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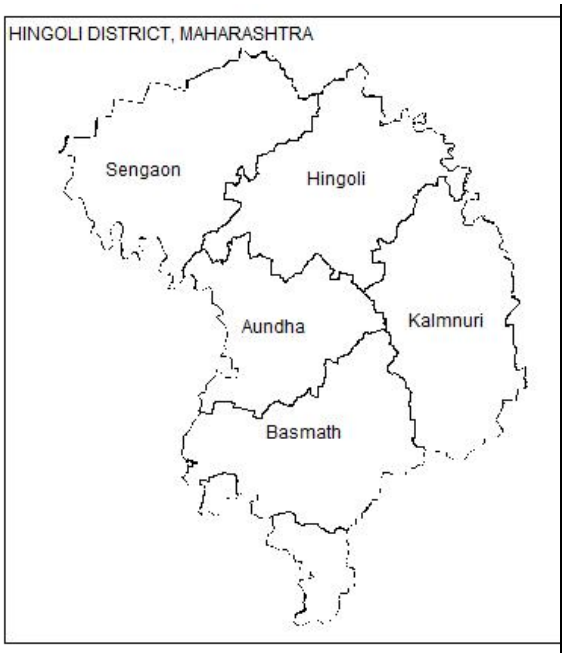
भारत सरकार
जल संसाधन मंत्रालय
केंद्रीय भूजल बोर्ड
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत हिंगोली जिले की भूजल विज्ञान जानकारी

GROUND WATER INFORMATION
HINGOLI DISTRICT, MAHARASHTRA



By

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द्वारा

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मध्य क्षेत्र , नागपुर
CENTRAL REGION, NAGPUR
2013

HINGOLI DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	4827 sq. km.
Administrative Divisions	:	Taluka-5; Hingoli, Sengaon, Aundha Nagnath, Kalamnuri and Vasmat.
Villages	:	710
Population (2001)	:	986717
Average Annual Rainfall	:	890.28 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	Part of Western Ghats, Malhivra hill range, and Penganga plain
Major Drainage	:	Penganga, Purna, Kayadu

3. LAND USE (2009-10)

Forest Area	:	275 sq. km.
Net Area Sown	:	4451.36 sq. km.
Cultivable Area	:	4509.42 sq. km.

4. SOIL TYPE

: Black Cotton Soil

5. PRINCIPAL CROPS (2008-09)

Cotton	:	2545.00 sq. km.
Cereals	:	905.79 sq. km.
Pulses	:	9025.40 sq. km.
Jowar	:	3929.40 sq. km.
Wheat	:	2545.00 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2000-01) **- Nos. / Potential Created (ha)/ Potential Utilized(ha)**

Dugwells	:	29049/75956/75924
Shallow Tubewells/	:	3000 / 8111 /8086
Deep Tubewells		: 340 /1056 /1056
Surface Water	:	7352 /23525 /23024
Net Irrigated Area	:	108089 ha

7. GROUND WATER MONITORING WELLS (As on 31/05/2012)

Dugwells	:	42
Piezometers	:	Nil

8. GEOLOGY

Recent	:	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.
Premonsoon Depth to Water Level (May-2011)	:	6.27 to 9.32 m bgl
Postmonsoon Depth to Water Level (Nov.-2011)	:	3.60 to 6.90 m bgl
Premonsoon Water Level Trend (2001-2010)	:	Rise: 0.00 to 0.1343 m/year Fall: 0.0047 to 0.9035 m/year
Postmonsoon Water Level Trend (2001-2010)	:	Rise: 0.0584 to 0.1409 m/year Fall: 0.0366 to 0.6153 m/year

10. GROUND WATER EXPLORATION (As on 31/03/11)

Wells Drilled	:	11(EW-10, PZ-1)
Depth Range	:	30-200.2
SWL	:	6.53-112.4
Discharge	:	0.07 to 4.43 lps

11. GROUND WATER QUALITY

The quality of ground water is generally alkaline and suitable for drinking and irrigation purpose with few exceptions

12. DYNAMIC GROUND WATER RESOURCES (HAM)- (As on 31/03/2009)

Net Annual GW Availability	:	1030.01 MCM
Total Draft (Irrigation + Domestic)	:	380.07 MCM
Projected Demand (Domestic + Industrial)	:	17.63 MCM
Stage of Ground Water Development	:	36.90 %

13. AWARENESS AND TRAINING ACTIVITY

A	Mass Awareness Programme	:	Nil
B	Water Management Training Programme	:	Nil

14. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka	:	Nil
Semi-Critical Taluka	:	Nil

15. MAJOR GROUND WATER PROBLEMS AND ISSUES

Although a modest area in Hingoli district is under canal command of various irrigation projects and the area is showing decling trend of ground water levels due to exploitation of ground water for irrigation and other purposes at a faster rate. The conjunctive use of water is recommended in this area.

