DISTRICT AT A GLANCE

SHAJAPUR DISTRICT

MADHYA PRADESH

Ministry of Water Resources

Central Ground Water Board

North Central Region

BHOPAL

2013

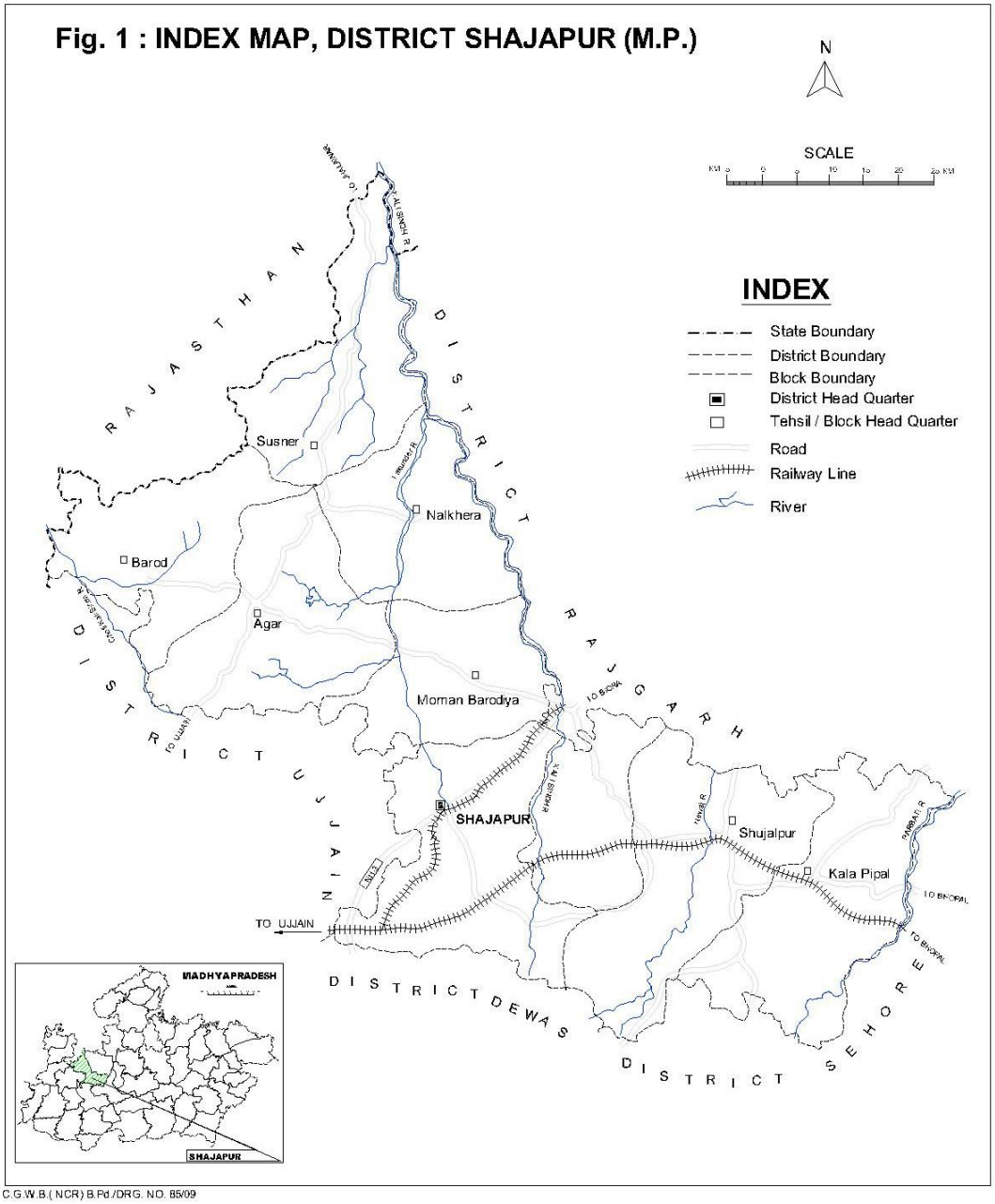
SHAJAPUR DISTRICT PROFILE

S. No.	Items	Statistics	
1	**General Information**		
	(i) Geogrophical Area (ii) Administrative Division (As on 2013) Number of Tehsils Number of Blocks Number of Panchayat Number of Janpad Panchayat Number of villages (iii) Population (iv) Normal Rainfall (mm)	6195.00 sq. km 9 8 554 08 1120 15,12,353 1020.2 mm	
2	**Geomorphology**		
	Major Physiographic Units **Major Drainages**	Western, southern, south eastern part are highly undulating with broad flat topped hills and isolated hills. North eastern part flat land mass small mounds and hillocks Central plain with scattered hillocks. Kali Sindh, Lakhundar Nevaj, Parbati River Chambal and Ganga basin.	
3	**Land Use (Sqkm)**		
	(a) Forest Area (b) Net area sown	0.6 4190	
4	**Major Soil Types**	Black Cotton soil, lateritic soil, alluvium mixed silt + clay	
5	**Principal Crops**	Wheat, soyabean and Maize	
6	**Irrigation by Different Sources**	**Irrigated Area SqKm**	**No. of Structures**
	Dug wells Tube well/Bore wells Canals Tanks/Ponds Net area irrigated	1450 868 67 73 2460	61759 18657 104 109 -
7	**Number of Ground Water Monitoring Wells of CGWB. (As on 31.3.2013)**		
	No. of Dug Wells No. of Piezometers	23 10	
8	**Predominant Geological Formations :**	Recent alluvium, laterite and Deccan traps	
9	**Hydrogeology**		

