DISTRICT GROUND WATER INFORMATION BOOKLET

VIDISHA DISTRICT

MADHYA PRADESH

Ministry of Water Resources
Central Ground Water Board
North Central Region
Government of India
2013

VIDISHA DISTRICT AT A GLANCE

S.No.	ITEMS	STATISTICS	
1.	General Information		
	i) Geographical area	7371 Km^2	
	ii) Administrative Divisions (As on 2012) Number of Tehsil/Blocks No of Villages	10/7 (Vidisha, Gyarspur, Basoda, Nateran, Kurwai, Sironj, Lateri) 1624	
	iii) Population (Census 2011)	1458212	
	iv) Average Annual Rainfall (mm)	1135.5	
2.	Geomorphology		
	1. Major Physiographic Units: 2. Major Drainage:	Malwa Plateau, Vindhyan Hill Range and Betwa Alluvium Betwa River, Bah Nadi, Nion River, Keother Nadi, Bina River, Kethan nadi and Sindh River	
3.	Land Use (Km^2)		
	i) Forest area:	1096	
	ii) Net area sown:	7444	
	iii) Cultivable area:	5847.32	
4.	Major Soil Types	Black Cotton	
5.	Area Under Principal Crops	2478.92 Km^2	
6.	Irrigation by Different Sources	Nos.	Irrigated area km^2
	Dugwells	11816	427
	Tube wells/Bore wells	16057	1063
	Tanks/Ponds	23	48
	Canals	11	399
	Other Sources		618
	Gross Irrigated Area		2555
7.	Number of Ground Water Monitoring Wells of CGWB (As on 31.3.2013)		
	No. of Dug Wells No. of Piezometers	21 6	
8	Predominant Geological Formations	Deccan Trap basalts underlained by Vindhyan sandstone and overlain by river alluvium	
9	Hydrogeology Major Water Bearing Formation (Pre-monsoon depth to water level during 12) (Post-monsoon depth to water level during 12) Long Term water level trend in 10 years (1903-2012) in m/yr	Weathered/vesicular basalt, flow contacts, fractured sandstone and granular sand 2.8–16.2 mbgl m/annum fall 2.08–9.58 mbgl/annum rise Pre-monsoon 0.1- 0.83 m/annum fall Post-monsoon 0.02- 0.83 m/annum rise	
10.	Ground Water Exploration By CGWB (As on 31.3.2013)		
	No of wells drilled (EW,OW,PZ,SH, Total)	9 EW, 46 OW, 6 PZ	

	Depth Range (m)	18.0 – 242.0 mbgl
	Discharge (litres per second)	0.5 – 8.3
	Storativity (S)	
	Transmissivity (m^2 /day)	0.5- 32 m^2 /day
11.	Ground Water Quality	
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	Chloride & Nitrate
	Type of Water	Alkaline
12	Dynamic Ground Water Resources (2009) In MCM	
	Net Ground Water available	796.0
	Gross Annual Ground Water Draft	405.79
	Projected Demand for Domestic and Industrial uses up to 2033	47.6
	Stage of Ground Water Development	51%
13	Awareness and Training Activity	
	Mass Awareness Programmes Organized No. of Participant:	Nil
	Water Management Training Programmes No. of Participant:	1 190
14	Efforts of Artificial Recharge & Rainwater Harvesting	
	Projects completed by CGWB (No. & Amount Spent)	Nil
	Projects under technical guidance of CGWB (Numbers)	Nil
15	Ground Water Control and Regulation	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Notifed Blocks	Nil
		All blocks are safe
16	Major Groundwater Problems and Issues	Depletion in groundwater level and deterioration of Groundwater quality

1.0 INTRODUCTION

Vidisha district is lying in the central part of Madhya Pradesh. It is in Bhopal commissioners division and is well connected by roads and railway. National Highway 67, connecting Bhopal and Dewas passes through the district. There are 7 tehsils and 7 blocks in the district. The block headquarters are Vidisha, Gyarspur, Basoda, Nateran, Kurwai, Sironj, Lateri. Vidisha district with an area of 7371 km^2 lying between the North Latitudes 22^0 20' and 24^0 22' and East Longitudes 77^0 16' and 78^0 18'" and falls under the Survey of India toposheet No. 54H, 54L, 55E and 55 I. The district is encircled by Guna district in the North, Sagar and Raisen in the east, Raisen in the South and Bhopal in the west (figure 1).