Ground water quality is adversely affected at some places due to high concentration of some parameters specially nitrate. Adequate precautionary measures ma be taken to control the nitrate contamination.

Ground Water Information Brochure
Hingoli District

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Ground Water Information Brochure
Hingoli District

1.0 Introduction

Hingoli became full-fledged district of Maharashta from 1st May 1999 bifurcating Parbhani District. Hingoli was known in history by different names like wingoli, vingmul, lingili etc. In ancient times Hingoli was one of the main villages of Narsi parganas of Washim district. In the year 1903 Nizam had formed army base at Hingoli. Now, Hingoli is the main town on Nanded-Akola highway. It is known for wholesale market and Jyotirling temple located at Aundha Nagnath.

The district comprises of 5 talukas viz: Hingoli, Sengaon, Kalamnuri, Aundha Nagnath and Vasmat. The district forms the part of Marathwada region of Maharashtra and is bordered by Parbhani district in the west, Buldhana district in the north, Yavatmal and Washim districts in the east and Nanded district in the south. The district lies between 19^0 14' to 20^0 01' North Latitude and 76^0 16' and 77^0 28' East Longitude.

Ground water exploration in the district has been taken up in different phases in hard rock areas occupied by Deccan Trap Basalt. A total of 10 EWs have been constructed till March 2011.

Table 1: Salient Features of Ground Water Exploration, Hingoli District

Taluka	Formation	Wells		Depth (mbgl)	SWL (mbgl)	Discharge (lps)
		EW	OW			
Hingoli	Basalt	3	0	200.2	39.4-112.4	0.98-3.77
Aundha	Basalt	2	0	200.2	6.53-55.5	0.14-0.986
Kalamnuri	Basalt	4	0	200.2	49-66.4	0.07-4.43
Wasmat	Basalt	1	0	200.2	112.4	0.38

In Basalt 10 wells were drilled through outsourcing in Hingoli district down to the deoth of 200.2 metres below ground level (m bgl). The discharge from these wells varied from 0.07 to 4.43 litres per second (lps). Static water levels ranged from 6.53 to 112.4 m bgl.

2.0 Climate

The district has dry and tropical climate with hot summer and mild winter with humid SW monsoon season of moderate rainfall. The climate can be divided into three main seasons viz;

a) Hot to warm humid monsoon season from June to September.

b) Cool dry winter season from October to February and

c) Hot dry summer season from March to June.

The minimum temperature of the district is 12.7^0 C and the maximum temperature is 41.7^0 C.

The rainfall record of the district shows that the average annual rainfall is 890.28 mm. During the year 2011, rainfall recorded is1244 mm. About 83% of the rainfall occurs during June to September and July is the rainiest month.

The air is generally dry over the district except during the southwest monsoon when the relative humidity is high. The summer months are the driest when the relative humidity is generally between 30 percent in the afternoon.

Winds are generally light to moderate with increase in speed during the later half of the hot season and in monsoon season. The winds blow predominantly from directions between west and north during the hot season. They are mostly from directions between southwest and northwest during the southwest monsoon season.

3.0 Geomorphology and Soil Types

The area represents a plateau with low to moderate relief and it has few mesas and buttes structures. The general slope of the district is towards south and southeast with general elevation of 450 m amsl. The predominant Malhivra hill range of the district divides Penganga and Kayadu basin.

The Black cotton or Regur type soil occurs in the district. It comprises of lime, Iron, Magnesium. The pH of soil is 8.36 and therefore It is of alkaline nature.

The district is well drained by river system, which are dendritic type and have matured valleys. There are three main drainage systems viz: (1) Penganga river and (2) the Purna and (3) Kayadu rivers.

The river Penganga originates from Ajanta hills in Buldhana. It enters in

the district from Sengaon Taluka towards north eastern corner and by making a jorney of about 80.45 Kilometres in the district moves towards Yavatmal district. Isapur Dam is constructed on the river. It is one of the most important rivers of Deccan plateau and whole district of Hingoli falls in its great basin.

The direct tributary of the river is Kayadhu. This tributary rises from the hill ranges near Risod taluka of Washim district. The length of the river in the district is 80.50 kms. It is a seasonal river, which dries up in summer.

The Purna river rises from Ajnata hill ranges. It enters in the district from Jalna district. After making a journey of nearly 100 kms, it moves towards Parbhani district. Yeldari and Sidheshwar dams are constructed on the river.