	Major Water Bearing Formation **Pre-Monsoon** Depth to water level during 2012 **Post-Monsoon** Depth to water level during 2012 Long Term water level trend in 10 years (2003-2012)	Alluvium, laterite, weathered vesicular and fractured basalts. 6.90-23.4 m 1.07-15.08 m 0.09-0.11 m/year (Rise) 0.1-0.17m/year (Fall)
10	**Ground Water Exploration by CGWB (As on 31.3.2013)**	
	No. of wells drilled EW OW, PZ, Total Depth range (m) Discharge (lps) Storativity (s) Transmissivity (m^2/day)	Exploratory well 35 Piezometers 12 59.98 – 203.35 m 0.8 – 15 lps - -
11	**Ground Water Quality**	
	Presence of chemical constituents more that permissible limit. (e.g. EC, F, As, Fe)	EC-825-2530, Nitrate-36-270 Fluoride – 0.01-1.45 in phreatic aquifer
12.	**Dynamic Ground Water Resources (2009)**	
	Net Ground Water Availability Existing Gross Ground Water Draft Projected Demand for Domestic and Industrial uses up to next 25 years Stage of Ground Water Development	92141 ham 88825 ham 3755 ham 96 %
13	**Awareness and Training Activity**	**Nil**
14	**Efforts for Artificial Recharge & Rainwater Harvesting – Artificial recharge through dug well**	
15	**Ground Water Control and Regulation**	
	No. of Over Exploited Blocks No. of Critical Blocks No. of Semi- Critical Blocks	Mohan Barodia, Nalkheda, Shujalpur and Susner(04) Agar (01) Kala pipal, Barod, Shajapur (03)
16	Major ground water problems and issues	1. Depletion of ground water level. 2. Drought due to ground water, over exploitation 3. Salinity problems at places.

1.0 Introduction

Shajapur district is situated in north- western part of Madhya Pradesh. It is part of Malwa plateau spanning over an area of 6,195 Sq.km. The district is bounded by Rajgarh District on the west , Ratlam district on the north , Jhalawad district of Rajasthan state and by Dewas and Sehore district in the south. The district extends between the parallel of latitude 23^0 06' and 24^0 20' north and between meridians of longitude of 75^0 41' and 77^0 02" falling in survey of India toposheet No. 46M, 54D. Eastern boundaries of the district having natural division and bounded by rivers Parwati, Kali sindh and Chhoti Kali Sindh respectively.



C.G.W.B.(NCR) B.Pd./DRG. NO. 85/09

Shajapur which is district head quarter formed in 1901 is located on national highway No. 3 Agra – Bombay road, the district has a good network of roads and rail communication. The district head quarter is 211 km from Bhopal. Shajapur district is mainly agriculture based district and its main crop wheat, Jawar, Soyabean are common crops, Maize gram Rice, Bajra, Sugarcane, Groundnut are the less important crops.

The total geographical area of the district is 6195 sq. kms and has been divided in 09 Tehsil 8 blocks with a population of 15,12,353 according to census 2011. Fig-1. The details of administrative units are given below in table No. 1.

Table-1 : Administrative Division, Shajapur, District M.P.

S.No.	Blocks	Area in Sq. Km
1	Shajapur	917.86
2	Mohan Barodiya	904.05
3	Sujalpur	825.67
4	Kalapipal	825.67
5	Agar	724.40
6	Barod	735.98
7	Susner	654.23
8	Nalkheda	607.32

Drainage :

Entire Shajapur district lies within Yamuna basin, Chambal sub basin and is drained by Prominently northerly flowing rivers like Chhoti Kalisindh, Kali Sindh, Lakhunder Newaj and Parvati. These rivers and their streams give dendritic drainage. The district area is located between surface elevation 335 and 608 msl.

Irrigation :

The Irrigation facilities in Shajapur district are moderate and 58.7% (2011-12) of net sown area is irrigated and rest of the area is rain-fed. Surface water irrigation in the district is largely through tanks and their canals. Total 41 minor, 4 medium, 6 lift, irrigation scheme is working in entire district ground water is the main sources of irrigation in the district. Out of total 2460 sq. km irrigated land, 2318 sq. km is irrigated from ground water sources which is about 94.22% of total irrigation in the district. There are 18657 bore wells and 61,759 dug wells in the district for irrigation.