Administrative Division

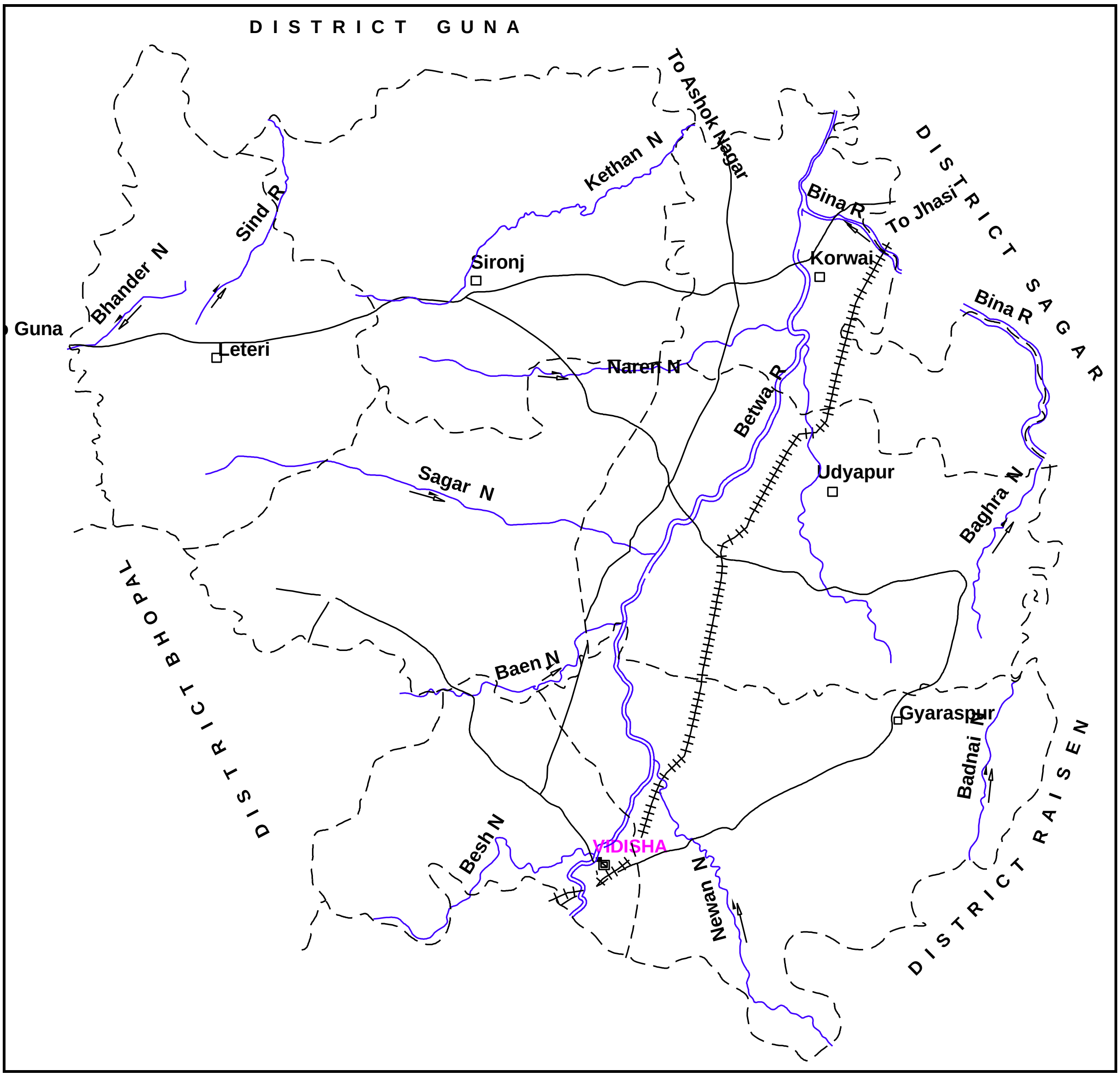
The district is sub divided into seven administrative blocks and seven tehsils. The administrative divisions are shown in figure-1 and details are given in table–1.

Table – 1: Administrative Division, District Vidisha, M.P.

District/ Block	Area Sq.km
1. Vidisha	1066
2. Gyarspur	872
3. Basoda	1223
4. Nateran	1069
5. Kurwai	831
6. Sironj	1255
7. Lateri	986
District Vidisha	7302

Vidisha district forms the part of Malwa plateau and Vindhyan hill range with an undulating topography. Vidisha district is primarily an agricultural district occupying the Betwa basin valley, having predominantly an agricultural economy. Agriculture is the main occupation of the people in the district. Wheat, Jawar, Maize and Soyabean are the major crops sown in the district. Ground water has an important role to play for irrigation.

Out of total 243150 hectares irrigated land, 139600 hectares was irrigated from ground water sources. There were 12193 tube wells and 11822 dug wells up to the year 2006 for irrigation purpose.



Land Use (Km²)		
i) Forest area:	1096	
ii) Net area sown:	7444	
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Irrigation by Different Sources	Nos.	Irrigated area km²
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Other Sources		618
Gross Irrigated Area		2555

2.0 RAINFALL AND CLIMATE

The climate of Vidisha district characterized by a hot summer and general dryness except during the southwest monsoon season. The year may be divided into four seasons. The cold season, December to February is followed by the hot season from March to middle of June. The period from the middle of June to September is monsoon season. October and November form the post monsoon or transition period.
The normal rainfall of Vidisha district is 1135.5 mm. It receives maximum rainfall during southwest monsoon period. About 91.4% of the annual rainfall received during monsoon seasons. Only 8.6 % of the annual rainfalls take place during October to May period. The surplus water for groundwater recharge is available only during the southwest monsoon period. The maximum rainfall received in district at Kurwai i.e. 1191.0 mm and minimum at Bareli i.e. 1150.3 mm.