Soils:

The Soils of the district are derived from the basaltic lava flows. Thickness of the soil cover is less in northern and western parts where ground elevations are higher and consequently soil regur, gravels, murum are transported down to lower regions through gravity, transported down to lower regions through gravity, water or winds. Soils in central, southern and eastern regions of the district near the banks of Penganga and Purna rivers are thicker. Here soils, ranging in depth from 1 to 2 m, are black and rich in plant nutrients.

4.0 Ground Water Scenario

4.1 Hydrogeology

Groundwater occurrence and movement in the area is influenced by its rock formations. Groundwater potential depends upon porosity and permeability (both primary and secondary) of rock formations. Hingoli district is underlain by basaltic lava flows and alluvium only. Water bearing properties of these rocks are described below.

The regional Static water level in the area varies from 20 mbgl to 25mbgl. Ground water extraction in the area is done mainly through dug wells and bore wells. The average depth range of dug wells in the area is 15.00m to 30.00 m. The average depth range of bore wells in the area is 60.00to 80.00 m.

4.1.1 Deccan Trap Basalt

The basaltic lava flows belonging to the Deccan Traps occupy about 98% of the area of the district. The formation is very thick and comprises scores of lava flows of 5 to 25 meters individual thickness. Each flow comprises a lower zone of 40 to 70% hard, massive basalt which is devoid of primary porosity and permeability. The upper zone of 30 to 60% is vesicular basalt which has limited primary porosity. However, the formation generally has secondary porosity and permeability acquired due to weathering, jointing, shearing, fracturing etc. When the thickness of these zones are appreciable (30 to 60% of a flow), the flow forms an aquifer of moderate potential. The structural and composite characteristics described above are repeated in all the lava flows of an area and they thus form a multiple aquifer system which generally extends to depths of 150 to 250 meters.

Apart from the inherent properties of lava flows cited above, topography also plays an important role in groundwater potential of basaltic area. Hills and higher grounds occur as the rocks were hard, compact and resistant to weathering. The steep gradient causes rain water to run off rapidly without much infiltration. In contrast, the valleys depressions and areas of lower elevations are formed where the rocks were weaker, prone to weathering due to joints, fractures etc. In addition, rain water run off is less and infiltration is more.

Groundwater in Deccan traps occur under water table condition in weathered, jointed, fractured and vesicular zones of the flow exposed at the surface. Groundwater occurs under confined conditions in Jointed, brecciated or fractured and vesicular zones of lower flows. The vesicular and zeolitic basalts are highly susceptible to weathering as interconnected vesicles form conduits from weathering agents. It is generally seen that “Pahoehoe” flows contain uniformly distributed vesicles, have good porosity and permeability and form potentials aquifers.

4.1.2 Alluvium

Alluvium occurs as small patches along banks, flood plains and meanders of main rivers. These have individual extent ranging from 1 to 20 Km^2 and 5 to 30m thickness. It comprise beds and lenses of sands, gravels and boulders in a matrix of clays. These granular zones from aquifers in which

groundwater occurs under phreatic and semi confined conditions. The porosity of these granular zones ranges from 10 to 15 %.

4.2 Water Level Scenario

Central Ground Water Board periodically monitors 42 National Hydrograph Network Stations (NHNS) stations in the district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon). The data on premonsoon and postmonsoon water levels along with fluctuation during 2011 and long term water level trends (2001-10) is given in **Table- 2**.

Table 2: Water Level Data (2011).

