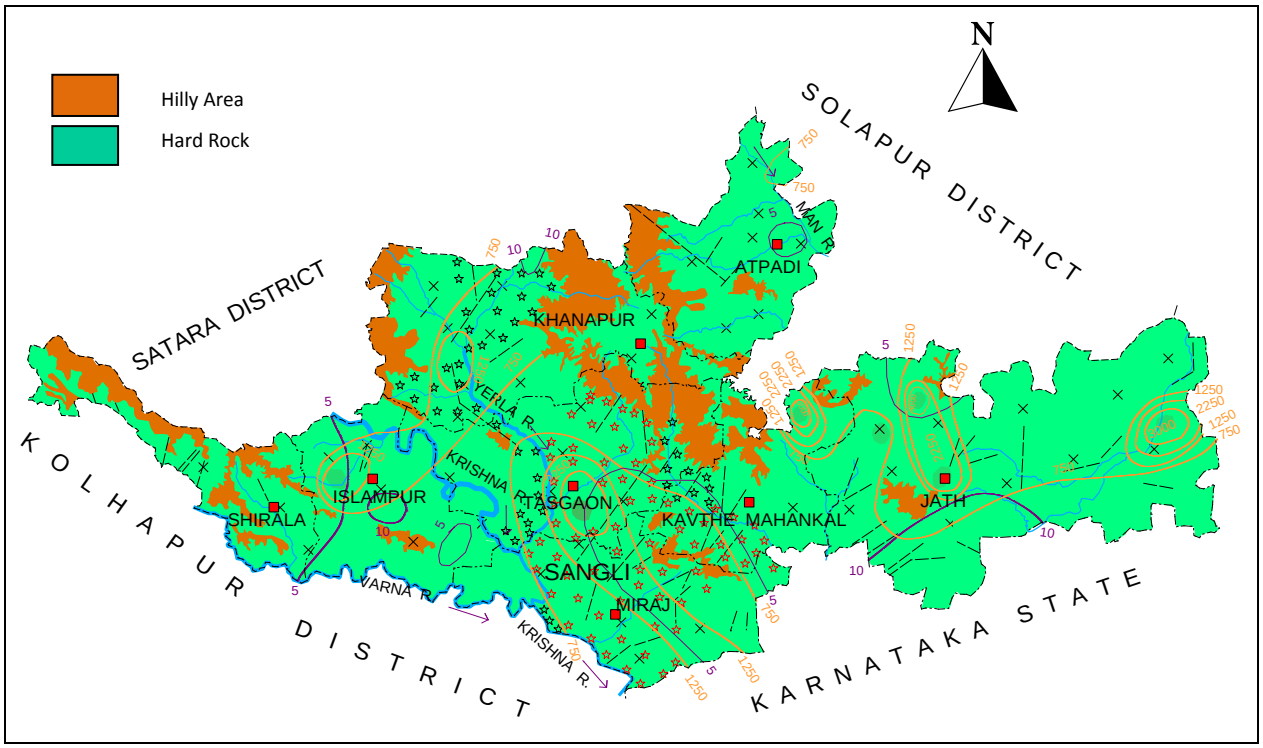


Figure 2: Hydrogeology

4.1.1 Hard rock (Basaltic lava flows/Deccan Traps)

Deccan Traps are horizontally disposed thick piles of basaltic lava flows, which are apparently more or less uniform in composition. Each individual flow is a typical section, which varies from porous, weathered base to massive middle unit and becoming increasingly vesicular towards top. Each flow (lower flow and upper flow) is separated from each other by intermittent

bole bed which is normally red in colour and called red bole. These bole beds comprise clay which is deposited between two lava eruptions, thus a individual flow forms a district hydrogeological unit as they differ in respect of capacity to receive, stock and transmit water due to the inherent physical characteristics like porosity and permeability.