Central Ground Water Board (CGWB) Activities :

- Systematic hydrogeology survey were carried out by the Central Ground Water Board,, north central region Bhopal during 1988-89
- Hydrogeological investigation for source finding in hard core problem villages referred by public health engineering department during the year (1988-89).

- Reappraisal Hydrogeological investigation were taken up by Central Ground Water Board, NCR, Bhoapl covering the entire district during 1994-95.
- Reappraisal hydrogeological investigation were taken up by Central Ground Water Board, North Central Region Bhopal covering entire district during 2004-05.
- Under accelerated exploratory drilling program 35 number of exploratory wells were drilled in entire Shajapur district for water supply during 2003-04.
- Under the world bank assisted hydrogeology project 09 shallow and deep Piezometers had been constructed in Shajapur district.

2.0 Rainfall and Climate

The climate of Shajapur district MP charactersized by hot summer and general dryness except during the south west 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 about the middle of June. The period from the middle of June to September is the south west monsoon season. October and November form the post monsoon or transition period.

The normal annual rainfall of Shajapur District is 1020.2 mm. Shajapur district receives maximum rainfall during south – west monsoon period i.e. June to September. About 92.3% of the annual rainfall received during monsoon season. Only 7.7% of the annual rainfall takes place between October to May period. Thus surplus water for ground water recharge is available only during the south – west monsoon period. The maximum rainfall received at Shajapur is 987.3 mm and minimum at Susner 865.4 mm.

The normal maximum temperature recorded during the month of May is 39.9^0 C and minimum during the month of January 9.6^0 C. The normal annual means maximum and minimum temperature of Shajapur district is 31.3^0 C & 35.5^0 C respectively.

During the south- west monsoon season the relative humidity generally exceeds 88% (July / August month). The rest of the year is drier. The driest part of the year is the summer season, when relative humidity is less than 33%. 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 is 27.0 km / hr. observed during the month of June and minimum 7.1 km/hr during the month of November. The average normal annual wind velocity of Shajapur district is 15.9 km / hr.

3.0 Geomorphology and Soil Types

3.01 Geomorphology

The district lies on a part of Malwa plateau at a general elevation between 335 and 608m amsl with an elevation of about 275m. The entire district is characterized by a typical Trappean geomorphology comprising extensive plain, low lying hills and hills clusters with gentle northerly slope. Western, south, south-eastern parts are highly undulated with broad flat topped hills, cluster terraces and isolated hills. A number of hils caped by laterite are noticed in the north-western, western part. The central area is plain with scattered hillocks.The highest point 608m amsl occurs a few kilometers south-west of Shajapur and the lowest part is about 335m in the Kali Sind and Newaj river valleys. Bad land topography along small nalah courses and scarp development upto maximum of 20m are quite common along the rivers. The general slopes is from south to north marked by a number of small rivers which later join the Kali Sind river.

3.02 Soils

The soil in Shajapur district are of mixed type and there is no distinct boundary in between any two type of soils. There are three categories of soils identified in the district area-

(a) Black cotton Soil

These soils are dark grey to black in color, composed of clay and are plastic & sticky in nature. These soils are fertile in nature and derived from decomposition of trappean rocks having thickness of 15 cm to 2m . These soils cover major part of the district.

(b) Lateritic soil

These soils consist of sandy loam to clayey loam and brick red to red in colour. These soils are derived from weathered ferruginous basalt and are found around Agar and Barod blocks.

(c)Alluvium soil

The alluvium is of mixed origin & comprises of silt & clay and admixtures of these in varying properties. The occurrence of alluvium is confined to the bank of stream and rivers and usually 3 to 4m in thickness.

