भूजल सूचना पुस्तिका

साहेबगंज जिला, झारखंड

Ground Water Information Booklet

Sahebganj District, Jharkhand State

Petrified fossils at Mandro, Sahebganj, Jharkhand

केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)
राज्य एकक कार्यालय, राँची
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
State Unit Office,Ranchi
Mid-Eastern Region
Patna

सितंबर 2013

September 2013

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Prepared By

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GROUND WATER INFORMATION OF SAHEBGANJ DISTRICT, JHARKHAND STATE

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SAHEBGANJ – DISTRICT AT A GLANCE

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1.	GENERAL INFORMATION		
	i) Geographical Area (Sq km.)	1600 Sq. km.	
	(16) Administrative Divisions (As on 2007) Number of Block Number of Panchyat / Villages	 9 132/1807	
	(ii) Population (As on 2011 Census)	1150567 persons	
	(iii) Average Annual Rainfall (mm)	1575 mm	
2.	GEOMORPHOLOGY	Rajmahal hills and Ganges plain	
	Major Physiographic units		
	Major Drainages	Ganga, Gumani and Morang	
3.	LAND USE (Sq Km.)		
	a) Forest area:	427.4	
	b) Net area sown:	414.6	
	c) Cultivable area:	473.10	
4.	MAJOR SOIL TYPES	Inceptisols (Shallow black soil)Alfisols (Older Alluvial soils) ultisols (Lateritic soils)Light textured Slightly Acidic Poor in N & P Fairly rich in K	
5.	AREA UNDER PRINCIPAL CROPS	Pulses – 44.1 Oilseeds – 13.58 Paddy – 284.43	
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number of Structures)	Nos.	Area(Ha)
	Dugwell	1361	906
	Tube wells /Bore wells	187	672
	Tanks / Ponds	133	225
	Canals	Nil	-
	Other Sources	797	1261
	Net irrigated area		
	Gross irrigated area (Ha)		3066
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-03-2012) No of Dugwell No. of Piezometers	 8 Nil	
10.	PREDOMINANT GEOLOGICAL FORMATIONS	Rajmahal Trap, Laterite alluvium	
11			
	➢ Major Water bearing formation ➢ (Pre-monsoon Depth to water level during 2012) in mbgl ➢ Post-monsoon Depth to water level during 2012) in mbgl ➢ Long term water level trend in 10 yrs (2002-2011) in m / yr. (All period)	 4.60 – 12.00 2.85 – 7.93 Rise = 0.086 – 0.260 Fall = 0.036 – 0.413	

12.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-07)	
	No. of wells drilled (EW, OW, PZ, SH, Total	EW – 8, OW – 5
	Depth Range (m)	23 – 200 mbgl
	Discharge (litres per second)	6.12 – 51.6 m^3/hr.
	Storativity (S)	$1.4x10^{-4}$ to $7.3x10^{-5}$
	Transmissivity (m^2/day)	32.3 – 176 m^2/day
13.	GROUND WATWER QUALITY	Good
	Presence of Chemical constituents more than permissible limits (e.g. As in alluvial area)	EC 193 to 1687 micro mhos/cm at 25^0 C.
	Type of Water	Alkalanity
14.	**DYNAMIC GROUND WATER RESOURCES (2009) in ham.(Net annual ground water availability)**	**11613.70 ham**
	Net Annual Ground Water Draft	2606.09 **ham**
	Projected Demand for Domestic and Industrial uses for next 25 years	1976.48 **ham**
	Stage of Ground Water Development	22.44%
15.	**AWARENESSS AND TRAINING ACTIVITY**	
	Mass Awareness Programmes Organized Date Place No. of Participants	Nil
	Water Management Training Programmes Organized	Nil
16.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Projects completed by CGWB (No & Amount spent)	Nil
	Projects under technical guidance of CGWB (Numbers)	Nil
17	**GROUND WATER CONTROL AND REGULATION**	
	Number Of OE Blocks	Nil
	No. of Critical Block	Nil
	No. of Blocks notified	Nil
18.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Arsenic occurs more than permissible limits in ground water in some of the villages.

"Ground Water Information Booklet"
Sahebganj District,
Jharkhand State

1.0 Introduction

1.1 Administration

The district Sahebganj is situated in the north – eastern part of the Jharkhand state. It is bounded in the north by a small portion of Bhagalpur and Kathihar districts of Bihar state, in the east by West Bengal, in the south by Pakur district and in the west by Godda district and a portion of Bhagalpur district (Bihar). The district is situated between 24^0 43' 00"and 25^0 50' 45" North latitude and 87^0 27' 30" and 87^0 58' 15" East longitude. The district covers Survey of India toposheets nos. 72 O/ 7, 72 O/ 8, 72 O/ 11, 72 O/ 12, 72 O/ 16, 72 P/5, 72 P/ 9, 72 P/10, 72 P/13 and 72 P/14.

The district has two sub divisions i.e. Sahebganj and Rajmahal and nine blocks namely – Sahebganj, Borio, Taljhari, Rajmahal, Barharwa, Pathna, Barhait, Mandro and Udhwa (Fig. 1). Total population of the district is 1234 (as per census of 2001). The administrative division with population of the district is given in table – 1.

1.2. River System

The river Ganges forming the northern boundary of the district enters into it along the north – west corner and flow eastward upto Sakrigali. Here it takes a turn to the south and then forward forming the eastern boundary of the district upto a little beyond Radhanagar in Rajmahal sub division. The other rivers of the district are Gumani and Morang. The river Gumani flows SW to NE direction upto Barhait then it turn to east direction. The river Morang flows from north to south direction and join river Gumani near Barhait. The drainage pattern of the district is dendritic. All these rivers are seasonal in nature except the river Ganges.

1.3. Irrigation

Paddy and maize are important crops grown in the district. Linseed, groundnuts, sweet potatoes and khesari are other crops grown widely in Rajmahal and its adjoining areas. Irrigational facilities are not adequate in this district. The most common source is the dug well, but this is not a very dependable source of irrigation. The major part of the district being rocky in nature, it is difficult to dig wells. The undulating nature of land makes it possible to store rain water by bunding. Apart from being dependent upon rains, these are by no means adequate. The result is that failure of rains invariably involves failure of crops except in small pockets.