The vesicular unit of each flow inter connecting vesicles, which provides more space for storage and movement of ground water. However, in "pahoehoe" type of flow, vesicles are separated and sealed, while in "aa" type of flows vesicles are concentrated in upper 20 to 40% of thickness of individual flows. These vesicles are more susceptible to weathering and therefore form good potential aquifers particularly at shallow depth. The massive unit of the flow is basically dense compact and hard and devoid of primary porosity. However, the porosity and permeability have been found to change within the flow and individual unit, from flow to glow and from place to place. Therefore, the variety of physical characteristics of basaltic units amongst themselves give rise to varying degree of ground water productively in same places.

Ground water in these basaltic flows occurs in the weathered mantle, joints and fractures which serves as loci for accumulation. The degree of fracturing and weathering plays dominant role in storage of ground water particularly in massive portion of these units as they lack primary porosity and permeability where as the vesicular portion of these flows are characterised by both primary and secondary porosity and interconnection of vesicles and voide are created by tectonic disturbances. The yield potential of these formations becomes quite significant, when shallow Trappean beds are sufficiently thick and wide in areal extent.

The red bole bed occurs as top unproductive layer on each flow and forms marker horizon in prospecting ground water, as it is associated with more porous bed lying underhealth.

4.1.2 Soft Rock (Alluvium)

Alluvium deposits in Sangli district occurs in very thin and isolated pockets along the major rivers. These deposits comprises of upper layer of silty material underlain by layers of coarse detrital materials like sand and gravel with admixture of clay. The coarse detrital material occurring as thin layer or lenses form good water bearing strata while finer material do not permit movement of ground water. The thickness of these deposits in Sangli district varies from 10 to 40 m

4.2 Occurrence of Ground Water

4.2.1 Basaltic lava flows

The ground water in basaltic lava flows of Deccan trap occurs under water level and semi-confined to confined condition in deeper aquifers. The vesicular portion of different flows varies in thickness from 8 to 12 m and sometimes up to 20 m. It has primary porosity. However, the density of vesicles, their distribution, interconnection, depth of weathering and topography of the area are decision factors for occurrence and movements of ground water in these units. The weathered and fractured trap occurring in topographic lows is the main water bearing formation in the district.

The massive portion of the basaltic flows is devoid of water but when it is weathered fractured, jointed thus forming a weaker zone then ground water occurs in it. The massive trap showing persistent spheroidal weathering and exfoliation have more ground water potential than the un weathered massive trap. However, the water carrying capacity of massive traps is not homogenous as it completely depends upon the presence of fracture and joints, their nature, distribution and their interconnection.

4.2.2 Alluvium

In the district, ground water in alluvial formation occur under water table conditions as it is very shallow in depth and spreads over a very limited area. It is observed that the saturated thickness of alluvial material comprises of silt, clay sand and gravel. The detrital material consisting of sand and gravel occurring as thin layer or as lenses in the alluvial pile sometimes forms good aquifer. However, these deposits do not form as potential aquifer in the district as compared to hard rock due to their limited areal extent.

4.2.3 Water Level Scenario

CGWB Periodically monitors 29 National Hydrograph Network Stations (NHNS) in the district four times a year i.e. January, May (pre monsoon), August and November (Post monsoon). The premonsoon (may) and post monsoon (November) water level data for year 2011 have been analyzed to depict the ground water level behaviour in the district

4.2.4 Depth to Water Level - Pre Monsoon (May 2011)

The depth to water level in Sangli during premonsoon (may-11) vary between 0.35 mbgl (village Arag) to 16.45 mbgl (village Bilur) It is observed from the water level data collected from 29 observation well locations (NHNS) in Sangli district that many of the stations were dry during premonsoon seasons indicating roughly that the water level has gone below 10 mbgl as majority of wells are having a depth range between 5 and 10.00 mbgl. Out of 29 observation wells, five have been found dry at the time of monitoring. A depth to water level (DTW) map has been

prepared from the available data and is presented as Fig 3. A perusal of figure indicates that the deeper water level i.e more than 10 mbgl was observed in eastern part of the district while the shallow water level below 5.00 mbgl was observed only at five observation well while deepest water levels were recorded at Bilur, 16.45m , yednipani 14.42 (shirala Taluka). An isolated patch indicating water level below 2 m bgl is also seen in south central part of the district near village Arag. However major part of the district show water level between 5-10 mbgl.