The normal maximum temperature received during the month of May is 41.7^{o}C and minimum during the month of December is 8.9^{o}C. The normal annual means maximum and minimum temperature of Vidisha district is 32.0^{o}C and 17.9^{o}C respectively. During the southwest monsoon season the relative humidity generally exceeds 94% (August month). In rest of the year is drier.

The driest part of the year is the summer season, when relative humidity is less than 39%. April is the driest month of the year. The wind velocity is higher during the pre-monsoon period as compared to post monsoon period. The maximum wind velocity 11.2 km/hr observed during the month of June and is minimum 1.5 km/hr during the month of December. The average normal annual wind velocity of Vidisha district is 5.3 km/hr.

CGWB ACTIVITES

Shri S Gupta, Hydrogeologist, carried out systematic Hydrogeological Surveys in part of the district during 1990-91. Shri Babu Nair and Shri M. L Parmar, Hydrogeologist carried out reappraisal Hydrogeological surveys during AAP 1993-94 in the district.

Under the World Bank assisted Hydrology Project- I, 6 shallow and deep piezometers have been drilled by the Central Ground Water for water level and quality monitoring. In Vidisha district, 10 exploratory boreholes and nine-observation borehole were drilled under Indo-British Betwa Groundwater project. The exploratory boreholes were drilled in the depth range of 85.7 – 241.6 mbgl and the observation wells were drilled within the depths ranges from 17.8 and 171.4 mbgl. The yield of boreholes varies between 30 to 500 lpm.

3.0 GEOMORPHOLOGY & SOIL TYPES

Physiographically the district has been divided into three major units i.e. Malwa Plateau, Vindhyan Hill range and Alluvium plain. The district is formed by the valleys of major rivers like Betwa basin and Sindh River.

Most part of the district, measuring about more than 80% is located in the Betwa river basin, which is drained by its tributary like Bah nadi, Nion river, Keother nadi, Bina river and Kethan nadi. The presence of elevated ground on all the subbasin marks the surface water divides. The interior area of the basin is marked by undulating topography with elevated plains with very few low altitude isolated hills. The ground elevations in the area vary between about 383 m (Kurwai Block) in the northeast and about 550 m (Lateri Block) in the northwest part of district.

The district is generally covered with black cotton soils covering almost three fourths of the area. This part is occupied by Deccan Basalts. The rest part has red-yellow mixed soils derived from sandstone, shale. The alluvial soils are found along the river courses. The higher elevations i.e. the hilly regions have a cover of murum, which is made up of small rounded pieces of weathered trap. The Vindhyans and Bijawars have a thin cover of sandy loams. The alluvium is derived from hill slopes by numerous streams and watercourses.

4.0 GROUND WATER SCENARIO

Most of the area of district is occupied by Deccan trap and remaining areas are covered by alluvium and Vindhyan formations. The generalized geological succession is given below in table 4 and the hydrogeological map of district is shown in figure 2.

Table-4: General geological succession of Vidisha district.

<table>
<tr><th>Age</th><th colspan="2">Formation</th><th>Lithology</th></tr>
<tr><td rowspan="2">Recent to Pleistocene</td><td colspan="2">Alluvium</td><td>Clay with Kankar Sand and river alluvium</td></tr>
<tr><td colspan="2">Laterite</td><td>Small capping of lateritic on hills and patches in river valley</td></tr>
<tr><td>Upper Cretaceous to Lower Eocene</td><td colspan="2">Deccan Trap</td><td>Lava flows of basalt with red bole and intertrappean beds</td></tr>
<tr><td rowspan="2">Upper Pre-Cambrian to lower Paleozoic</td><td rowspan="2">Vindhyan System</td><td>Upper Bhander series</td><td>Upper Bhander sandstones Sirbu shales at the base of scarps.</td></tr>
<tr><td>Lower Bhander series</td><td>Lower Bhander sandstone but intercalated bands of shales known as Sanchi shale, Bhander limestone and ganurgarh shale</td></tr>
</table>

Description of rocks and their water bearing properties

Vindhyan System

Vindhyan formations comprising of sandstone shales and breccias are exposed in the western and southeastern part of the district. The small patches of Vindhayans are exposed in the form of hills. A major part of Nateran, Gyarspur and Basoda blocks is occupied by Vindhyan formation and comprises of sandstone and shales. The sandstones are normally hard, Quartzitic, massive and compact. However, they are jointed at the surface level.

The Vindhyans are, in general, poor aquifers, however, these formations when subjected to weathering or jointing and fracturing gives rise to moderately yielding aquifers. The depth to water level in this formation varies from 4.0 m to 10.0 mbgl and seasonal water level fluctuation ranges from 1 to 4.00 meters. The yield of wells in this formation varies from 0.5 to 6 lps.

Deccan trap formations

Deccan trap formations occupy more than 60% of the total area of the district. The general flow is characteristic of lava flows in the area are the most of the flows are of 'Aa' type in nature being disposed in a three-fold system along a vertical column. Each flow normally consists of an upper fragmentary zone, a middle massive part and an impersistent thin layer of basalt clinkers. The fragmentary top zone presents a brecciate look. It is very often highly vesicular and amygdular.

