

Problem of Ground Water in Vaishali District : A Geographical Study

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ABSTRACT-Vaishali district constitutes a part of Ganga river basin. It has two sub basins, namely Gandak Sub-basin and BurhiGandak, sub-basin. The major part of the district falls under BurhiGandak Sub-basin. The Gandak is the main river flowing in the southeasterly direction and forming western boundary of the district.

Main objectives of this study are, to study about the problems of Ground water, to study of scenario of ground water, to study of arsenic and its affects and to solve the problems of contaminated ground water.

The methodology of present study including field survey, procurement of data and maps, their analysis and preparation of data and maps, their analysis and preparation of diagrams and maps. The study is based on two types of data. These are the primary and secondary sources of data. Secondary data will be used in the present study for showing population gathered from published and unpublished census reports. Books and journals will be consulted for an indepth study of the problem. Maps and diagram will be prepared by suitable cartographic methods. These will form the base for analysing the problems under the study.

Keywords : Ground water, Water pollution, Arsenic contaminant.

INTRODUCTION :-Vaishali district was a sub-division of erstwhile Muzaffarpur district which was upgraded into a full fledged district on 2nd October, 1972.

The district is bounded in the north by Muzaffarpur, in the south by Patna (the river Ganga forms a natural boundary), in the east by Samastipur, and in the west by Saran (Gandak river), districts. According to Census 2011, population is 3495249 and out of this 3262715 (Rural) and 232534 (Urban). There are 16 development blocks.

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Gandak is the main river flowing in the southeasterly direction and forming western boundary of the district. It discharges in the river Ganga near Hajipur. River Gandak does not receive any important tributary in its course. There are two important distributaries channels namely the Gandaki and the Baya rivers flowing parallel to the river Ganga. The Baya runs through the central part of the district in north-south direction.

The average annual rainfall in the district is 1168 mm. The district receives about 85% of the total rainfall from south-west monsoon the south west monsoon extends from the middle of June to end of September. The district receives 50% of the rainfall during July and August months of the years.

Methodological Approach-The methodology of present study includes field survey, procurement of data and maps, their analysis and preparation of data and maps, their analysis and preparation of diagrams and maps. The study is based on two types of data. These are the primary and secondary sources of data. Secondary data will be used in the present study for showing population gathered from published and unpublished census reports.

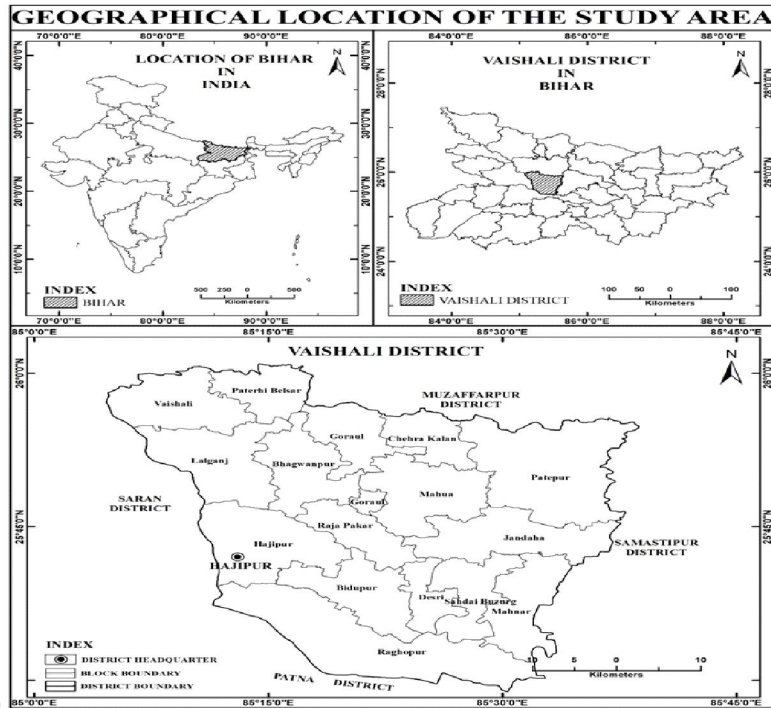
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Study Area-Vaishali district lies between north latitude 25°28'0" to 26°5'0" and east longitude 85°5'00" to 85°40'00". It covers a part of the degree sheet number 72G of survey of India. The geographical area of the district is 2015. 37 km². Its district headquarter is Hajipur. Vaishali (Hajipur) situated at the confluence of the river Gandak and the river Ganga, was a place of great strategic significance and remained the headquarter of the governors and the rulers of Bengal. This town had been an ancient urban site since very long. It was named after Haji Ilyas, the king of Bengal (1345-1358 A.D). The present Hajipur became the major town and headquarter of Vaishali district on 2nd October, 1972.