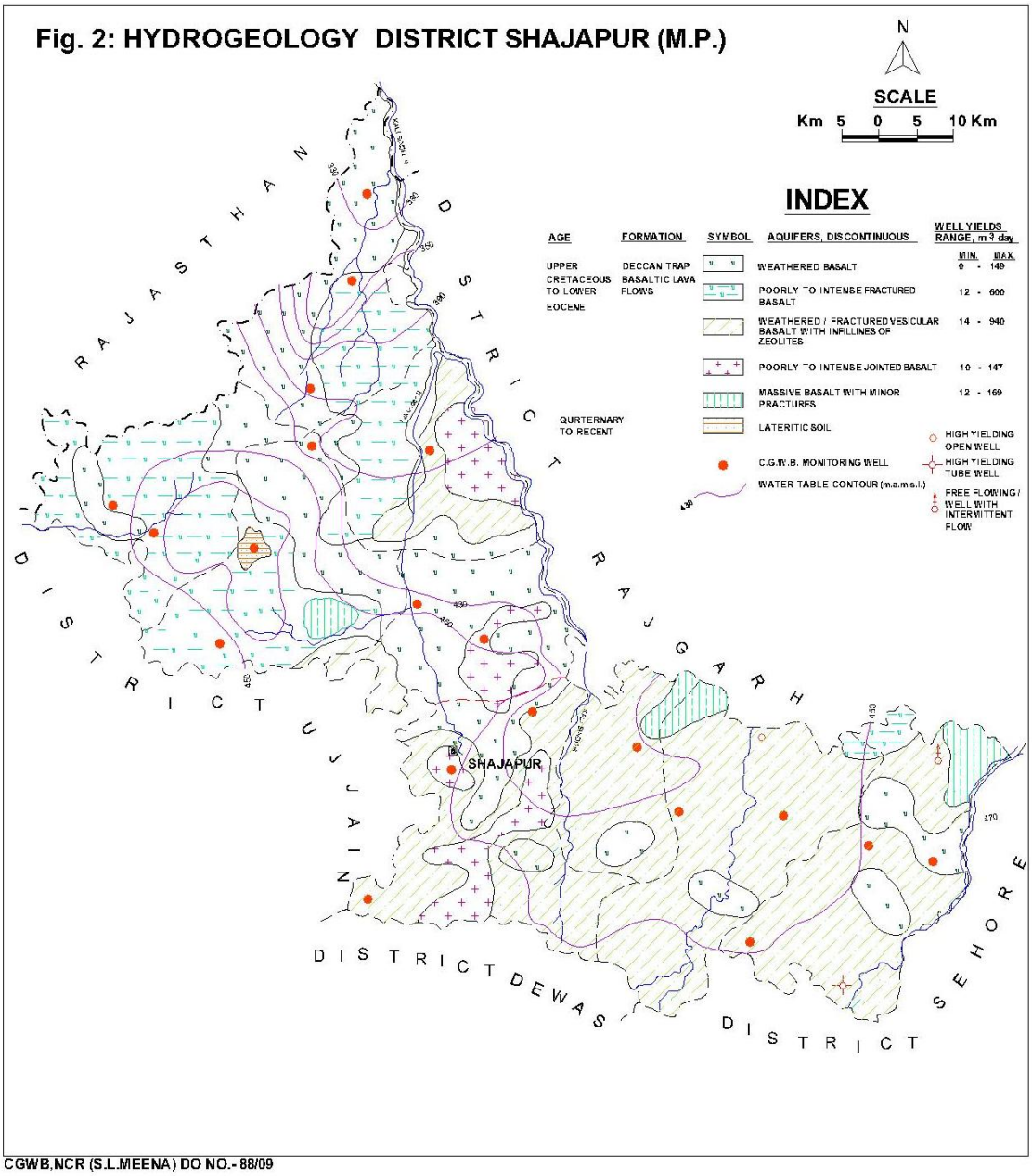
4.0 Ground Water Scenario

4.1 Hydrogeology

Decan Trap basaltic rock occupies the entire Shajapur district. The different flows of basaltic rock are mostly of “Aa” type but ”Pahoehoes” and intermediate type are also present. A typical flow unit consist of a lower dense massive, horizon passing upwards into a vesicular, amygdaloidal or jointed basalt. At places, top of individual flows are marked by reddish brown clayey material(Red bole) of few cm to 5 m thickness. Usually the red- bole and vesicular basalt are prone to weathering and give rise extensive black cotton soil. There are sixteen basaltic flows which were identified by Geological Survey of India in a vertical column of 275m between altitude of 335 to 610 m amsl) in entire Shajapur district. The various flows of basalts are at times inter-bedded and fossiliferous inter trappen. The description of various lava flows are presented in the table 2-

Table-2: Type : Thickness of Basaltic Lava Flows in Shajapur District

Flow Nos	Thickness	Formation & Description	Age
11 to 16	100m (Elevation above 500m)	Indore Formation, six, fine grained Sparsely porphyritic Aa type flows	Upper cretaceous to lower Eocene
07-10	60M (Elevation 460 m)	Kankariya Purukheri formation, four Aa to Pahoehoe type flows (Fossiliferous inter trappean)	
02-06	100 m (Elevation upper contact at 440-443m)	Kalisindh formation, Five, fine grained sparsely to moderately porphyritic Aa flows	
00-01	15 M (Elevation 340 m)	Mandleshwar formation fine to medium grained sparely to moderate, porphyric Aa flows	



4.2 Occurrence of Ground Water :

Ground Water occurs in different lava flows having distinctive feature like significant primary porosity in the form of vesicles lava tubes formed due to emanations of gases in weathered lava flows along with fractures, variation vesicles and its vide spatial and temporal with minerals considerable reduced by filling up with minerals like zeolites, calcite, and silica to form amygdale. Alternating sequence of pervious and compact horizon function as a multi aquifer system.