The vesicles are generally sub- rounded to irregular in shape. The middle part comprises of massive basalt, which is aphanitic to highly porphyritic. Basalt clinker & horizon is impersistent and often absent. The thickness of this horizon where ever present varies between a few centimeters to about 0.50 m. This zone is analogous to top vesicular amygdular horizons in physical characters. Variation in thickness of different flows is also evident in the area.

Most of the flow contacts can be demarcated by the presence of a red bole horizon. About 10-12 flows of Deccan trap can be identified in the district. In general the thickness of the individual flows range between 4 and 12m. However, the older flows seems to have more thickness compared to the younger ones as indicated by flow numbers, 0 and 1. A major part of Lateri, Sironj, Kurwai, Nateran and basoda is covered by Basaltic rock formations.

The main aquifer systems in the formation are the weathered, vesicular flow contacts jointed, fractured zones etc. The ground water occurs mainly under phreatic conditions the red bole horizon generally confined conditions the red bole horizon generally act as semi-confining and confining layers in the deep aquifers. The yield of wells in this formation varies from 1 to 5 lps.

Alluvium

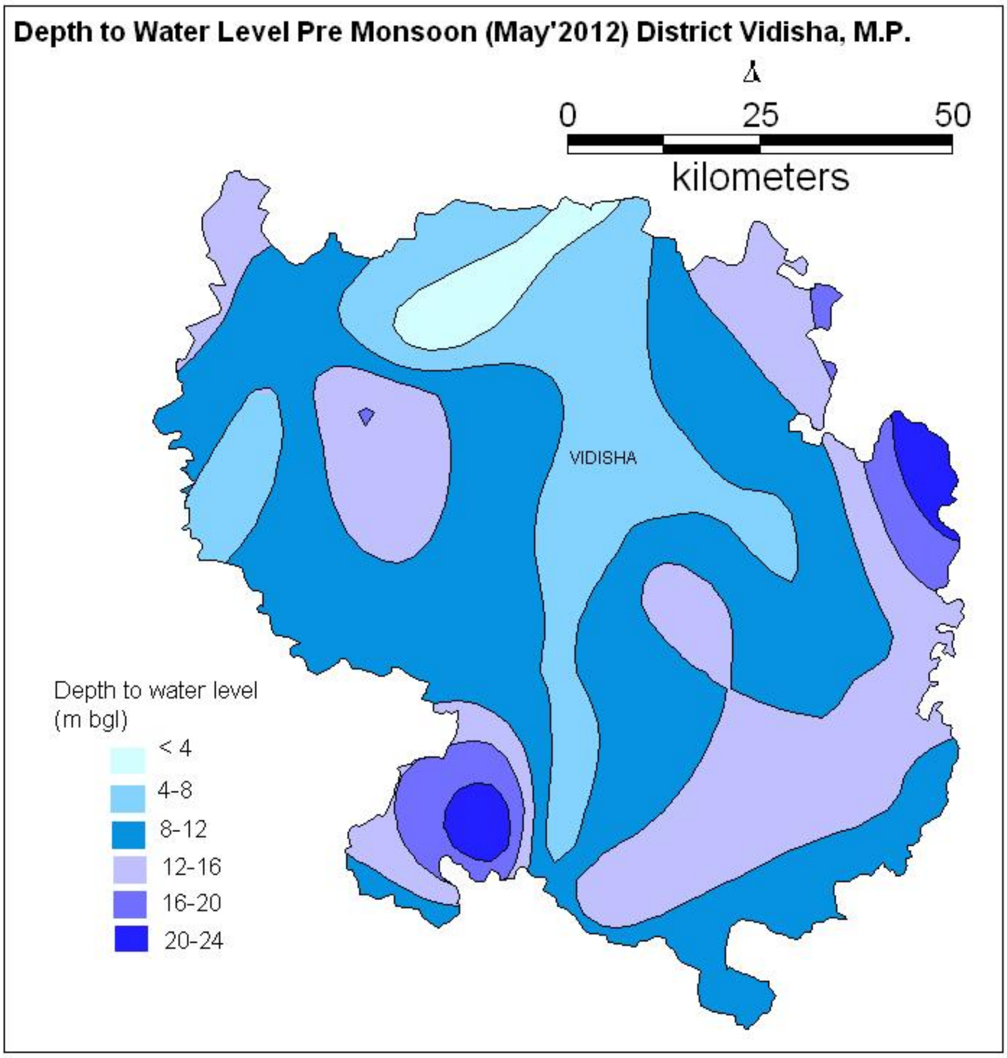
Recent to sub-recent alluvial formations of significant extension occur in the southeastern part of the district falling in Vidisha and Gyarspur block. The alluvial formation in this part occurs along the Betwa River. The other patches of alluvial formation, though insignificant in both aerial extension and thickness occur along the major rivers and streams flowing in the area. The alluvial formations comprises of Silt, Clay, Sand, Gravel and Pebbles Cobbles etc. with Kankar. The sandy gravelling zones when saturated form very good aquifers. The yield of the formation depends upon the ranges from 4 to 10 lps.