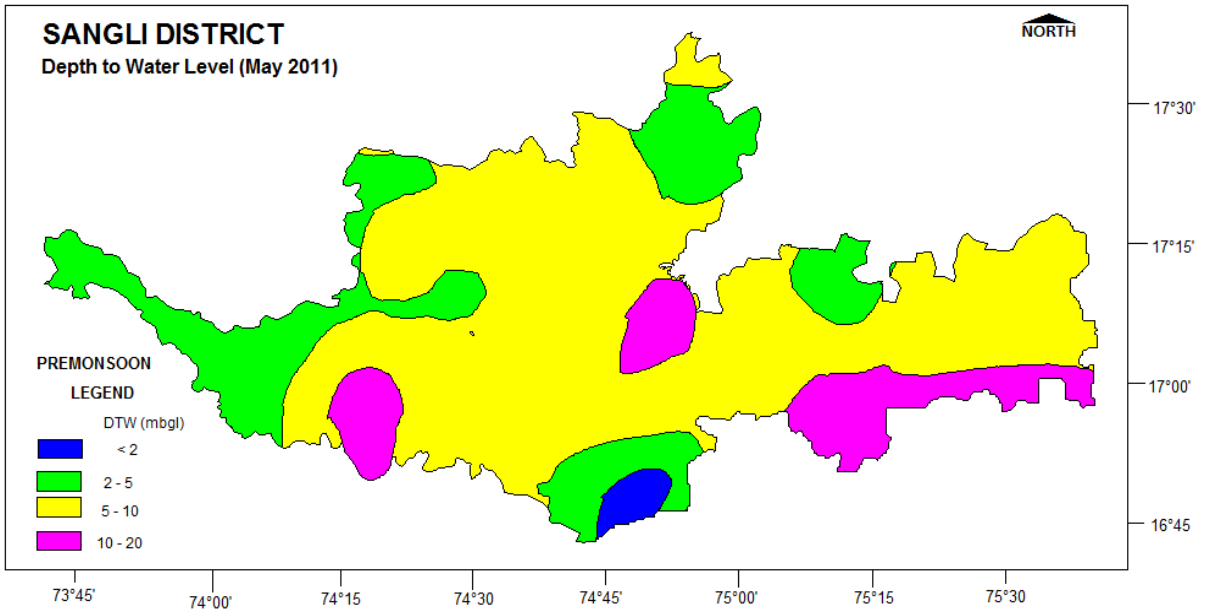


Fig 3: Pre-monsoon Depth to Water Level (mbgl) 2011

4.2.5 Post Monsoon Scenario (Nov. 2011)

Depth to water level during Nov-2011 (Post monsoon) in the district veries between 0.2m (village Arag) to 11.0 m bgl (village Belur, Jath, taluka) Based on the data collected from CGWB observation well a map showing depth water level has been prepared and is presented in Fig 4. it is seen that major part of the district shows water level in the range of 2 to 5 m bgl. It occupies almost all northen, southern western and central parts of the district. In few patches the DTW was observed below 2 m bgl. The almost entire eastern part of the district covering Jath Taluka has indicated water level below 5 m bgl. Apart from this, an isolated patche having water level below 5 m bgl have also been seen in northen boundary of the district near villages Mahuli and Vibhutwadi in vita taluka. The shallow water level above 3 m bgl have been recorded near village chikhal wadi, kawathe Mahakal, Takari in north eastern border of the district in Kawathe

Mahakal taluka. Similarly in northen portion around village Umbargaon, and Atpadi in Atpadi taluka water level above 3 m bgl have been recorded. The very small isolated patches have also seen in eastern part of the district having deepest water level ie above 10 m bgl.