1.4 Previous Studies

Central Ground Water Board has established a network of observation wells under National Hydrograph Network programme to study the behavior of ground water level and quality of ground water in the district. The systematic hydrogeological survey has been carried out during the year 1976 – 77 and ground water management study has been carried out under the AAP 2006 – 07 and collected the actual field data for the study of ground water conditions in respect of quality and quantity. The board has also carried out exploratory drilling in the district and drilled five bore wells to know the sub – surface geology, depth and thickness of water bearing formation with their yield and determine the different aquifer parameters (Table - 2).

2.0 Rainfall and Climate

2.1 Rainfall

The area receives rainfall by South-West monsoon. Rainy season sets in the middle of June and lasts till September. The normal average rainfall) in the district is 1575 mm.

2.2 Climate

The district is characterized by humid to sub-humid climate. During summer the hot spell prevails from March to middle of June. Rainy season started from middle of June to end to September. Winter starts from the middle of November and continues till the end of February. The district experiences great heat from March to May, when the maximum temperature reaches upto 44.4^0c. December being the coldest month when the minimum temperatures fall down up to 6.8^0c.

3.0 Geomorphology and Soil types

3.1Geomorphology

Major part of the district is characterized by undulating topography covered by basaltic flows of Rajmahal Trap. The district is mainly drained by the rivers Ganges, Gumani and Morang. All there rivers are seasonal in nature except the river Ganges. The river Gumani and Morang contribute to the major surface run – off during monsoon. The main geomorphological features of the district are scarp on the northern part of the area, flat alluvial terrain in the eastern fringe of the district and resistant lava plateau of Rajmahal which rises above the general level and occupies major part of the district. The general evaluation of the hills and plateaus varies from 57 to 375 m above msl.

3.2 Soil

The major soil type of the district is the Rajmahal type soil witch derived from basaltic lava. These soils are black in colour, very fertile and restricted to Rajmahal lava areas. The other soil type of the district are red soil, eroded scarp soil, foothill soils, Tal soil and alluvial soil. The red soils are light to medium and are red to yellow or light grey in colour. The eroded scarp soil occurs in transverse section of dissected, descending scarp land at various altitude of upland. The yellowish red foothill soils occur in the eastern fringe of the district. The Tal soil is found in the back water belt of the Ganga around Barharwa when the rain water remains stagnant in the rainy season. The clayey loam type alluvial soil occurs near Sahebganj plains.

4.0 Ground Water Scenario

4.1 Hydrogeology

Rajmahal Trap is the major rock type in the district. The other geological formations of the district are alluvium and Laterite.

The alluvium occurs in the northern and eastern boundary of the district, which is composed mainly of sand and sub ordinate clay. Laterites are mainly of insitu origin and have been formed by sub-aerial eroson of underlying basalts under favorable climatic conditions. Laterites provide a productive ground water reservoir due to its very good porous and permeable in nature.

Rajmahal traps having a large thickness of basaltic lava flows occurs in the major part of the district. The different units of the lava flows are the main water bearing horizons in basaltic formation. The basic properties such as the ability to receive recharge, holding capacity of water to take into storage and transmit it as ground water by gravity are different for different litho units of the trappean flows. The massive basaltic unit is hard and compact in nature with negligible primary porosity and permeability. But the process of weathering and development of secondary porosity such as joints and fractures makes it to act as good ground water reservoir. The vesicular units have abundant vesicles that contribute towards hydrogeological properties and thus have high degree of porosity and permeability to serve as potential aquifers. The ground water occurs in near surface in weathered, joined and fractured basalts zone under water table conditions. The water bearing zone occurring between depths of 15-40 m are either interflow weathered shear zones and directly connected to shallow aquifer in widely spaced major joints and fractures and forms semi confined aquifer. Below the depth of 40 m, where the fracture porosity is insignificant, the weathered flow contacts are completely cut-off from lower aquifer on account of intervening high impermeable massive basalts and intertrappean beds and thus give rise to confining conditions. The Hydrogeolocical map is shown in Figure 4.

4.2 Exploratory wells: To understand the sub – surface geology, identify the various water bearing horizons including their depth, thickness and compute the

hydraulic characteristics such as transmissivity and storativity of the aquifers, exploratory drilling programme was carried out by Central Ground Water Board during AAP 1982 – 83 and 05 exploratory wells and 04 observtion wells were drilled in the district. In addition, 3 exploratory wells and one observation well drilled during 2012. The depth of exploratory wells ranges between 44.20 to 100.00 mbgl. The static water level of these exploratory wells varies from 5.53 to 9.30 mbgl. The Transmissivity value varies from 32.30 to 176.00 m^2/ day while the Storativity value varies from 07.00 X 10^{-5} to 07.70 X 10^{-5}. The detail of exploratory wells drilled by Central Ground Water Board in Sahebganj district is given in table – 2.

Depth to Water Level: - There are eight numbers of permanent observation well (HNS) of Central Ground Water Board is located in the district for monitoring of ground water regime. During the year 2012, the pre monsoon depth to water level was monitored between 4.60 to 12.00 mbgl. while the post monsoon water level observed between 2.85 to 7.93 mbgl. The pre monsoon and post monsoon depth to water level maps (2012) of the district prepared and shown in Figure 2 and 3 respectively.

4.3.1Seasonal water level fluctuation: - From the pre monsoon and post monsoon depth to water level data collected during May 2012 and November 2012 respectively, water level fluctuation were computed for all the HNS located in the district. The water level fluctuation of the district varies from 0.28 to 9.15 m.