WATER LEVELS

A scientific database of groundwater levels is essential for assessing the regional groundwater scenario to reliably estimate the groundwater resources for long term planning and judicious use of available groundwater resources. Variation in groundwater levels in an area is an important component of the hydrological cycle because it is a physical reflection of aquifer systems. As change in groundwater level is directly related to groundwater balance its continuous records provide direct information to geo-environmental changes due to withdrawal of groundwater. To monitor the seasonal and year by year change in quantity and quality of groundwater, Central Ground Water Board (CGWB) has established 21 National Hydrograph Stations (NHS) and 6 Peizometers in Vidisha district.

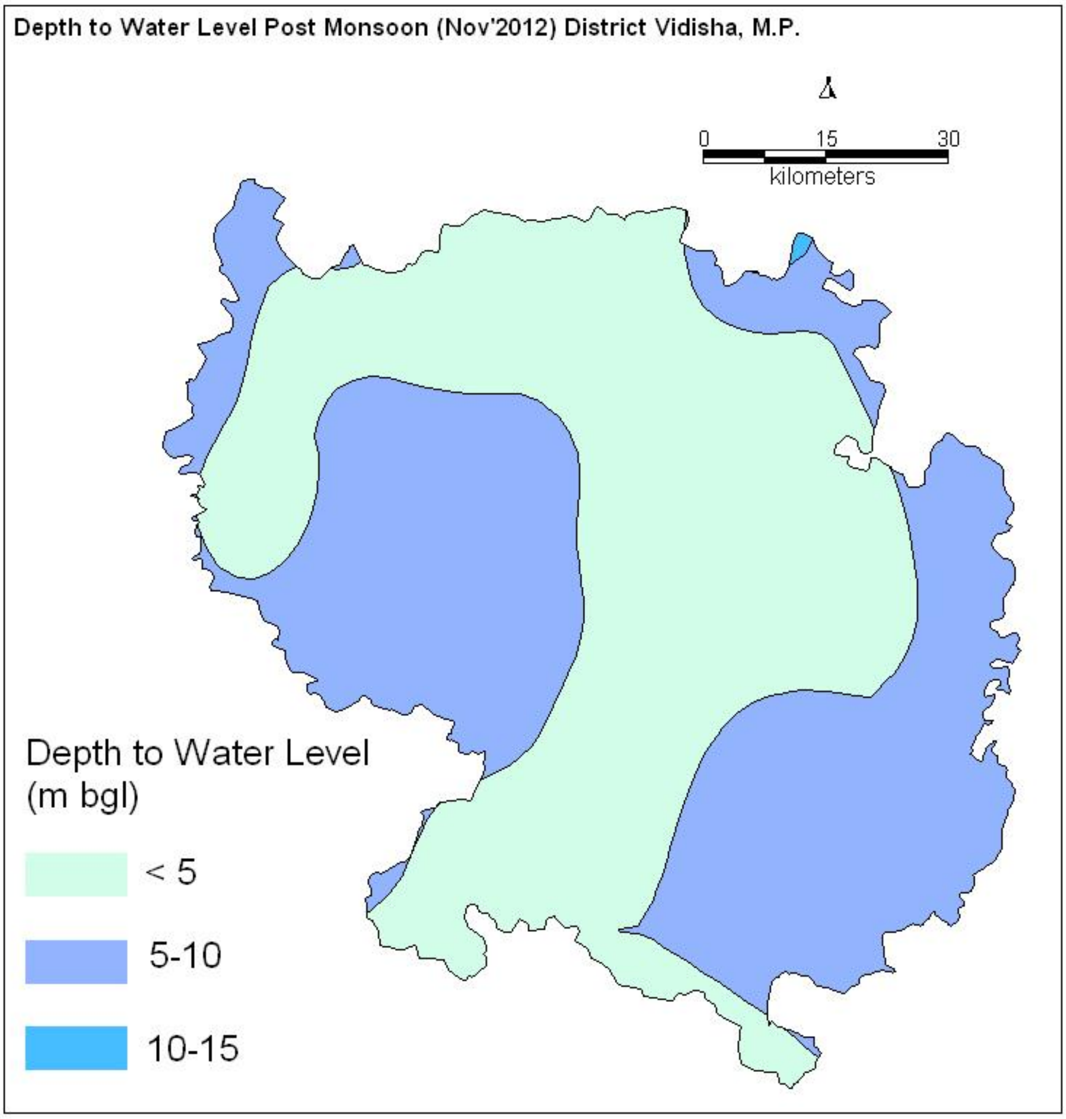
Pre-monsoon (May 2012)

During May 2012, pre-monsoon the depth to water level (figure-3) in Vidisha district ranged between 2.8 m bgl at Deopur in Sironj block and 16.2 m bgl at Balrampur. During the pre monsoon the central part of the district have water level in the range of 3 - 9 mbgl. In the eastern part of district the water level in the range of > 12 mbgl.



Post-monsoon (November 2012)

During post-monsoon period of the same year, November 2012, (figure-4) the water levels varied from 2.01 m bgl at Deopur to 9.58 mbgl at Bagrod Crossing in Basoda block. It is observed that in most part of the district have shallow water levels in comparison to other part of the district.