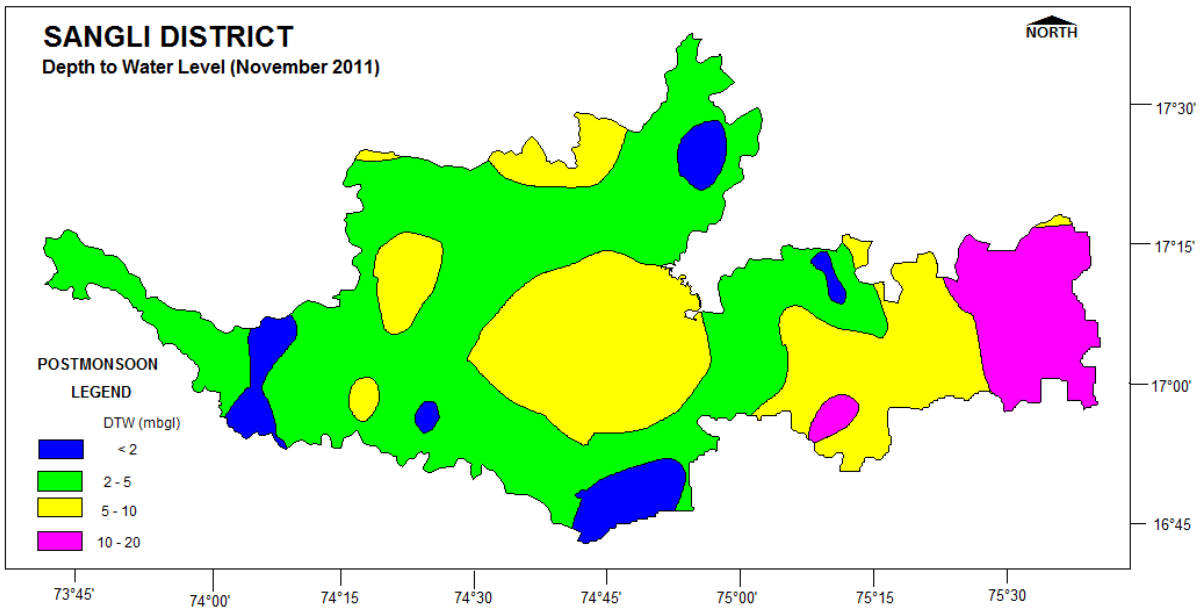


Figure 4: Depth to Water Level (Post monsoon 2011)

4.2.6 Seasonal Water Level Fluctuation

The water level generally attain its deepest level before rain starts in pre-monsoon season. The water level subsequently rises during monsoon due to its natural replenishment from rains. The water level then stabilises after discharge due to the base flow etc. after the monsoon is over by the first week of November. The difference between pre and post monsoon water level indicates the seasonal fluctuation, which provides significant data for ground water resource estimatimation. The seasonal fluctuation of water level between pre and post monsoon 2011 were calculated and analysed. Due to some of the observation wells (NHNS) were dry during pre-monsoon water level measurement its becomes difficult to calculate the true valve of water level fluctuation in the district. However, the water level fluctuation is calculated based on available data. Minimum water level fluctuation 0.15 m recorded at Aragand maximum 10.28 at Tisangi village in Sangli district.

4.2.7 Long Term Water Level Trend (Decadal)

Ground water level trends diagnostically indicates whether over the period of observation, the ground water reserve is tending to gain or looses its storage or whether it has tendency to maintain its level. Ten (10) years water level data for the period 2000-2010 of CGWB observation wells (NHNS) located in the district for both pre and post monsoon seasons have been utilized to work out the long term water level trend. Data for 22 stations for pre monsoon and 29 stations for post monsoon seasons have been analysed for trend analysis. The results of trend analysed indicate that there is neither significant rise or in post monsoon trends.

4.3 Aquifer Parameter

The aquifer parameters of water table/ phreatic aquifer are available from reports of systematic hydrogeological surveys conducted by CGWB. In the Deccan Trap basalt, the specific capacity of the dugwells ranges from 58 to 373 lpm/m of drawdown, specific yield ranges from 1.5 to 2% and transmissivity ranges between 30 and 450m^2/day. In the addition to these, the yield of borewells drilled by CGWB tapping deeper ranges 0.56 to 15.0 lps for drawdown of 4 to 29 m. The hydraulic and well characteristics of basaltic aquifers are presented in table 4.