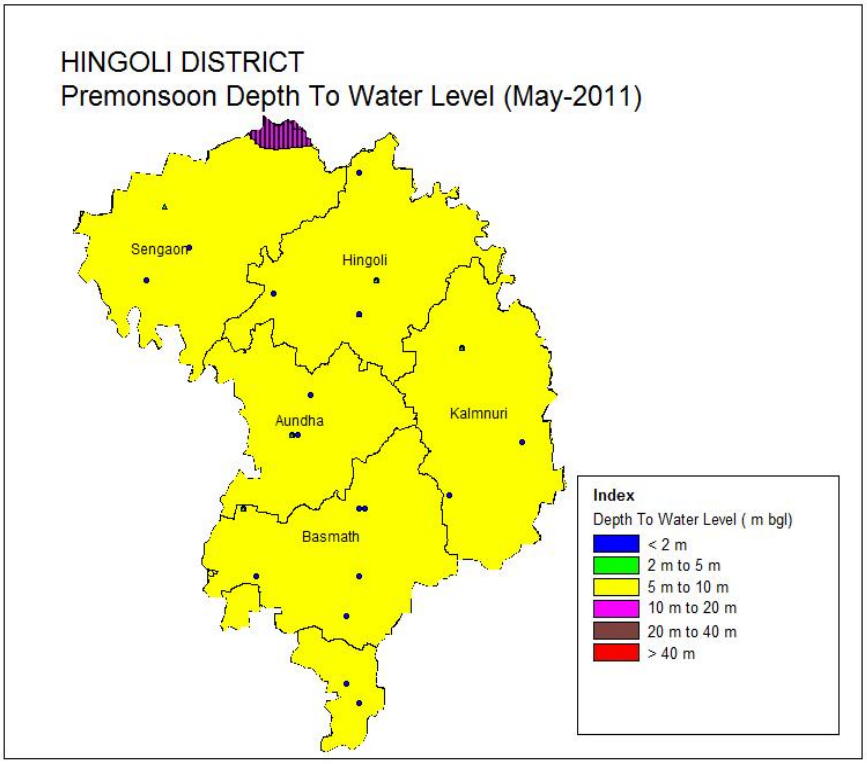
S. No.	Location	Premonsoon WL (m bgl)	Postmonsoon WL (m bgl)	Fluctuation (m)
1	**2**	**3**	**4**	**5**
1	Aundha nagnayh	6.27	5.75	0.52
2	Alegaon (Old)	7.56	4.6	2.96
3	Hingoli	Dry	3.6	-
5	Kanhergaon	9.32	6.9	2.42
6	Kolsa	Dry	6.05	-
7	Hatta	Dry	3.95	-

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

The depth to water level in the district ranges between 6.27 (Aundha Nagnath) and 9.32 (Kanergaon) m bgl during May 2011. Shallow water levels within the range of 2 to 5 m bgl are not seen in the district. The NHNS located at Aundha Nagnath, Alegaon and Kanergaon are showing the range of water level between 5 to 10 mbgl.

. Deeper water levels of more than 15 m bgl are also not observed in the district. The Talukawise extent of Depth to water levels during premonsoon (May 2011) of the district has been depicted in **Figure-1**.

Figure 1: Depth to Water Level Map (May-2011)



4.2.2 Depth to Water Level – Postmonsoon (Nov-2011)

The depth to water levels during postmonsoon (Nov. 2011) ranges between 3.60 (Hingoli) and 6.90 (Kanhergaon). The NHNS at Hingoli is showing the shallowest depth to water level. The shallow water levels within the range of 2-5 m bgl are observed at 3 NHNS i.e. at Hingoli, Hatta and Alegaon. Water level within 5 to 10 m bgl are extended to in the district. 3 NHNS located at Aundha Nagnath, Kanhergaon, Kolsa are showing this particular range of water level. Deeper water levels in the range of 10 to 20 mbgl are not seen in the the district. The Talukawise spatial variation of the district in Postmonsoon (November 2011) depth to water levels is shown in **Figure 2**.

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

During the period, the entire district has recorded rise of water level in the range of 0.52 to 2.96 m. The Talukawise spatial variation of Seasonal Water Level Fluctuation (May to November 2011) is shown in Figure 3.

Figure 2: Depth to Water Level Map (November-2011)