4.4 Long Term Water Level Trend: - Water level of an area depends upon various factors like the storage of ground water development and variation in rainfall over a long period, recharge from rainfall and different sources. Central Ground Water Board has established eight National Hyrdograph Stations (NHS) for the study of water level behavior in the district. The water level data of each station has been analyzed. Pre monsoon and post monsoon long term water level trend has been calculated for the period of 2002 – 2011 (Table 4). The long term water level trend is showing rising trend between 0.006 – 0.530 m/year, 0.116 – 0.274 m/ year and 0.086 – 0.264 m/ year for pre monsoon, post

monsoon and all season respectively. Similarly, the long term water level trend is showing falling trend between 0.018 – 0.404 m/year, 0.026 – 0.561 m/year and 0.018 – 0.413 m/ year for pre monsoon, post monsoon and all period respectively. About 37.5% of NHS showing rising trend of ground water while 25% of NHS showing falling trend for pre and post monsoon period. Similarly, about 37.50% of NHS shows rising trend and rest 62. 50% show declining trend for all seasons.

4.2 Ground Water Resources

Based on the recommendation of the Ground Water Estimation Committee – 1997 (GEC – 1997), block wise the ground water resource assessment has been carried out for all the blocks of the district. The net ground water availability of the district is 11613.70 ham. The gross ground water draft for all uses of the district is 2606.09 ham. The average stage of ground water development in the district is 22.44 %. All blocks of the district are falling under “Safe” category. The stage of ground water development varies from 8.20% to 46.26% (Table – 6, Fig. 5). The net ground water availability for future irrigation development for the district is 8513.63 ham. The State of Development map is shown in Figure 5.

4.3 Ground Water Quality

To evaluate the quality of ground water, samples have been collected from 5 representative HNS during the May – 2011. These samples were analyzed to assess the chemical quality of ground water and its suitability for drinking and irrigation purposes. The samples represent the quality of phreatic zone or the shallow zone. The ground water samples were analysed for major chemical constituents by using standard procedure at chemical laboratory in CGWB, MER, Patna. Analysed results are given in Table 5.

The results of ground water samples were analyzed in accordance with the standard (ISI – 1993) for drinking purpose. In general the quality of ground water in the phreatic aquifer is suitable for drinking and irrigation purpose except

few samples, which shows nitrate concentration more than permissible limit. The EC value ranges from 193 – 1687 micro Siemens/cm at 25^0c.

During the Ground Water Management Studies (AAP 2006 – 07), 60 acidified samples were collected form Gangetic alluvium of the district for the study of Arsenic in ground water. As per the analytical results of these samples, the Arsenic concentration is found more than 50 ppb in 20% of the samples and in 16.66% of the samples Arsenic value ranges between 10 – 50 ppb.

4.4 Status of Ground Water Development

There is sufficient scope for ground water development through shallow as wells deep bore wells. State Govt. department has been constructed a large number of bore wells to mitigate the drinking water problem in the district. Central Ground Water Board has drilled 8 exploratory wells 5 observation wells in the district. The depth of bore wells ranges between 44.20 – 200.00 mbgl. The yield of bore wells ranges from 1.08 to 30.00 m^3/hr. The Transmissivity and Storativity value ranges from 32.30 to 176.00 m^2/day and 01.40 x $10^{-4}$to 07.30 x 10^{-5} respectively (Table 2). The stage of ground water development of the district is only 22.44%.

5.0. Ground Water Management Strategy

5.1. Ground Water Development

Dug wells and shallow to medium depth (upto 50 m) bore wells are the main ground water extraction structures in the area to meet the increasing demand of domestic water supply and irrigation. The overall stage of ground water development of the district is 22.44% only. Thus, there is sufficient scope for development of ground water through dug wells, shallow and medium deep bore wells.

Construction of dug cum bore well structure is also suitable for enhancing the yield of dug wells, which will be coast effective. The ground water development varies in different places depending on the availability of favorable

potential zones / aquifer. For the construction of ground water structures, knowledge of the local as well as regional hydrogeological condition of the area is necessary.

Ground water potential available for future development, considering the present ground water draft has been worked out as per norms of Ground Water Estimation Committee – 1997 (GEC – 1997) and the details of ground water recharge, net annual ground water availability, annual draft, net ground water balance and stage of ground water development has been assessed and presented in table - 6.

5.2. Water Conservation and Artificial Recharge

In view of the increasing thrust on development of ground water resources, there is urgent need to augment the depleting ground water resources. This gets augmented through natural recharge and can be augmented in a increased scale through artificial recharge. From hydrogeological point of view, rain water conservation is needed to arrest decline in ground water levels and to improve ground water quality by dilution. The construction of water conservation structures, artificial recharge structures, depends on the topographic features, hydrological and hydrogeological conditions of the area. From this point of view, the Sahebganj district may be divided into two parts – 1) the hard rock area i.e. basaltic terrain is undulating topographic setting with hills is suitable for check dam, gabion structures, percolation tank, contour bunding and trenching 2) the alluvial area is suitable for recharge shaft and percolation tank.

6.0 Ground Water Related Issue and Problems

The Arsenic concentration has been found more than permissible limits in some villages like Hazipur Bihta, Dihari, Bari Kudarjana, Nadhi Dera, Reza Nagar, Baluadiara and Chanan of Sahebganj block.

7.0. Awareness and Training Activity

7.1. The Mass Awareness Programme (MAP) by CGWB -NIL

7.2 Participation in Exhibition, Mela, Fair etc.: - Nil

7.3 Presentation and Lecture deliver in public forum / Radio / T.V / Institution of repute / Grassroots association / NGO / Academic institution etc.: - Nil

8.0 Area Notified by CGWA / CGWA

As per the ground water resource assessment of Jharkhand State, all the blocks of the district fall under the safe category. Thus, the authority has not notified any of the blocks.