Decadal Average Water Level (May 2003-2012)

Decadal average water level is an average of water levels of a particular monitoring station for the last 10 consecutive years. This gives a more realistic picture of the area as the water level of any particular year depends on rainfall and draft and may vary widely during the particular year. It is noticed that there is a fall of 0.1- 0.83 m/annum during pre monsoon and rise of 0.02- 0.83 m/annum in post monsoon.

Aquifer Parameters

The exploratory drilling has been carried out mainly in areas occupied by Deccan Traps underlain by Vindhyan shale and sandstone. In Basalt, the vesicular, weathered and fractured basalt form the aquifers while in Vindhyan, fractured sandstones are aquifer. These exploratory wells were mostly drilled down to a depth of 290.41 m bgl, yielding upto 15 lps discharge. The piezometers were restricted to the depth of 30 m, 60 m, 90 m and 120 m bgl. The specific capacity, as determined in a few wells in basalt area, ranged from 3.5 to 61.23 lpm/m of draw down while in alluvium areas it varies from 15 to 120 lpm/m. The transmissivity of basaltic aquifer varies between 0.94 m^2/day to 28.9 m^2/day while in alluvium formation it varies between 32.31 to 137.87 m^2/day.

4.2 Ground Water Resources

The entire command and non-command area in all blocks of district are in safe categories. The stage of ground water development has reached to 51% in Vidisha district. The Net annual ground water available in the Vidisha District is 796.0 MCM and draft from all uses is 405.79 MCM, Net ground water available for future irrigation use is 377.43 MCM. The Net annual ground water resources available in the Vidisha District and draft from all uses for all the blocks is given in table-5 below.

Table-5: Ground Water Resources & Stage of Development in Vidisha District.

S. No.	District/ Assessment Unit	Sub-unit Command/ Non-Command/	Net Annual Ground water Availability (ham)	Existing Gross Ground water Draft for Irrigation (ham)	Existing Gross Ground water Draft for Domestic & Industrial water Supply (ham)	Existing Gross Ground water Draft for All uses (ham)	Provision for domestic, and industrial requirement supply to next 25 year (2033) (ham)	Net Ground water Availability for future irrigation d development (ham)	Stage of Ground water Development (%)
	Vidisha								
	Basoda	Command							
		Non-Command	12645	6185	919	7105	1103	5357	56
		Block Total	**12645**	**6185**	**919**	**7105**	**1103**	**5357**	**56**
	Gyaraspur	Command							
		Non-Command	9862	5188	274	5462	458	4215	55
		Block Total	**9862**	**5188**	**274**	**5462**	**458**	**4215**	**55**
	Kurwai	Command							
		Non-Command	9437	5586	347	5933	561	**3290**	63
		Block Total	**9437**	**5586**	**347**	**5933**	**561**	**3290**	**63**
	Lateri	Command							
		Non-Command	10170	2710	395	3105	535	6925	31
		Block Total	**10170**	**2710**	**395**	**3105**	**535**	**6925**	**31**
	Nateran	Command							
		Non-Command	11466	6096	506	6602	719	4651	58
		Block Total	**11466**	**6096**	**506**	**6602**	**719**	**4651**	**58**
	Sironj	Command	1122	93	17	110	28	1001	10
		Non-Command	11316	5260	474	5734	668	5388	51
		Block Total	**12437**	**5353**	**491**	**5844**	**696**	**6389**	**47**
	Vidisha	Command	3647	658	143	801	259	2730	22
		Non-Command	9936	5320	408	5728	429	4186	58
		Block Total	**13583**	**5979**	**551**	**6529**	**688**	**6917**	**48**
		District Total	**79600**	**37097**	**3482**	**40579**	**4760**	**37743**	**51**

4.3 Ground Water Quality

Ground water quality in relation to Vidisha district is assessed annually by CGWB on the basis of analysis of ground water samples collected from 14 No. of hydrograph stations in the district. On the basis of the data for the year 2011, the water quality is described as follows:

Quality of Ground Water for Drinking Purpose: The pH values of all the water samples varied in between 7.10 to 7.80 hence proved alkaline in nature and were within permissible limit (6.50 to 8.50) as described by BIS (IS: 10500: 2009). The EC values were found to be in the range of 476 and 2550 µS/cm at 25^0 C (Bilari, highest) and were on the side of permissible limit (3000 µS/cm at 25 ^{0}C) as described by BIS (IS: 10500: 2009). The anion chemistry shows that the chloride concentration ranged 18 - 539 mg/l in the area surveilled and two locations namely Malakpur (539 mg/l, highest) and Bilari (440 mg/l) reported to have chloride concentration more than desirable safe limit of 250 mg/l as set by BIS (IS: 10500:2009). The concentration of NO_3^- exceeding 45 mg/l (BIS, IS: 10500: 2009) were reported in 57.14% wells with highest as 405 mg/l of Bilari followed by Patharia as 328 mg/l.This higher concentration of NO_3^- can be attributed from anthropological sources. A scrutiny of data shows that none well of the district was reported having fluoride greater than 1.5 mg/l of BIS (IS: 10500: 2009) permissible limit.