Table 4: Aquifer Parameters of Basaltic Aquifers in Sangli District

Sl no	Aquifer	Specific Capacity (lpm/m of drawdown)	Transmissivity (m^2/day)	Specific Yield Range (%)	Average Specific yield (%)
1	Vesicular Basalt	96-169	30-300	0.8-2.8	2.70
2	Vesicular Basalt, Weathered Basalt	58-140	40-335	0.4-2.7	0.4-2.7
3	Highly weathered and decomposed Basalt	75-379	40-415	0.3-1.9	1.50
4	Fractured and Jointed Massive Basalt	113-250	30-450	0.1-2.9	2.70

4.4 Yield of Irrigation Dug Wells

The dug wells are main ground water extraction structures in the district. As on 2000 there were 53796 dug wells in the district out of which 30502 wells were fitted with electric pumps and 4416 wells with diesel pumps and are utilized for irrigation purpose in the district. The aquifer wise and season wise of yield of formations is given in table 5.

Recommended Safe spacing of the wells is given Table 6. Ground water potential if the district is shown in figure 5.

Table 5: Aquifer wise yield of formations

Sr. No.	Aquifer	Yield of dug well (m^3/day)	
		Winter	Summer
1	Alluvium	30 to 620	10 to 150
2	Alluvium + Deccan trap	60 to 400	15 to 60
3	Weathered Basalt	30 to 725	1 to 150
4	Vesicular Basalt	30 to 600	1 to 150
5	Massive Basalt	10 to 360	Nil – 150

Table 6: Recommended Safe spacing of the wells.

Type of well	Discharge in Lps	Spacing in m
Dug well and dug cum bore well	Less than 2 2 to 5	No. recommendation 200
Shallow bore well up to 40 m bgl	Less than 2 2 to 4 4 to 10	No recommendation 100-400 400-600
Deep bore well tapping confined aquifer below 40 m depth	Less than 2 3 to 10	No recommendation 250 to 750