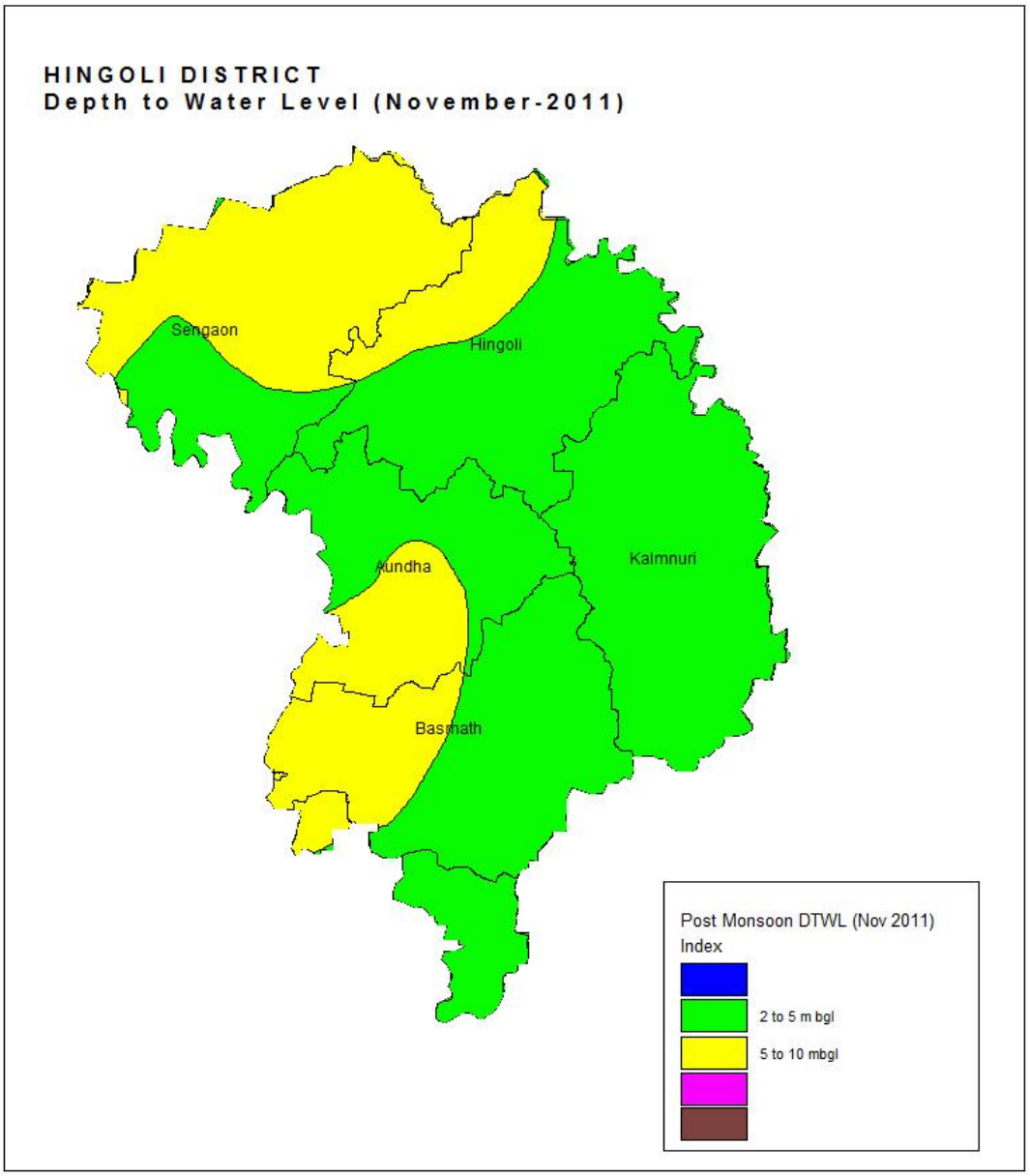
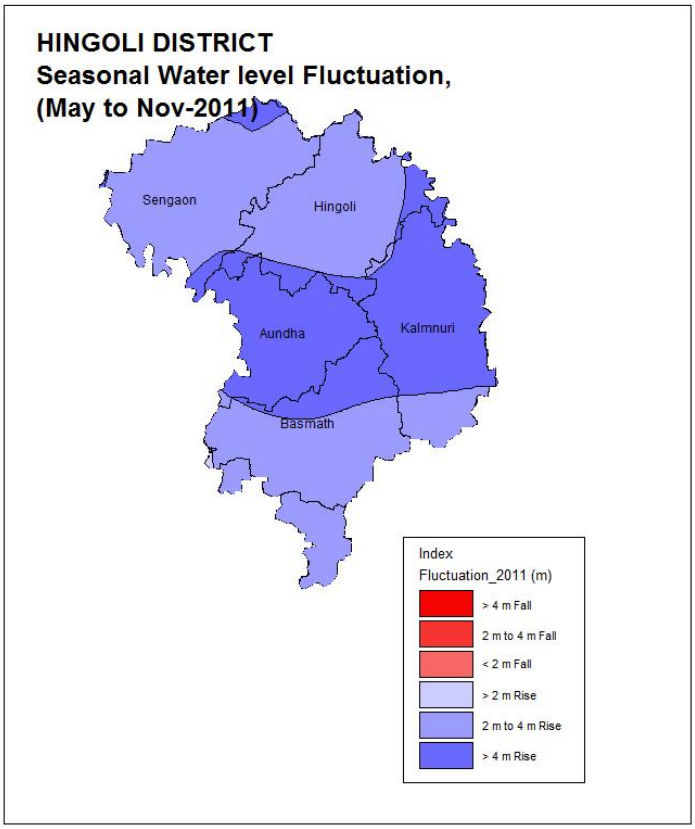


Figure 3: Seasonal Water Level Fluctuation Map (May to November-2011)



4.2.4 Water Level Trend (2001-2010)

Trend of water levels for pre-monsoon and post-monsoon periods for last ten years (2001-2011) have been computed for 14 NHNS and are given in **Table-3**.

Table 3: Long Term Trend Data (2001-10).