Shallow ground water occurs in the weathered vesicular, jointed fractured zones of basaltic flows generally under unconfined conditions at some places under semi confined to confined condition due to the presence of thickly silty clays overlying the

jointed rocks in the cases of deepr aquifer. Shallow aquifer also noticed in alluvium occurs along Lakhunda , Kalisindh , Newaj and Parvati river courses .Laterite development on basalt is not extensive except in and around Agar town where the traps have undergone maximum degree of leaching. The hydrogeology of the Shajapur district has been depicted in fig. 2

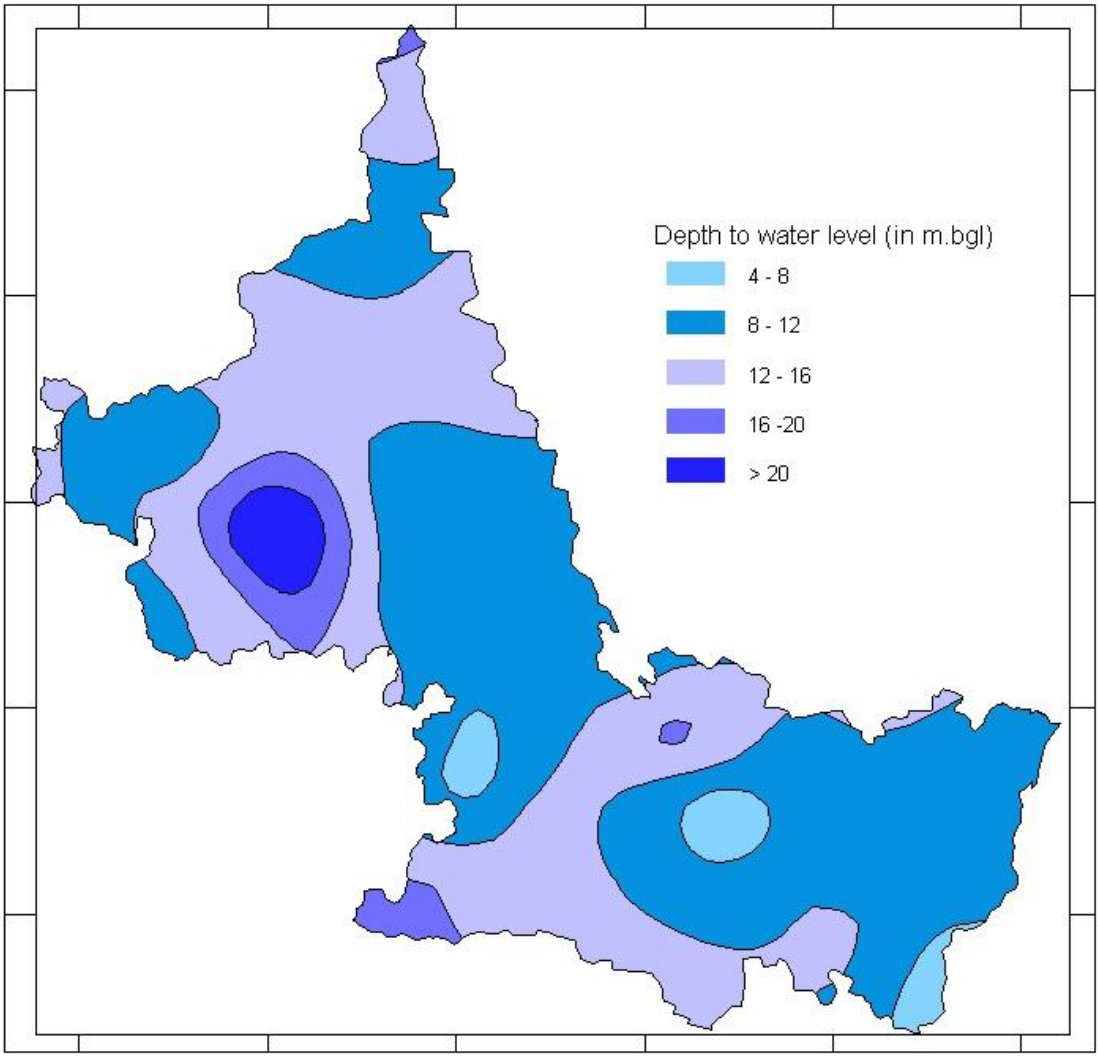
4.3 Ground Water Levels

Variation of ground water levels in a area is an important component of Hydrological cycle because of its is a physical reflection of aquifer system. As the change in ground water level is directly related to ground water balance and its continuous records provide direct information of sub surface geo environmental changes due to withdrawal of ground water. To monitor the seasonal & annual fluctuation, change in quantity and quality of ground water, CGWB has established. Ground water monitoring wells and piezometers in entire Shajapur district. The monitoring of ground water levels in these wells is being carried out by CGWB during the month of May, August, November and January. High frequency ground water level monitoring is being carried out at many places deep piezometers using automatic water level recorders. To study ground water regime of the area pre monsoon and post monsoon maps of the Shajapur district has been prepared .

4.3.1. Pre Monsoon (May 2012.)

In pre monsoon period, May 2012,depth to water level ranges between 6.90mbgl to 23.40 mbgl. The most part of the district have water level in the range of 8.0 to 12.0 m bgl during the pre monsoon water level.