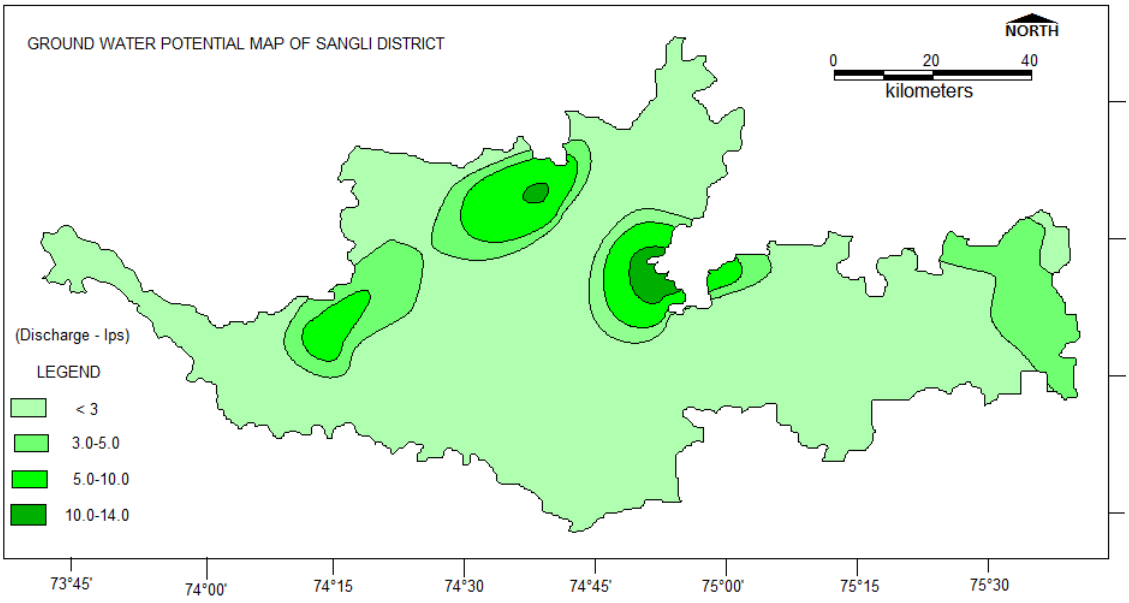


Figure 5: Ground water Potential

Status of Borewells Drilled for Water Supply Scheme

A wide variation in yield of borewells have been recorded in the district. The Ground water Survey and Development Agency (GSDA) and Sangli Zilha Parishad (A local Govt. body) has drilled more than 10,000 borewells in the distt for rural water supply. As per available record with Sangli Zilha parishad. till end of march 2011, 8295 numbers of successful bore wells were in operation. Out of 8295 successful and operative bore wells, 7584 have been fitted with hand pumps and 711 borewells where the discharge was recorded more than 5000 lit / hrs and water demand was more, have been fitted with power pumps fro village water supply purpose.

4.5 Ground Water Resources

The estimation of ground water resources of Maharashtra has been done by Central Ground Water Board, central Region in collaboration with Ground Water Survey and Development Agency (GSDA) Govt. of Maharashtra as per the recommendations of GEC 1997 Methodology.

It has been estimated that the Net annual ground water availability in Sangli district is 89102 ham. The existing ground water draft for all uses is 68369 ham. The net annual ground water availability for future irrigation is 20118 ham.. The provision for domestic and industrial water supply for year 2025 is projected as 5021 ham. The average stage of ground water development is 76.72%.
The scope of further development is very less and is to be taken up cautiously. Further analysis indicates that the stage of ground water development has reached 93.72% with significant decline in pre and postmonsoon in Kavathe Mahankal taluka and it has been categorised as Critical while in Miraj Taluka it is 90.05% and the taluka has been categorised as Semi–critical. Care should be taken before taking further development in these talukas. On other hand the high stage of ground water development has been recorded in Walwa (77.02% %) Atpadi (74.07%) and Palus (79.81%) talukas. There is much scope of ground water development in shirala taluka where stage of ground water development is only 38.75%. A summary of Resources is given in table 7. Watersheds BM-113, BM-115, KR-35, 38,39 are categorised as semicritical whereas, KR-36, 37, 50, 52, 53 are categorised as critical

Table 7: Dynamic Ground Water Resources of Sangli District - 2008-2009

(in ham)

Sl No.	Administrative Unit	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	Category
1	Atpadi	7641.04	5509.17	150.39	5659.56	297.88	1830.96	74.07	Safe
2	Jat	24141.04	15937.90	594.52	16532.42	1098.57	7605.10	68.48	Safe
3	Kadegaon	7466.53	4930.84	249.75	5180.59	446.05	1950.32	69.38	Safe
4	Kavathe Mahankal	8504.48	7512.77	457.23	7969.99	620.69	1153.18	93.72	Critical
5	Khanapur	5108.28	4370.78	188.90	4559.68	334.35	402.47	89.26	Safe
6	Miraj	10620.34	9309.02	254.99	9564.01	403.36	1464.40	90.05	Semi Critical
7	Palus	2808.69	2151.40	90.23	2241.62	212.36	529.38	79.81	Safe
8	Shirala	5362.18	1795.46	282.21	2077.67	538.88	2982.03	38.75	Safe
9	Tasgaon	10986.55	9349.56	243.20	9592.75	442.77	932.64	87.31	Safe
10	Walwa	6462.82	4686.37	291.33	4977.70	612.14	1252.23	77.02	Safe
	TOTAL	**89111.95**	**65564.26**	**2814.74**	**68369.00**	**5021.06**	**20117.70**	**76.72**	Safe