Sl No.	Location	Pre Monsoon		Post Monsoon	
		Rise (m/year)	Fall (m/year)	Rise (m/year)	Fall (m/year)
1	Kolsa	-	0.0830	-	0.1552
2	Kanhergaon	0.1343		-	0.2001
3	Dandegaon	-	1.0979	-	0.4799
4	Balapur Akhada	-	0.0047	-	-
5	Aundha nagnayh	-		-	0.1336
6	Yehelegaon	-	0.0788	-	0.1180
7	Hingoli	-	0.8401	-	0.1420
8	Narsi	-		-	0.1494
9	Hatta	-	0.0480	0.0584	-
10	Alegaon (Old)	-	0.7322	-	0.6153
11	Churawa	-	0.9035	-	0.0366
12	Babulgaon	-	0.1596	0.1409	-
13	Aral	-	0.2077	-	0.5977
14	Basmath	-	0.3698	-	0.1569

Analysis of trend indicates that during premonsoon period, rise in water levels is shown at only one NHNS located at Kanergaon. While fall in water level ranges between 0.0047m/year (Balapur Akhada) and 1.0979 m/year (Dandegaon). During post monsoon period, rise in water level are recorded at only two locations in the range of 0.0584 at Hatta to 0.1409 m/year at Babulgaon, whereas fall in water levels ranging between 0.0366 (Churawa) and 0.6153 m/year (Alegaon) is observed. Thus in major part of the district, both during pre and post monsoon periods declining trends have been observed

4.2.5 Aquifer Parameters

Dug wells are the most common ground water extraction structures in the area. The yield of dug wells during the post monsoon season varies between 80 to 615 m^3 / day. The specific capacity of the dug wells varies from 25 to 976 lpm/m/dd.

Total 2381 borewells are drilled by state agencies for drinking water purposes and out of these, 1984 are successful (whose yield is > 500 lph) and are fitted with hand pumps and powerpumps for drinking water supply.

5.0 Ground Water Resources

Central Ground Water Board and Ground Water Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Hingoli district based on GEC-97 methodology. The same are presented in **Table 4**.

As per the estimation, the total annual ground water recharge is 1084.22 MCM with the natural discharge of 54.21 MCM, thus the net annual ground water availability comes to be 1030.01 MCM. The gross draft for all uses is estimated at 380.07 MCM with irrigation sector being the major consumer having a draft of 362.44 MCM. The domestic and industrial water requirements are worked as 17.63 MCM. The net ground water availability for future irrigation is estimated as 632.30 MCM.

Stage of ground water development varies from 31.22% (Aundha) to 44.47 % (Kalamnuri). The overall stage of ground water development for the district is 36.90%. Taluka wise assessments indicate that out of 5 talukas, no

talukas fall under “Over- Exploited” , Semi critical and Critical category, all the talukas fall under “Safe” category. Watershed wise, all the 23 watersheds fall under “Safe category”. The Talukawise Ground Water resource Estimation (March 2009) is shown in **Figure 4**.

Figure 4: Ground Water resource Estimation (As on March 2009)