9.0 Recommendation

1. As per the ground water management study 2006 – 07, Arsenic concentration in ground water is found more than permissible limit (> 50 ppb) in Hazipur Bihta, Dihari, Bari Kudarjana, Nadhi Dera, Reza Nagar, Baluadiara and Chanan of villages Sahebganj block. The alternate water supply schemes should be developed for arsenic affected villages from surface water source or ground water source after sealing the arsenic affected aquifers.
2. Nitrate concentration in shallow aquifer (dug well) is found more than permissible limit in / around villages like Sakrigali (Sahebganj block) and Borio (Borio block). The bore well may be a better alternate option for the drinking water purposes for the above villages.
3. The exploration data indicates the poor percentage of successful bore wells in the district. Thus the geophysical surveys may be adopted for selection of suitable sites for ground water exploration.
4. In order to conserve run – off water during monsoon, the water conservation and recharge structure may be constructed in and around Barharwa, Berhait, Borio, Sahebganj and Sakrigali villages where the long term (2002 – 2011) water level trend shows declining trend during post monsoon.

TABLE – 1: ADMINISTRATIVE DIVISIONS OF SAHEBGANJ DISTRICT

Sr. No.	Block	Area (Sq. km)	Rural population			Urban population		
			Male	Female	Total	Male	Female	Total
1	Sahebganj	173.27	39275	34631	73906	46449	41765	88214
2	Mandro	123.52	38114	37545	75659	--	--	--
3	Borio	261.74	45622	45259	90881	3612	3352	6964
4	Barhait	308.82	58922	56820	115742	7479	7006	14485
5	Taljhari	158.28	38659	37671	76330	--	--	--
6	Rajmahal	126.93	72364	68199	140563	14564	13286	27850
7	Udhwa	199.13	86122	81605	167727	4845	4691	9536
8	Pathna	163.16	41136	40804	81940	--	--	--
9	Berharwa	187.25	85678	82475	168153	6550	6067	12617
Total		1702.10	505892	485009	990901	83499	76167	159666

TABLE 2: DETAILS OF EXLPORATORY WELLS DRILLED BY CGWB IN SAHEBGANJ DISTRICT

Sr. No	Location/ Block	Depth Drilled (mbgl)	Length of casing pipe/ Depth const. (m)	Static Water Level (mbgl)	Dis-charge (m^3/hr)	Draw-down (m)	Specific Capacity (m^3/hr/m)	Trans-missivity (m^2/day)	Storativity
1	Barharwa	100.00	44.70	9.30	51.60	8.92	5.78	176.00	01.40 X 10^{-4}
	OW	90.70	--	--	--	--	--	--	--
2	Barhait	90.65	16.00	7.65	21.10	15.34	1.70	44.00	--
	OW	100.00	--	--	--	--	--	--	--
3	Borio	75.00	14.20	5.53	21.00	9.65	2.17	32.30	07.00 X 10^{-5}
	OW	44.20	--	--	--	--	--	--	--
4	Rajmahal	74.45	24.30	6.90	6.12	3.67	1.66	88.00	07.30 X 10^{-5}
	OW	74.45	--	--	--	--	--	--	--
5	Sahebganj	54.15	--	Abandoned					
6	Borio	200.00	29.70	Abandoned					
7	Mandro	200.00	32.00	Abandoned					
8	Taljhari	200.00	31.00	7.92	47.88	25.14	1.90	12.00	--
	OW	200.00	32.00	7.84	47.88	11.76	4.07	17.50	01.25 X 10^{-3}

TABLE 3: DEPTH TO WATER LEVEL OF EXISTING HYDROGRAPH NETWORK STATIONS OF SAHEBGANJ DISTRICT (2012)

Sr. No.	Location	Depth to water level (mbgl)			
		May 2012	Aug. 2012	Nov. 2012	Jan. 2013
1	Sahenganj	10.00	8.52	7.93	8.00
2	Rajmahal	6.00	4.45	3.00	5.22
3	Taljhari	12.00	2.25	2.85	4.81
4	Berhait	9.00	8.20	7.63	8.15
5	Barharwa	10.80	7.20	5.55	6.08
6	Borio	4.60	4.45	4.32	4.38
7	Mandro	6.90	1.60	5.08	3.55
8	Sakrigali	7.10	7.70	4.09	4.62

TABLE 4: LONG TERM WATER LEVEL TREND FOR EXISTING HYDROGRAPH NETWORK STATIONS IN SAHEBGANJ DISTRICT (2002 – 2011)