4.6 Ground Water Quality

CGWB is monitoring the ground water quality of the Sangli district since the last four decades through its established monitoring wells. The objectives behind the monitoring are to develop an overall picture of the ground water quality of the district. During the year 2011, the Board has carried out the ground water quality monitoring of 16 monitoring wells. These wells are mainly dug wells representing the shallow aquifer. The sampling of ground water from these wells was carried out in the month of May 2011 (pre-monsoon period). The water samples after collection were immediately subjected to the analysis of various parameters in the Regional Chemical Laboratory of the Board at Nagpur. The parameters analyzed, include pH, Electrical Conductivity (EC), Total Hardness (TH), Nitrate (NO_3) and Fluoride (F). The sample collection, preservation, storage, transportation and analysis were carried out as per the standard methods given in the manual of American Public Health Association for the Examination of Water and Wastewater (APHA, 1998). The ground water quality data thus generated was first checked for completeness and then the validation of data was carried out using standard checks. Subsequently, the interpretation of data was carried out to develop the overall picture of ground water quality in the district in the year 2011.

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 being, 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., TH, NO_3 and F prescribed in the standards and is given in **Table-8**.

Table-8: 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
TH (mg/L)	300	600	9	5	2
NO_3 (mg/L)	45	No relaxation	7	-	9
F (mg/L)	1.0	1.5	16	-	-

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

The perusal of **Table-8** shows that the concentrations of all the parameters except nitrate in most of the samples are within the maximum permissible limits of the BIS standards. It is also seen from the **Table-8** that the potability of ground water in the wells is mainly affected due to the Nitrate (NO_3) as its concentration exceeds more than MPL in 56% of samples. Overall, it can be concluded that the ground water quality in the wells monitored in the district is affected because of high NO_3 concentrations.

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. Electrical Conductivity (EC) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation.

Electrical Conductivity (EC)

The amount of dissolved ions in the water is best represented by the parameter electrical conductivity. The classification of water for irrigation based on the EC values is as follows.

Low Salinity Water (EC: 100-250 µS/cm): This water can be used for irrigation with most crops on most soils with little likelihood that salinity will develop.

Medium Salinity Water (EC: 250 – 750 µS/cm): This water can be used if moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

High Salinity Water (EC: 750 – 2250 µS/cm): This water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

Very High Salinity Water (EC: >2250 µS/cm): This water is not suitable for irrigation under ordinary condition. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

The classification of ground water samples collected from monitoring wells was carried out for irrigation purpose and given below in **Table-9**.

It is clear from the **Table-9** that maximum number of samples (62%) falls under the category of high salinity water while nearly 7% of samples fall in very high salinity water category. This shows that the ground water in the pre-monsoon season from shallow aquifer in the district should be used for irrigation with proper soil and crop management

practices.

Table-9: Classification of Ground Water for Irrigation based on EC.

Type	EC (µS/cm)	No. of Samples	% of Samples
Low Salinity Water	<250	Nil	Nil
Medium Salinity Water	250-750	5	31
High Salinity Water	750-2250	10	62
Very High Salinity Water	>2250	1	7
Total		**16**	**100.0**

4.7 Status of Ground Water Development

Ground water in the district predominantly used for irrigation, as it is major source for irrigation. The minor irrigation census data (2010-11) indicate that irrigated area by ground water in the district is 102327 ha by 54065 no of irrigation dug well.

5.0 Ground Water Management Strategy

5.1 Ground Water Development

Ground water has special significance for agriculture development in the State of Maharashtra. The Ground water development in some part of the state has reached a critical stage resulting in decline of ground water levels. Thus there is need to adopt an integrated approach for groundwater development coupled with ground water augmentation to provide sustainability of ground water resources.

Almost entire district is underlying by Deccan Trap basalt. Also the isolated and small parts adjoining the hilly areas have low ground water development potential. The availability and sustainability of ground water in the Sangli district is controlled by physiography, geology, hydrogeology and rainfall received. There are prominent hill ranges, many isolated hillocks undulation etc in the district which facilitate higher runoff. Almost entire district is occupied by hard rock formation of basaltic lava flow, which is generally very poor in ground water storage and transitivity. Therefore this formation gets maximum saturation during monsoon season and thus resulting in a situation of rejection of recharge in many places. These aquifers than are drained naturally due to sloping and undulating topography. Similarly wherever ground water

development is more, there aquifers becomes almost nearly dry or semi-dry thus attaining water scarcity situation for even drinking purpose during Summer months.