Quality of Ground Water for Irrigation: The chemical quality of water is an important factor to be considered in evaluating its suitability for irrigation purpose. The parameters such as Electrical conductance (EC), Sodium adsorption ratio (SAR), percent sodium (% Na), and Residual sodium carbonate (RSC) are used to classify the water quality for irrigation purpose. A diagram for classifying waters for irrigation purpose was suggested by the U.S. Salinity Laboratory in 1954. The plot of U.S. Salinity Laboratory diagram suggested that 71.42 % wells of district were grouped under C_3-S_1 (High Salinity & Low Sodium) class. This water can be used for irrigation purpose applying restriction on drainage, whereas all other wells (21.42%) named Balrampu, Mohanpura and Udaipura were observed under C_2-S_1 Class (Medium Salinity & Low Sodium) which means that these waters can be used for all type of crops on soils of low to high permeability. The well of Bilari village was grouped as C_4-S_2 (Very High Salinity & Medium Sodium). This water can be used in growing high salt tolerant crops. Special management practices are required for salinity control.

4.4 Status of Ground Water Development

Ground water is the main source for drinking and irrigation in the Vidisha district. About 75% of irrigation in the district is from ground water, though the level of irrigation in the district is very low, only 25.5% of total geographical area is being irrigated. The total number of dug wells and tube wells in the district were 11816 and 16057 respectively. On the drinking water front, Vidisha city have entire supply from ground water. There has been a steady rise in ground water development in the district. The Stage of Development in the district was 57%.

5.0 GROUND WATER MANAGEMENT STRATEGY

It is felt that the overexploitation, indiscriminate development of groundwater, anthropogenic and irrigation practices have led to many groundwater related problems, which need proper management of groundwater resources. These problems are being discussed below.

5.1 Groundwater Depletion

It is observed that in Vidisha district, the stage of groundwater development is moderate (51%). In certain areas the withdrawal of groundwater is more than recharges causing depletion in groundwater level. It is observed that the fluctuation in water table is mainly due to rainfall and withdrawal of groundwater. The study on the long term analysis of water level, conducted by CGWB, indicate that water level in Vidisha district have shown a steady decline of 0 to 2.49 m during past one decade. The incidence of rainfall remaining more or less same in the period of question the only possible reason for the decline in groundwater level appears to be over development of groundwater resources indiscriminately through ever increasing number of tube wells tapping the unconfined and unconfined aquifers for agricultural, industrial and domestic uses. To remedy the ill effects, the following steps are required to be taken for effective groundwater management in Vidisha district.

5.1.1 Groundwater recharge

Due to fast industrialization and urbanization in Vidisha district, there is a reduction in open green areas resulted in substantial decrease in natural recharge to groundwater. Also, the improvement in drainage pattern has caused reduction in percolation of rainwater to the groundwater thereby affecting the natural recharge. It is reported that huge amount of surface water available during rainy season goes as runoff. Hence it can be harnessed through suitable artificial recharge techniques to groundwater. Construction of various suitable artificial groundwater recharge structures will result in augmentation of the groundwater aquifers and arrest further decline of groundwater level. As the area is urban area the roof top rainwater harvesting technique should be adopted in a big way. As the geology of the area along with climatological and pedalogical parameters provide the hydrogeological environment which governs the groundwater recharge, modern techniques like remote sensing and geophysics should be applied for finalization of location, extent and design of artificial groundwater recharge structures.

5.1.2 Water conservation

It is evident that to solve the problem of depletion in groundwater level, it is necessary that the groundwater withdrawal should be reduced substantially. Some of the options available are:

5.1.2.1 Recycling of water

Due to limited groundwater resources and increased demand of water there is a need of recycling of water for its conservation. The treated sewage water can judiciously be utilized to reduce stress on exploitation of groundwater for various purposes including domestic, industrial and horticultural needs.

5.1.2.2 Change in cropping pattern

In last few decades the cropping pattern in Vidisha district has changed substantially. In some parts of district, the farmers have started multi crop cultivation due to profitability which will caused extensive development of groundwater resources. There is a need to change the cropping pattern in the area and adopt cultivation of those crops, which require less irrigation.

5.1.2.3Change in irrigation policy and power pricing

It is observed that in many parts of Vidisha district the complete irrigation is being done through flooding. As the district is covered with hard rock terrain and is water scare, the flooding practice of irrigation requires change. Sprinkler and drip irrigation should be adopted in the area wherever feasible. In this regards the government should come forward and provide infrastructure and other benefits. In most parts of district the irrigation is being done through dugwell and tubewells using power pump. Rates of power for tube well irrigation are irrational and require modification. There should be no free power for irrigation so the consumers should take due cares for its economic and judicious use. Instead of flat rates, metering may be introduced.

5.1.2.4 Mass awareness program

The management of groundwater resources cannot be successful without public participation. It requires educating the public regarding judicious use of water. To make the public aware, it is necessary to educate the people through mass awareness program at grass root level and impart training on rainwater harvesting and artificial recharge techniques for groundwater augmentation.

5.1.2.5 Groundwater regulation

As the groundwater condition in Vidisha block is in alarming stage, groundwater regulation may be enforced for its judicious exploitation and use.