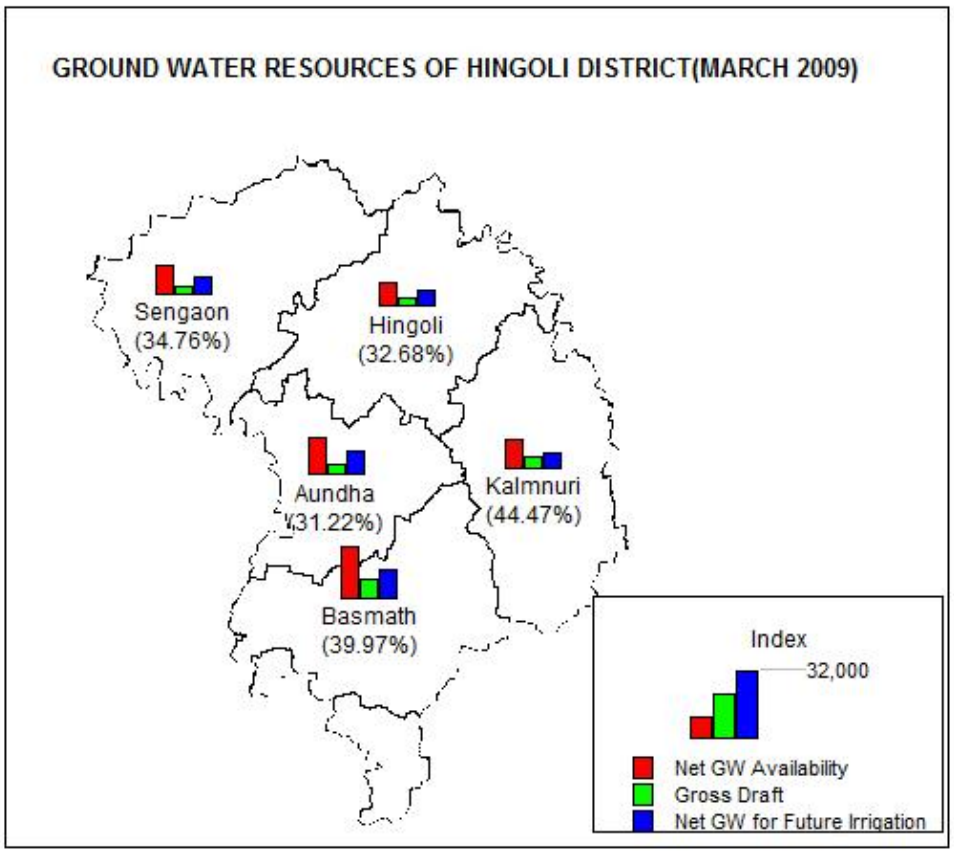


Table-4: Taluka wise Ground Water Resources (March 2009).

Sr. No.	Taluka	Area Type	Net Annual Ground water Availability (ham)	Existing Gross Groundwater Draft for Irrigation (ham)	Existing Gross Groundwater Draft for Domestic & Industrial water Supply (ham)	Existing Gross Groundwater Draft for All uses (ham)	Allocation for domestic & industrial requirement supply upto nest 25 years (ham)	Net Groundwater Availability for future irrigation development (ham)	Stage of Groundwater Development (%)
1	2	3	4	5	6	7	8	9	10
1	Aundha	Command	15373.42	2723.87	217.02	2940.89			
	Aundha	Non Command	7126.58	3704.18	378.45	4082.63			
	Aundha	Total	22500.00	6428.05	595.47	7023.51	1147.79	14159.71	31.22
2	Basmath	Command	28829.25	10142.13	395.75	10537.88			
	Basmath	Non Command	2352.68	1821.04	104.54	1925.58			
	Basmath	Total	31181.94	11963.17	500.29	12463.45	1023.37	18334.35	39.97
3	Hingoli	Command	3717.58	642.16	30.35	672.51			
	Hingoli	Non Command	10974.14	3888.18	240.59	4128.77			
	Hingoli	Total	14691.73	4530.34	270.94	4801.28	550.65	10528.29	32.68
4	Kalmnuri	Command	8914.47	1762.82	61.35	1824.16			
	Kalmnuri	Non Command	8415.04	5664.64	217.81	5882.45			
	Kalmnuri	Total	17329.51	7427.45	279.16	7706.62	570.43	9215.75	44.47
5	Sengaon	Command	4252.81	397.76	10.56	408.32			
	Sengaon	Non Command	13045.48	5498.15	106.60	5604.75			
	Sengaon	Total	17298.29	5895.91	117.16	6013.07	233.78	10992.42	34.76

6.0 Ground Water Quality

In the district, 5 ground water water samples were collected during May 2010 for chemical analysis to determine chemical quality. The samples were broadly classified into four classes as given in **Table-5**.

Table-5 Results of Chemical analysis of Ground water Samples

Well No.	Village	pH	EC µs/cm	TA (mg/l)	TH (mg/l)	NO_3 (mg/l)	F (mg/l)
G/HN-007	Kanergaon	8.4	730	270	255	9	0.43
G/HN-010	Babulgaon	8.5	550	220	180	14	0.60
G/HN-015	Hatta	8.1	760	195	200	83	BDL
G/HN-023	Alegaon (Old)	7.9	2200	270	440	33	0.91
G/HN-025	Aundha Nagnath	8.4	660	225	200	30	0.43

6.1 Suitability of Ground Water for Drinking Purpose

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TH, TA, F and NO_3 prescribed in the standards and is given in **Table-6**.

Table-6 Classification of Ground water for Drinking Purpose

Parameters	DL	MPL	Samples with conc. < DL	Samples with conc. in DL-MPL	Samples with conc. >MPL
TH (mg/L)	300	600	4	1	0
TA (mg/L)	200	600	1	4	0
NO_3 (mg/L)	45	No relaxation	4	0	1
F (mg/L)	1.0	1.5	5	0	0

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

The perusal of **Table-6** shows that concentration of NO_3 in one of the location is above MPL indicating high influence of anthropogenic activity in the vicinity of the well, causing nitrate contamination. However, the concentration of nitrate is found less than DL at 4 locations.

Therefore, it can be concluded that the ground water quality in above said areas is suitable for drinking purpose. The ground water, in general, is potable with few exceptions.