5.2 Water Conservation and Artificial Recharge

The stage of ground development in the district is 76.72% which indicate that there is moderate scope for further ground water development. However, it is necessary to adopt water conservation and artificial recharge to increase the augmentation of precious resources

In the district, many areas where adequate recharge to grand water does not occurs due to one or many seasons, the presence of massive basalt at the ground surface also hinders in the process of recharge to underlying porous strata. The rainfall of the district varies from 558 mm to about 938 mm with average rainy days of 40. The heavy rainfall leads to flash flood. The late onset of the monsoon or early withdrawal of monsoon affects the rainfall recharge and ground water availability in the district. The years of low rainfall also adversely affect the ground water resources as 1) Lesser amount of recharge to ground water reservoir and 2) more withdrawal of water from the reservoir. This ultimately result into drying up and lowering of water levels in dug wells in district during the summer.

6.0 Ground Water Related Problem and related issue

Drought has again hit large parts of Maharashtra this year. But the worst affected are two talukas in Sangli district. Jat and Atpadi are facing the worst drought in decades, despite river Krishna flowing 100 km away. Analysts blame the plight on poor management of groundwater resource in the region which falls in the rain shadow area of the Western Ghats.

People in these talukas are adept of managing with meagre rainfall. Traditionally they grow sorghum, pearl millet and wheat that require less water. But some two decades ago, lured by the profits earned by farmers in western Sangli, which has adequate irrigation facilities from the Krishna Valley project, Jat and Atpadi farmers began growing cash crops. “Commercial cultivation of the crops forced them to over-exploit groundwater. Within years the talukas notched a place in the world map of pomegranate producing areas. But since 2005 the region has been witnessing a drastic change in rainfall pattern. This year there is no rain at all. With rainfall playing truant, farmers have nearly exhausted their groundwater resources.

According to Sangli Zilla Parishad, 35 of 41 farm ponds and all dug wells in the talukas have dried up since March. Even the Atpadi lake has dried up. Civic administration is now digging

the silt to extract the remaining water from the water body. The government issued a directive to ensure a supply of 20 litres of water per head every day to these villages. For the 200 villages in Atpadi and Jat, the administration has sanctioned 14,550 trips by 39 tankers. The government has also issued directives for supplying free fodder to cattle.

7.0 Mass awareness and Training Activities

M.A.P. and W.M.T.P. activities

Till March 2013, MAP and WMTP have not been organised in the district.

8.0 Area Notified by CGWA/SGWA

As per the resource estimation 2008-09, Kawathe Mahakal taluka has been categorised as Critical and Miraj taluka as semi Critical in the district. However, No taluka has been notified either by CGWA ar SGWA so far.

Table Area identified as semi critical and Over exploited in the district (Unit- Watershed)

9.0 Recommendations

1 Agriculture is the main source of lively hood in the district, therefore it is essential to develop the available ground water resources in scientific and planned manner.

2 Sangli district is divided into three categories. These are hill ranges, Deccan peneplains and urban areas.

3 Hilly areas and foot hills which are also known as recharge areas, are most suitable site for primary treatment by taking up soil and water conservation measures such as continuous contour trenching (CCT) Nala bunds, Gabion structure, loose boulder bund, Trenching etc. The construction of medium and minor irrigation projects are also feasible at foot hills.

4 Ground water conservation and surface water conservation structure like under ground bhandharas and KT were at suitable sites may be constructed in the district, particularly in semi critical and critical taluks and watersheds. This will not only reduce the runoff of water but also increase the water level in up stream side.

5 All the gram panchayat wells, community wells, old defunct wells may be used for artificial recharge provided source of water is free of silt and dissolved impurities.

6 All the agriculture land holder must be promoted to construct form ponds in their field at suitable locations.

7 To increase the porosity and storage potential, particularly in the areas where hard and massive basalts are exposed bore hole blasting or hydro fracturing may be taken up.

8 Periodic distillation of all MI and PT, cement Nala bund etc is recommended.