5.2 Groundwater Pollution

Due to increasing industrialization and fast population growth in Vidisha district, anthropogenic activities have led to pollution of groundwater in certain areas. The main sources of pollution are domestic and municipal waste, agricultural practices and industrial activities. Most of the localities/villages in Vidisha district do not have proper sewage treatment system; the groundwater gets polluted with variety of nutritional constituents and pathogenic microbes. Use of various chemical fertilizers and pesticides has led to increase of nitrates, phosphates and other organic component in groundwater. Untreated effluents discharged in/on ground has caused increased level of heavy metals. Some organic compounds have also led to deterioration of quality of groundwater.

5.2.1 Action Plan

It is fact that the groundwater pollution in the area increasing day by day there is a need to take up the comprehensive groundwater pollution studies in the Vidisha district township. It is necessary to initiate measures to control further groundwater pollution. Dilution of pollutant concentration through groundwater recharge can be effective to mitigate the hazards of high concentration of chemical constituents. It is also desirable to formulate water supply schemes utilizing such water for purpose other than drinking.

6.0 RECOMMENDATIONS

I. Ground water is meeting the most water needs of the district but it may not go very long in future. The average water levels of the district are deep, the decadal fluctuations and the long-term trends are showing a decline, and the water balance left is limited. The population and progress coupled with poor aquifers are responsible for this alarming situation. Thus special caution is to be observed while developing this natural resource.

II. The groundwater development in Vidisha district, both for irrigation and domestic purposes, is being done on need basis without proper backup of scientific investigations. Some times failure of monsoon led to crisis of even drinking water in district. A serious thought should be given to plan future development of groundwater on scientific lines. For a planned and coordinated development of groundwater resources it is essential that detailed hydrogeological, remote sensing and geophysical investigation should be carried out before taking decision on finalization of sites for drilling wells for irrigation and domestic use. The lithological details along with aquifer wise yield records should be maintained for future inferences.

III The groundwater resource evaluation for year 2011 indicates that the stage of groundwater development in district has reached to 57%. The Net annual ground water available in the Vidisha District is 890.45 MCM and draft from all uses is 481.28 MCM, Net ground water available for future irrigation use is 394.98 MCM only. Thus it has become imperative for further detailed hydrogeological investigation in district for water balance studies making watershed as a unit.

IV Vidisha district is mainly a hard rock area and the decision for the type of groundwater structures for groundwater development is dictated by local hydrogeological situation. Figure-5 shows the areas recommended for future groundwater development in Vidisha district.

a. In areas of phreatic aquifers with low permeability large diameter dugwells is the only suitable groundwater structure. The dugwell should be located as far as possible in topographic depressions, nearer to rivers and streams and if possible nearer to zone of structural disturbances. In Deccan trap areas of the district, instead of increasing the diameter of dugwells drilling of horizontal bore into the dugwell should be preferred to increase the yield of dug well.

b. In certain areas of district where dugwell do not penetrate fully to the aquifer, it is recommended that dug cum bore wells may be constructed.

c. As the Red bole clay is present between two flows and are collapsible in nature, telescopic drilling should be adopted for screening/casing the collapsible strata to increase the longevity and yield of boreholes.

d. In view of the limited regional extent of joints/fracturing, it is possible to miss a good water bearing horizons in a small diameter borehole during the drilling. It is recommended that technique of hydro-fracturing/bore blasting should be tried to enhance the yield of boreholes.

e. For wells constructed for drinking water it is much more important to ensure that the intake section of tubewell is not directly in connection with pollution from ground surface.

V. It is observed that in most part of the district there is an ample fluctuation in depth to water level during pre and post monsoon period. Also, there is substantial surplus monsoon run off going as unutilized needs to be conserved through artificial recharge techniques. In order to get sustainable yield from groundwater structures the need for augmentation of groundwater resources through artificial recharge structure is imperative. Artificial Recharge practices in rural areas should be taken up earnestly to improve the ground water quantity and quality. The selection of sites should be done on scientific basis by conducting hydrogeological and geophysical investigations.

VI. The Roof Top Rainwater Harvesting technique has wide scope in the areas covered with weathered basalt. In Vindhyan rock formation, tubewells can be used for this purpose. Roof top rainwater harvesting should be made mandatory considering the water scarcity in urban areas. This would mitigate the situation.

VII. Unscientific use of fertilizer/pesticides for agriculture and disposal of untreated industrial effluents through unlined drain in most of the industrial areas of district will be very dangerous for groundwater quality in near future. There is a urgent need to control such type of activities to check the groundwater pollution.

VIII. The deforestation of forestland to accommodate the population growth causes heavy run off and insufficient subsurface recharge to groundwater storage in foothill zone. Afforestation programme in such areas need to be taken up. This would not only check soil erosion and improve the environment but also conserve surface runoff and recharge the phreatic aquifers in the area.

IX. Change in cropping pattern is another measure, which will relieve the situation. Presently Soya bean crop is being grown in large areas, which has a high water requirement. There is a need to change the cropping pattern in the area and adopt cultivation of those crops, which require less irrigation.