6.2 Suitability of Ground Water for Irrigation Purpose

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

6.3 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 below in **Table-7**.

Table-7 Classification of Ground water for Irrigation based on 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	%
5	5	100	--	--	-	-

The **Table-7** shows that the RSC values of all the 5 samples collected from the wells located in the district are less than 1.25. Overall, the ground water quality in the wells monitored is good for irrigation purpose and there is a less possibility of developing sodium hazard.

7.0 Status of Ground Water Development

The yields of ground water structures are the functions of permeability and transmissibility of aquifer encountered in them. Yield characteristics are influenced by saturated thickness of aquifers, location, diameter and depth of the strata etc. There are three types of ground water structures in the area viz; dug wells, bore wells, and tube wells.

Dugwells

Dug wells are generally used for both domestic water requirements and for irrigation in the area. In hard rock areas where limited extent and continuity of aquifer wide vesicular porosity and permeability both vertically and horizontally and partial penetration of wells are common, such analysis is to be applied with caution. The most common groundwater structures are dug wells of depth ranging from 3 to 20 m bgl. The borewells may tap groundwater from 100 to 250 m bgl.

Borewells

State Government , have drilled large number of bore wells fitted with hand pumps for rural drinking water supply in Deccan trap area of the district. A Total of 2381 borewells are drilled by state agencies for drinking water purposes and out of these 1984 are successful (whose yield is > 500 lph) and are fitted with hand pumps and powerpumps for drinking water supply. The borewell tap 2 to 5 flows upto 120 mbgl depth. Groundwater occurs under semi confine conditions in jointed, fratured, brecciated and vesicular zones of lower flows. Majority of borewells tap aquifers of limited potential comprising interflow zones, vesicular zones and joints. Such borewells have yields of less than 2 lps. However, at places (i) interflow zones comprosing ash, tuff, breccia and intertrappean beds are 5 to 10 m thick, (ii) Joints, collumaner joints, platy joints, vertical joints are well developed and (iii) fractures are well developed due to local disturbances. The aquifers in these places have high secondary porosity and permeability. Consequently the bore wells located in such places have yields of 2 to 15 lps.

8.0 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.

8.1 Ground Water Development

The present stage of ground water development in the district is only 36.90%. Thus there is scope for ground water development in the district. However, cautious approach for future development has to be taken up after considering the recharge distribution together with projected extraction for a period of 10 years.

8.2 Water Conservation and Artificial Recharge

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. In the Basaltic area, the 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 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.

Considering the hydrogeological aspects, Hingoli district have feasibility of rainwater harvesting for ground water augmentation. The existing dugwells, borewells or tubewells may be used for recharging the ground water using proper filter media.

9.0 Ground Water Related Issues and Problems

Although a modest area in Hingoli district is under canal command of various irrigation projects and the area is showing declining trend of ground water levels due to exploitation of ground water for irrigation and other purposes at a faster rate. There is much scope for conjunctive use in such areas. The conjunctive use of water is recommended in this area.

Ground water quality is adversely affected at some places due to high concentration of some parameters specially nitrate. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.

10.0 M.A.P. and W.M.T.P.

Till March 2011, no Mass Awareness Programmes (MAP) have been organised in the district and the WMTP (Water Management Training Programme) is yet to be organised.

11.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation the district falls under 'safe' category, hence till March 2011 no area has been notified either by CGWA or SGWA.

12.0 Recommendations

1. About 98 % of the area is occupied by the basaltic lava flows belonging to the Deccan traps. Each flow comprises of lower massive zone and upper vesicular zone. Weathering, joints of various types and fractures impart secondary porosity and permeability to the formation and such zones form potential aquifers. In areas where weathered jointed and fractured zones are 20 to 40 m thick, the aquifers have considerable groundwater potential. Wells located in such areas can yield about 100 to 250 m^3/day. Thus in the area , a multi tier aquifer system is present. The deeper aquifers are tapped by bore wells up to 200m bgl. Under favourable conditions as mentioned above, bore wells can yield 2 lps to 18 lps or 7.2 to 70 m^3/hr. Reas such as zones of weathering

which facilitates weathering and denudation and hence often occur as depressions, river courses and lineaments. These features can be studied well through aerial photographs and should be demarcated for location sites for groundwater abstraction structures.

2. The area where groundwater development is less, it is recommended to locate sites for dug wells, dug cum bore wells and bore wells for further development .

3. The most feasible mode of groundwater extraction for small farmers is dug wells of 10 to 15 m depth and 5 to 8 m diameter in areas having low altitudes, 15 to 25m thick weathered, fractured and vesicular zones. For water supply and bigger farmers, bore wells may be constructed after hydrogeological Survey.