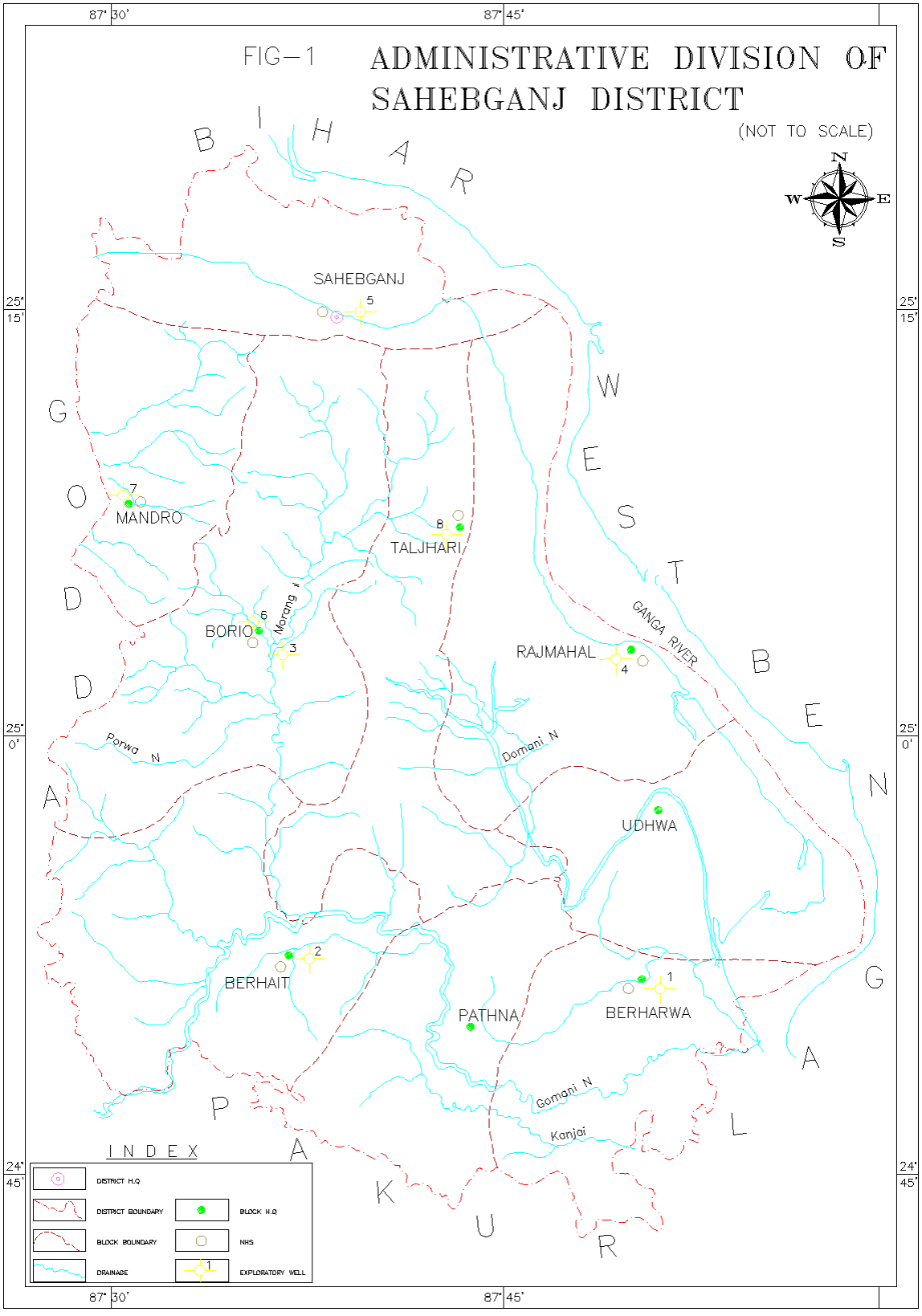
Sl. No.	**Location**	**Pre monsoon trend (m/year)**		**Post monsoon trend (m/year)**		**All period trend (m/year)**	
		Rise	**Fall**	**Rise**	**Fall**	**Rise**	**Fall**
1	Barhrwa	0.006	--	--	0.115	--	0.036
2	Barhait	--	0.018	--	0.561	--	0.270
3	Borio	0.530	--	--	0.026	0.201	--
4	Mandro	--	--	--	--	0.260	--
5	Rajmahal	--	0.404	0.116	--	--	0.104
6	Sahebganj	--	0.379	--	0.387	--	0.413
7	Sakrigali	--	0.072	--	0.058	--	0.018
8	Taljhari	0.484	--	0.274	--	0.086	--

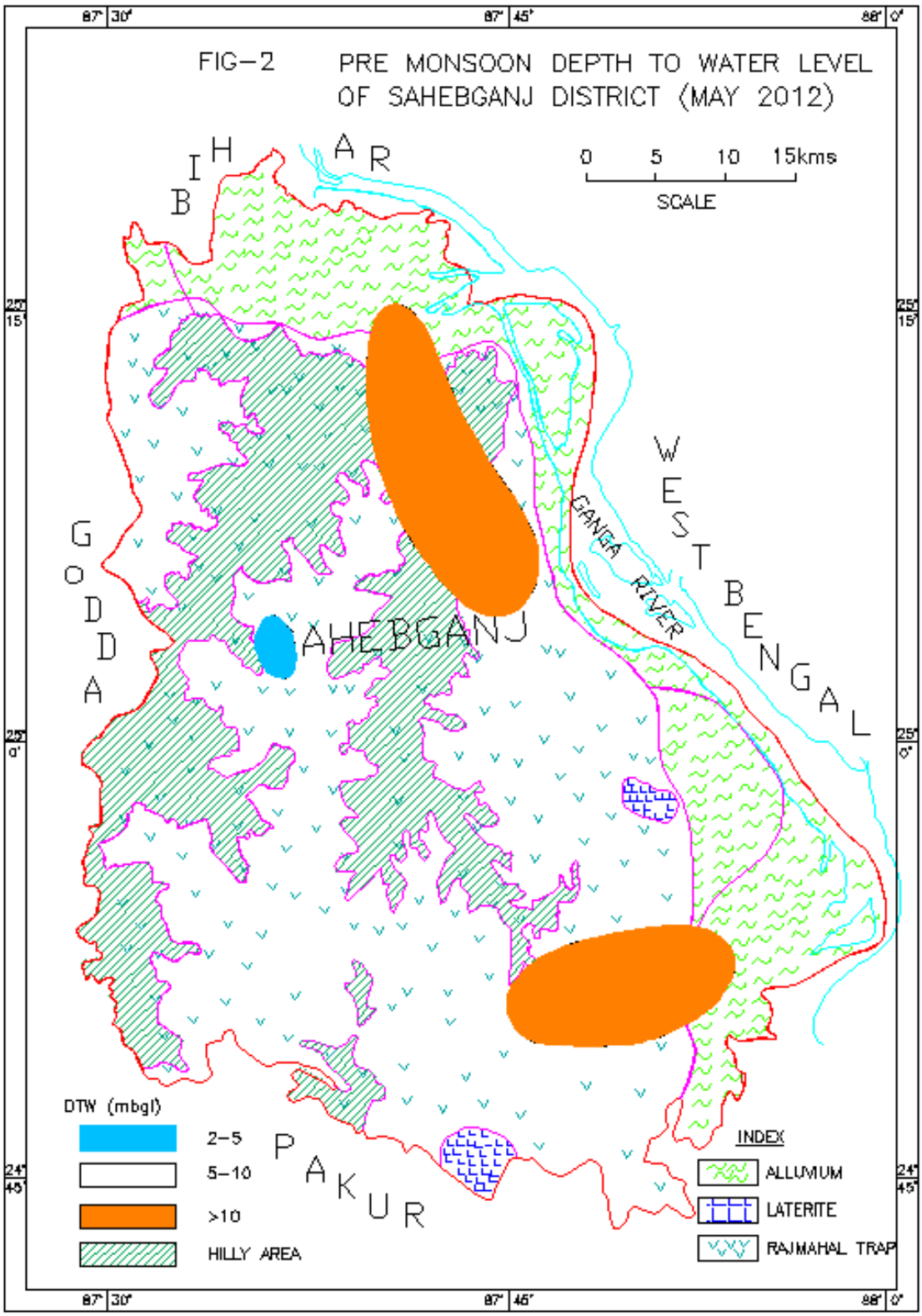
TABLE 5: CHEMICAL ANALYSIS RESULT OF WATER SAMPLES COLLECTED FROM SELECTED HYDROGRAPH NETWORK STATIONS OF SAHEBGANJ DISTRICT (May 2011)