The historical records show that Hajipur was the revenue centre in the ancient past. Hence it had important roads even in the pre-British days. Presently the Hajipur town has relatively well developed means of communication. It has a dense network rail and roadways. The Hajipur has come under direct influence of Patna (the state capital of Bihar) after the construction of Gandhi Setu and since then has witnessed all sorts of impacts over transportation and industrial development. The notable rail links of N.E.R. (North East Railway) pass through the district

(i) Hajipur - Muzaffarpur - Samastipur line and (ii) the Chord line between Hajipur and Bachhwara. Hajipur has been also made the Zonal head of N.E.R. the gradual expansion of various transport means has helped the expansion of Hajipur town alarmingly.

Location Map of the Study Area



Source : Vaishali District Census Handbook, Census of India, 2011
Figure : I

Following are the main objectives of the study :

- Study of problems of ground water,
- Study of scenario of ground water,
- Study of arsenic and its affects,
- To study the steps solve the problems of contaminated ground water.

DISCUSSION :

GROUND WATER SCENARIO :

(i) **Hydrogeology :** Depth to ground water level during pre-monsoon (fig. 2) and post monsoon (fig. 3) for the year 2011, has been prepared. A perusal of the depth to water level map of pre-monsoon period indicates that water level is ranges from 7.15 to 8.90 bgl and in post-monsoon its ranges between 3.68 to 60.06 m bgl.

Exploratory drillings down to depth range of 127 to 300.15 m by CGWB at Lalganj, Hajipur and Goroul confirm presence of highly potential and thick sand and gavel layers. The zones tapped at Lalganj ranges from 141 to 220 meter for a total drilled depth of 240 m. Due to impervious clay layers at greater depth the aquifers are semi-confined to confined in nature. The storability value of the deeper confined aquifer is 0.13×10^7 and transmissivity value ranges between 621 and 5163 m^2/day . The piezometric head has been found to rest within 5 m bgl. A high discharge of more than 200 m^3/hr may be obtained from a well drilled to 300 m tapping sufficient thickness of confined aquifer.

(ii) **Ground water Resources :** The net annual replenishable ground water resource of the district is 71952 ham. The gross draft for all used, (irrigation, domestic and industrial water supply) as on 31st March 2009, is 40288 ham. The allocation for domestic and industrial requirement supply up to next 25 years in 8730 ham. The stage of ground water development of the district is 56%. Except the Rajapakar Block, all the fifteen blocks of district fall under safe category. The ground water can be further exploited for irrigation and other uses. Maximum ground water development is in Rajapakar Block (74.7%). While minimum in Vaishali block (34.5%) Details of ground water resources of all blocks are given in next page.

(iii) **Chemical Quality of Ground Water :** The chemical analysis of ground water of unconfined aquifer of May 2006 indicates that the water is potable and can be used for industrial and irrigation purposes. The ground water of the district is basic in nature and bicarbonate type. The range of concentration of major constituents is given below :

Sl.No.	Chemical Parameters	Range
01.	pH	7.48 – 8.78
02.	Specific conductance	550 – 2500 microhos/cm at 25°C
03.	Calcium	18 – 70 mg/l
04.	Magnesium	6 – 101 mg/l
05.	Bicarbonate	154 – 592 mg/l
06.	Chloride	18 – 426 mg/l
07.	Total hardness as CaCO ₃	190 – 270 mg/l
08.	Na	32 – 265 mg/l
09.	K	1.9 – 6.2 mg/l

However, in some villages in Biddupur Block geogenic contamination of ground water with arsenic in phreatic aquifer has been

reported by PHED, Govt. of Bihar. The arsenic concentration has been reported to be above permissible limit of more than 0.05 mg/l. In two tolas namely Miyatoli and Babhantola of Kalayanpur village, Biddupur block, arsenic concentration of 85% and 79% of the total samples collected shows arsenic level above permissible limit observed by PHED during blanket testing in the field using field test kit. A few ground water samples from affected wells were rechecked in CGWB laboratory. The results of the analysis are given below. In non of the samples the as

concentration has exceeded the permissible limit of 0.05 mg/l.