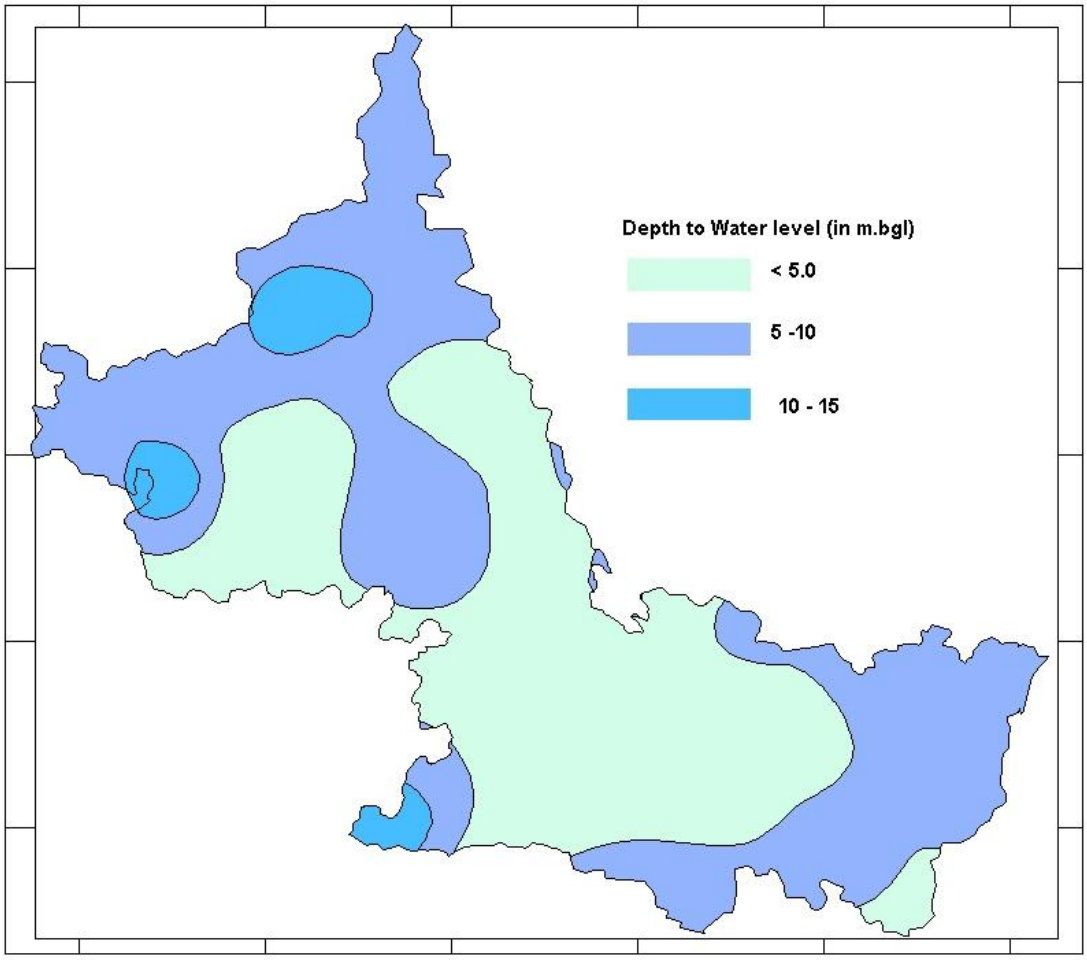
Depth to Watwer Level Pre- Monsoon (May 2012) Ditrict Shajapur, M.P.



4.3.2. Post Monsoon (November 2012)

During Post monsoon period November 2012 ,the water level ranges from 1.07 m bgl to 15.08 mbgl. It is observed that in most part of the district the water level lies within 5.00 mbgl. During post monsoon period water level between 5-10moccures in N-W &south-eastern part o0f the district.

Depth to Water Level Post Monsoon (Nov 2012) Distrcit Shajapur, M.P.



4.3.4. Ground Water Level Trend (2003 -2012)

Analysis of ground water level trend indicate that there is declining trend in water level between 0. 1 to 0.17 m/year & rising trend ranges between 0.09-0.11 m/year in different parts of the district.

4.4 Aquifer Parameters

Central ground water board has drilled only one exploratory well at Agar in Shajapur district which was abandoned due to meager discharge . 35 exploratory wells were drilled in Shajapur district through out sourcing under accelerated exploration program. Under the world bank assisted hydrology project 09 Piezometers have been drilled for monitoring of ground water levels in entire district. It is inferred from the exploratory data that the yield of deccan trap basalt, along the Kalisindh river, deeper aquifer are promising and yield ranges from 8 to 15 lps as compared to 5 to 15 lps in the district (0.5 lps at Jokhar, Jaikhi and 14.5 lps at Dhudhana village) .The draw down ranges between 0.5 m at Dhudhana to 40.06 m at Shajapur. The static water level is generally deep and varying from 2.44 mbgl at Shajapur to 102.0 m at Manglaj.