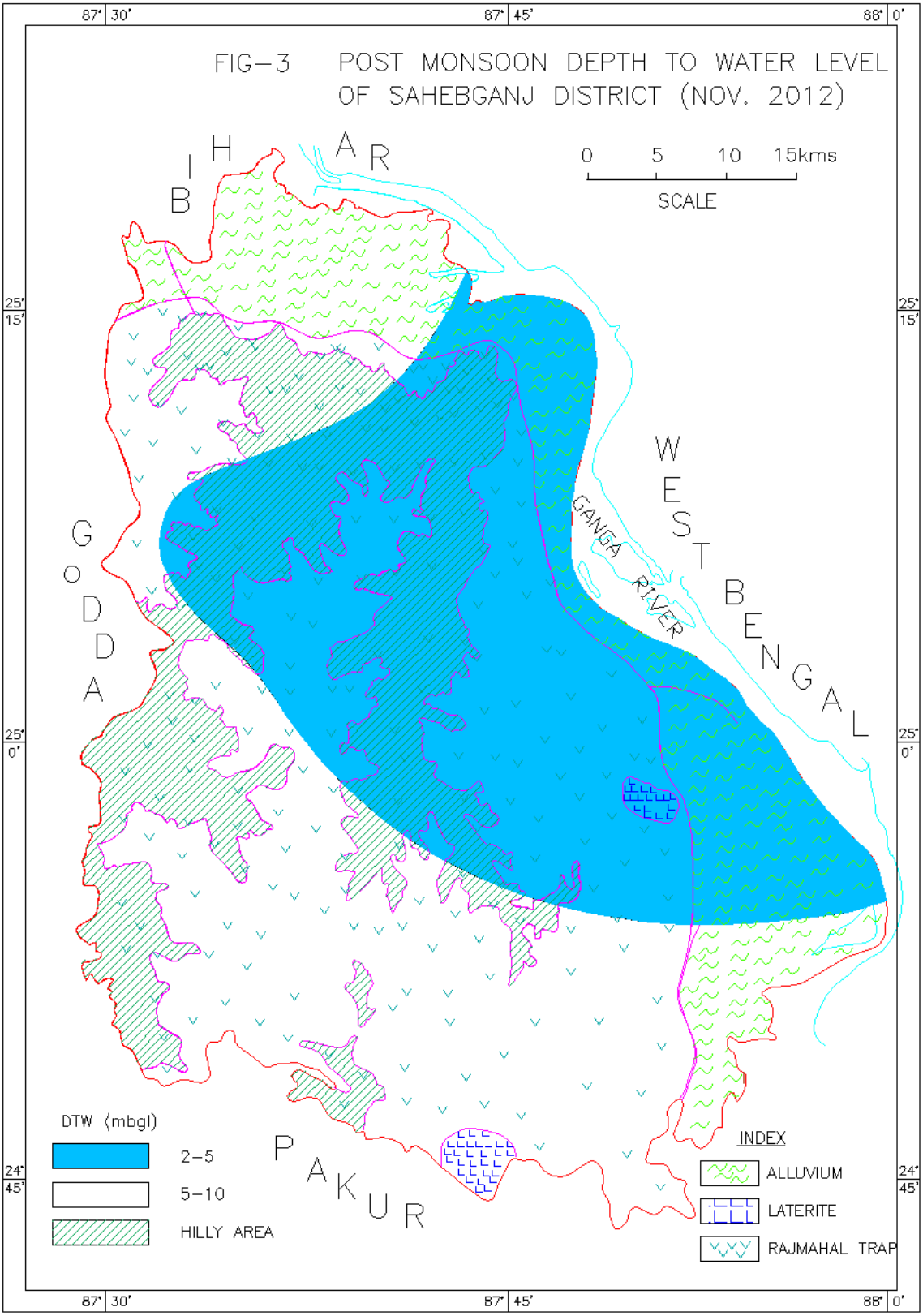
Well No.	Location	Block	EC in micro siemens/ cm at 25^0c	pH	TH as $CaCO_3$	Ca	Mg	Na	K	HCO_3	Cl
						← mg / l →					
1	Rajmahal	Rajmahal	1667	8.32	360	68	46.2	126	140	442.8	109.89
2	Berhait	Berhait	313	8.22	30	4	4.9	30	38	98.40	14.18
3	Barharwa	Barharwa	193	8.28	45	16	1.21	17	3.2	98.40	14.18
4	Borio	Borio	1687	8.30	380	60	55.9	124	87	221.4	439.58
5	Sakrigali	Taljhari	1404	8.14	260	48	34	187	6.5	332.1	166.61

TABLE 6: DETAILS OF GROUND WATER RESOURCES AND STAGE OF GROUND WATER DEVELOPMENT OF SAHEBGANJ DISTRICT AS ON 31st MARCH 2009 (in hectare meters)

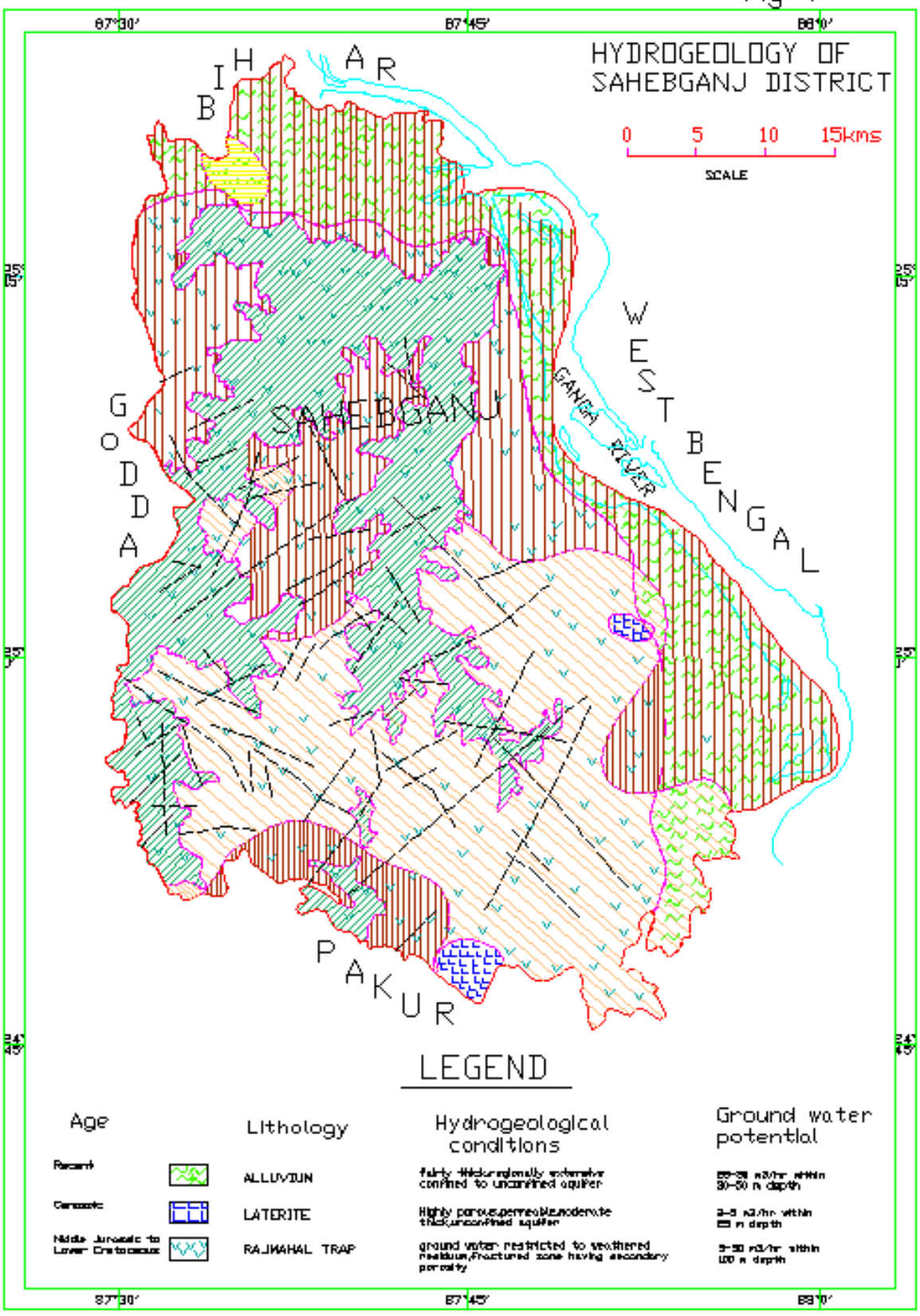
Sr. No.	Assessment Unit/ District	Net Annual Ground Water Availability	Gross Ground Water Draft for Irrigation	Gross Ground Water Draft for Domestic and Industrial water Supply	Gross Ground Water Draft for all Uses (10+11)	Allocation for Domestic and Industrial Requirement supply upto next 25 years	Net Ground Water Availability for future irrigation development (9 – 12 – 13)	Stage of Ground Water Development (12/9)*100 (%)	Categorisation for future ground water development (safe/ critical/ over - exploited)
1	2	9	10	11	12	13	14	15	11
1	Sahebganj	2365.41	25.056	168.99	194.05	225.30	2115.06	8.20	Safe
2	Mandro	462.87	111.36	100.79	212.15	217.14	1194.18	45.83	Safe
3	Borio	787.12	142.912	138.31	281.23	459.81	1785.75	35.73	Safe
4	Taljhari	386.78	58.464	108.06	166.52	144.06	184.26	43.05	Safe
5	Rajmahal	747.22	68.316	206.37	274.69	275.14	403.76	36.76	Safe
6	Udhwa	1978.59	31.552	219.49	251.04	292.62	906.10	10.90	Safe
7	Pathna	1292.89	112.752	114.19	226.94	1027.90	1219.05	17.55	Safe
8	Barharwa	1334.42	375.512	241.82	617.33	322.40	636.51	46.26	Safe
9	Barhait	1934.22	197.664	184.48	382.14	245.95	1490.60	19.76	Safe
	Total	**11613.70**	**1123.59**	**1482.50**	**2606.09**	**1976.48**	**8513.63**	**22.44**	