4.5 Ground Water Resources (2009)

Shajapur district is underlain by mainly Basaltic lava flows of Deccan trap. Dynamic ground water resources of the district have been estimated for base year -2008/09 on block-wise basis (table 3). There are eight assessment units (block) in the district which fall under non-command (98 %) and command (2.% Agar bolck) sub units. Barod, Kalapipal and Shajapur blocks of the district are categorized as semi critical and Agar as critical. Mohanbarodia, Nalkheda, Shujalpur and Susner blocks are categorized as over exploited. The highest stage of ground water development is computed as 138 % in Mohanbarodia block. The net ground water availability in the district is 92,141 ham and ground water draft for all uses is 88,825 ham, making stage of ground water development 96 % as a whole for district. After making allocation for future domestic and industrial supply for next 25 years, balance available ground water for future irrigation would be 2916 ham**.**

Table 3: DYNAMIC GROUND WATER RESOURCE POTENTIAL (2009).

S. No.	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 (%)	Category
1	Agar	Command	3441	323	74	397	133	2985	12	Safe
		Non-Command	7389	6384	295	6679	295	710	90	Critical
		Block Total	**10830**	**6707**	**369**	**7076**	**428**	**3695**	**65**	
2	Barod	Command								
		Non-Command	10567	7305	293	7598	498	2764	72	Semi Critical
		Block Total	**10567**	**7305**	**293**	**7598**	**498**	**2764**	**72**	Semi Critical
3	Kalapipal	Command								
		Non-Command	13552	12127	451	12578	451	974	93	Semi Critical
		Block Total	**13552**	**12127**	**451**	**12578**	**451**	**974**	**93**	Semi Critical
4	Mohan Berodia	Command								
		Non-Command	12398	16650	470	17120	470	-4722	138	Over Exploited
		Block Total	**12398**	**16650**	**470**	**17120**	**470**	**-4722**	**138**	Over Exploited
5	Nalkhera	Command								
		Non-Command	9609	10806	260	11066	260	-1458	115	Over Exploited
		Block Total	**9609**	**10806**	**260**	**11066**	**261**	**-1459**	**115**	Over Exploited
6	Shajapur	Command								
		Non-Command	14121	10952	661	11612	795	2373	82	Semi Critical
		Block Total	**14121**	**10952**	**661**	**11612**	**795**	**2373**	82	Semi Critical
7	Shujalpur	Command								
		Non-Command	11342	11053	541	11594	541	-252	102	Over Exploited
		Block Total	**11342**	**11053**	**541**	**11594**	**542**	**-253**	**102**	Over Exploited
8	Susner	Command								

		Non-Command	9724	9870	311	10181	311	-457	105	Over Exploited
		Block Total	**9724**	**9870**	**311**	**10181**	**311**	**-457**	**105**	Over Exploited
		District Total	**92141**	**85470**	**3355**	**88825**	**3755**	**2916**	**96**	

4.6 Ground Water Quality

4.6.1 Ground Water Quality for Drinking

Ground Water Quality in Shajapur district is assessed annually by CGWB on the basis of water samples collected from 23 nos. of hydrographs stations in the district. Ground water in the district is generally medium to high saline as electric conductivity values ranges between 825 – 2530 µS/cm.

Constituents like Sulphate, Calcium and Magnesium were within the safe limit for drinking water as per BIS standards. Nitrate in the ground water of Shajapur is varying between 36- 270 mg/l. High nitrate in the village area appears due to excessive use of fertilizers and agricultural waste. Ground water in the district at many places is saline and due care is needed before its use.

4.6.2 Ground Water Quality for Irrigation

High SAR is not good for irrigation as it lead to Sodium hazards. Water samples in the district generally fall in C_2S_1, C_3S_1 and C_4S_1 classes of US Salinity diagram. However, ground water in the district is generally safe for irrigation but proper drainage system is required where EC is more than 1500 µS/cm.

4.6.3 Geogenic problems

Fluoride in the district ranges between 0.01-1.45 in phreatic aquifers and is below 1.50 mg/l More than 1.50 mg/l is responsible for bone deformation. Due care is needed to use ground water for drinking where, fluoride concentration is more than 1.50 mg/lin deeper aquifers. No Arsenic has been detected in the district.

Table-4: Classification of Ground Water for Irrigation purpose.

C_1S_1 C_1 = 100-250 µS/cm S_1 = <10	C_1S_2 S_2 = 10-18	C_1S_3 S_3= 18-26	C_1S_4 S_4= >26
C_2S_1 C_2= 250-750 µS/cm	C_2S_2	C_2S_3	C_2S_4
C_3S_1 C_3= 750-2250 µS/cm	C_3S_2	C_3S_3	C_3S_4
C_4S_1 C_4 = 2250-5000 µS/cm	C_4S_2	C_4S_3	C_4S_4

C Stands for Salinity (TDS or EC)
S Stands for alkalinity (Sodium Absorption Ratio)

C_1= Excellent
C_2= Excellent
S_1= Good to Satisfactory
S_2= Satisfactory

C_3= Good
C_4= Bad
> C_4= Worst

S_3= Bad
S_4= Worst

4.7 Status of Ground Water Development

Ground Water is the main source for drinking and irrigation in the Shajapur district. About 94.22% irrigation in the district is from ground water sources, though the stage of ground water development is about 98%. There are 18657 tube wells and 61759 dug wells in Shajapur district & its depth ranges between 8.0 m to 24.0. Yields of tube wells ranges between 8 to 15 lps depending on hydrogeological situation in the area. High yielding tube wells are at passukhedi, Tilawad maina, Kishoni, Sujalpur, Nalkheda, Manglaj, Ukawat & Dudhana (14.5 lps).