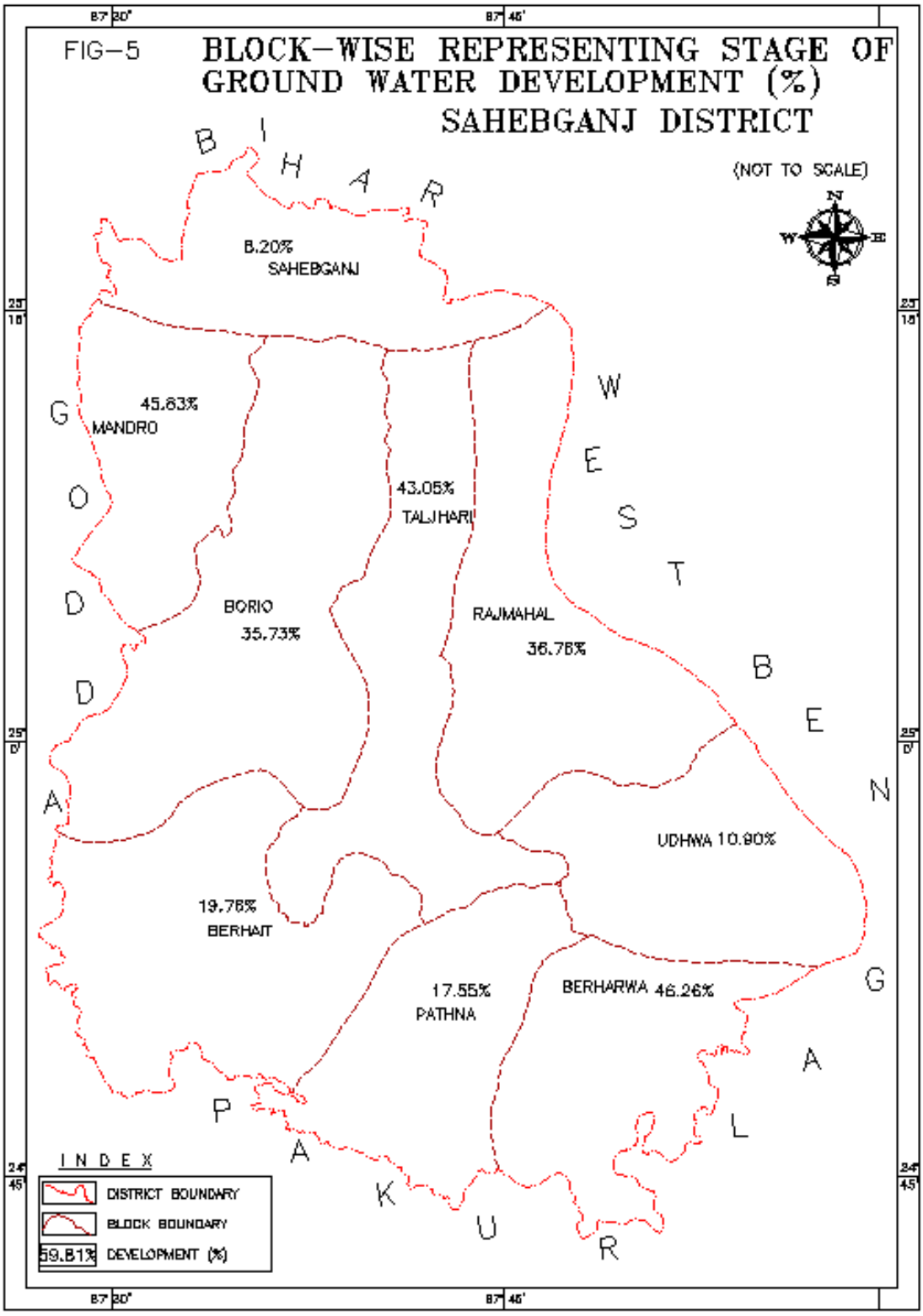

FIG–1
ADMINISTRATIVE DIVISION OF SAHEBGANJ DISTRICT
(NOT TO SCALE)
N
S
W
E
87° 30'
87° 45'
25° 15'
25° 0'
24° 45'
BIHAR
WEST BENGAL
GODDA
DUMKA
PAKAUR
SAHEBGANJ
5
MANDRO
7
TALJHARI
8
BORIO
6
3
RAJMAHAL
4
UDHWA
BERHAIT
2
PATHNA
BERHARWA
1
Morang
GANGA RIVER
Porwa N
Domani N
Gomani N
Kanjoi
INDEX
DISTRICT H.Q
DISTRICT BOUNDARY
BLOCK BOUNDARY
DRAINAGE
BLOCK H.Q
NHS
EXPLORATORY WELL


FIG–2 PRE MONSOON DEPTH TO WATER LEVEL OF SAHEBGANJ DISTRICT (MAY 2012)
BIHAR
0 5 10 15kms
SCALE
GODDA
SAHEBGANJ
GANGA RIVER
WEST BENGAL
PAKUR
DTW (mbgl)
2–5
5–10
>10
HILLY AREA
INDEX
ALLUVIUM
LATERITE
RAJMAHAL TRAP


FIG–3 POST MONSOON DEPTH TO WATER LEVEL OF SAHEBGANJ DISTRICT (NOV. 2012)
87° 30'
87° 45'
88° 0'
25° 15'
25° 0'
24° 45'
BIHAR
0 5 10 15kms
SCALE
GANGA RIVER
WEST BENGAL
GODDA
PAKUR
DTW (mbgl)
2–5
5–10
HILLY AREA
INDEX
ALLUVIUM
LATERITE
RAJMAHAL TRAP

Flg-4


HYDROGEOLOGY OF
SAHEBGANJ DISTRICT
0 5 10 15kms
SCALE
BIHAR
GODDA
SAHEBGANJ
GANGA RIVER
WEST BENGAL
PAKUR
LEGEND
Age
Lithology
Hydrogeological conditions
Ground water potential
Recent
ALLUVIUN
fairly thick,regionally extensive confined to unconfined aquifer
Cenozoic
LATERITE
Highly porous,permeable,moderate thick,unconfined aquifer
Middle Jurassic to Lower Cretaceous
RAJMAHAL TRAP
ground water restricted to weathered residium,fractured zone having secondary porosity


FIG–5
BLOCK–WISE REPRESENTING STAGE OF GROUND WATER DEVELOPMENT (%)
SAHEBGANJ DISTRICT
(NOT TO SCALE)
BIHAR
8.20%
SAHEBGANJ
45.83%
MANDRO
43.05%
TALJHARI
BORIO
35.73%
RAJMAHAL
36.76%
UDHWA 10.90%
19.76%
BERHAIT
17.55%
PATHNA
BERHARWA 46.26%
GODDA
WEST BENGAL
PAKUR
INDEX
DISTRICT BOUNDARY
BLOCK BOUNDARY
59.81% DEVELOPMENT (%)