Apart from private Sources, hand pumps are the main source of rural water supply in the district. There are 1068 villages having tube wells and hand pumps and 627 villages with pipe water supply facilities for drinking water.

Ground Water Issues and Management Strategy

It is felt that the over exploitation, indiscriminate development of ground water industrial, development, anthropogenic and irrigation practice have lead to many ground water related problems, which needs proper management of ground water resources. These problems are being discussed below :

5.1. Ground Water Depletion

As per ground water resources estimated of Shajapur district for the year 2011, the Net available ground water resources 989.02 MCM and gross annual ground water development for the entire district has been reached to 98% thus there is no scope for future development of ground water resources in the district. Out of eight blocks of district Barod, Kala-pipal and Shajapur blocks comes under semi critical category, Agar block comes under critical category, while rest of the four blocks are over-exploited.

5.2. Ground Water Conservation and Artificial Recharges

Considering stage of ground water development& hydrogeological situation of the area, decline trend of ground water level and occasional scanty rainfall followed by deviation in the incidence of average annual rainfall there is need to implement artificial recharge to replenish the over exploited aquifer and to store surplus water during the monsoon season for use, during the dry season. Among the requisite for artificial recharge of ground water is moderate permeability and the host rock (deccan trap basalts/ water bearing strata) on the one hand and high permeability of over burden on the other hand.

In view of the fact that these requirement are available in the district to a large extent, the feasibility of the artificial recharge to ground water becomes valid.

The degree & extent of weathering shallow depth is quite intense and the zone that favors higher infiltration rate is inferred. However the temporal and spatial extent of such weathered rock is to be systematically mapped.

Similarly the stream, which follows weak surface zone which can also constitute favorable areas for ground water recharge. Plan may be adopted using hill to valley approach in watershed. At origin of streams gully plug & contour trenches- may be constructed to arrest surface water run off. Gabion structures may be constructed at the down stream of these structures, across.

To check the the velocity of the stream ,percolation tanks are most important from ground water recharge point of view and these are recommended in second and third order stream on porous and permeable formations.

To overcome the silting problems, due to which percolation of water at sub surface may reduce, recharge shaft may be constructed inside the percolation tanks recharge shaft may also be constructed at those places where impervious formation are at surface and at shallow depth porous and permeable rocks are found.

Properly designed tube well also act as recharge shaft, if recharge water is needed in deeper aquifer overlain by imperious rocks. Sub surface dykes are water conservation structure constructed at suitable locations across the river beds at end of watershed to check sub surface flow of water along stream beds.

Dug well recharge is also applicable in rural area, in this the water from field is diverted in to recharge well through de-siltation chamber and filter media in well through delivery pipe.

In urban areas roof top rain water harvesting technique can be adopted. Municipal sewage and rejected waste water from industrial units in town and cities should be treated on large and such treated water could be used for irrigation gardening, horticulture etc.

5.0 Ground Water Related issues and problems

Long term water level trend analysis shows that majority of ground water monitoring wells are showing decline trend. This is due to heavy exploitation of ground water for agriculture and industrial user resulting in the 96% stage of ground water development as a whole the district may be treated as over exploited.

The successive drought due to scanty rainfall in the district has severely affected the agriculture activity resulting in the district falling under semi arid. The crises of drinking water are also worstened under such situations.

6.0 Awareness and Training Programme

Central Ground Water Board, North Central Region, has not organized any mass awareness programme, water management training programme Mela, fair etc. expect Artificial recharge through open dug wells in over exploited blocks of Shajapur district.

7.0 Recommendation

- The Stage of ground water development of Shajapur district as a whole is 98% which reveals that there is very less scope for future development of G. W. and depletion of ground water levels is recorded almost in all parts of the district due to the fact that withdrawal of ground water is exceeding the recharge and successive deficit in monsoon rainfall.

- Mass awareness programme and training programme by the scientist of Central Ground Water Board on ground water conservation and artificial recharge techniques should be conducted to aware the peoples and user agencies.

- It has been mandatory to implant the suitable rainwater harvesting techniques on the detailed hydrogeological and scientific basis delineating the productive and promising flow of Deccan traps by the use of satellite imagery and aerial photographs to locate worthy area for artificial recharge.

- Conjunctive area of surface water and ground water is recommended in the entire district.

- Roof Top Rain Water Harvesting project should be implemented in urban areas of Shajapur district.

- Cultivation in the district depends mostly on precipitation irrigation from ground water contributes upto 94.22% of the total area. This heavy dependence on ground water resources the existing medium and minor irrigation project should be utilized for assured irrigation.

- Municipal sewage and rejected waste water from industries units in town and cities should be treated and such treated water could be used for irrigation in gardening and horticulture etc.

- De-siltation of existing Ponds and Tanks structures / should be carried out every year to improve the ground water recharge through them.