Sl.No.	Location	Source	Concentration mg/l
1.	Kalyanpur	H/P	0.033
2.	Kalyanpur	H/P	0.033
3.	Kalyanpur	D/W	0.012
4.	KalyanpurBhabhantola	H/P	0.033
5.	KalyanpurBhabhantola	H/P	0.033
6.	Kalyanpur-Miyatola	H/P	0.047

(iv) Status of ground water development block wise : In Vaishali district the state of ground water development is 56% (fig. 4). The existing gross ground water draft for irrigation is maximum in PatehiBelsar Block (5211 ham and minimum in Goroul Block (857 ham) out of the total existing ground water draft for the entire district for irrigation (34729 ham). The maximum water use for domestic and industrial purposes in Jandaha block (620 ham).

Ground water related issue and problems :

1. Arsenic Affected Areas : Ground water quality in some block is a matter of concern as geogenic contamination of Arsenic in ground water above permissible limit of 0.05 mg/l has been observed. A few villages from Biddupur block have been reported as arsenic affected (Source : PHED, Bihar).

2. Water-logging and flooding : The district has several small patches of area which remain submerged for longer periods. The district has 9036 hectares of land which remains permanently waterlogged. As the district is bounded on two sides by two major rivers, flooding is the major problem in the district.

5. Ground water management strategy :

(i) Water conservation and artificial recharge : Water conservation like contour bunds, tanks and ponds should be recommended in the low ground water development blocks with consideration of local topography, slope, depth to water level and public participation. In urban area there is concentration of water leading to over abstraction of ground water artificial recharge may be recommended.

(ii) Ground water development : A perusal of Table 2 indicates that most of the blocks in low ground water development category. The ground water draft for irrigation is very low in Chehrakalan, Garoul, PatehiBelsar, Desari and Rajapakar blocks, hence development of ground water for irrigation and other usages viz., soft drinks, mineral water plants, can be taken up on large scale. This will increase the per capita income of the local people. The development of ground water can be done both by shallow and deep tube wells.

Additional number of ground water structures like heavy duty tube well (discharge 150 – 200 m³/hr), medium duty tube well (discharge 100 m³/hr) and shallow tube well (discharge 50 m³/hr) should be recommended for proper development of available ground water resources in the above mentioned blocks of Vaishali district for irrigation.

After study of the lithologs of wells drilled by CGWB and the state Agencies it has been observed that the impervious day layer becomes thick in the south and south eastern part of the district. A high discharge tube well should have greater depth than those in the northern part of the district in the western part aquifer geometry suggests that at depth of 40 m nearly 10 to 15 m thick water bearing formation is encountered. But in the southern sector, most promising range of depth for tapping aquifer should be kept between 60 to 75 meters.

Suggestions :

(i) The water logged areas can be developed as pisciculture centre.
 (ii) In arsenic affected area deep drilling should be carried out to delineate arsenic free aquifer and to provide arsenic free water for drinking purpose.

(iii) The net annual replenishable ground water resource of the district is 719288 ham. the allocation for domestic and industrial requirement supply up to next 25 years is 8730 ham. the stage of ground water development of the district is 56%.

(iv) Flooding in the district can be minimized by removing the blockade and choking (drainage congestion) of the drainage courses of distributaries of river Gandak.

(v) Additional number of ground water structures should be recommended for proper development of available ground water resources in the low ground water development block of Vaishali district.

Conclusion-The situation has reached that none can take drinking water anywhere in the district for granted because it could be polluted with either excess of arsenic, fluoride or iron or it may be deficient in iodine.

While thousands of people in the district Vaishali have been affected by various diseases after consuming polluted water, many have even lost their lives. It has been observed that soil sediments in the flood plains of the Ganga are polluted with arsenic which continuously find its way to ground water. The school of environmental studies has revealed the presence of arsenic above the world health organisation's maximum permissible limit of 0.050 mg/l and patients with arsenical skin lesions have been identified.

However, in some village in Biddupur Block geogenic contamination of ground water with arsenic in phreatic aquifer has been reported by PHED, Govt. of Bihar, the arsenic concentration has been reported to be above permissible limit of more than 0.05 mg/l. In two tolas namely Miyatoli and Babhantola of Kalyanpur village, Biddupur block, arsenic concentration of 85% and 79% of the total samples collected shows arsenic level above permissible limit observed by PHED during blanket testing in the field using filed test kit.

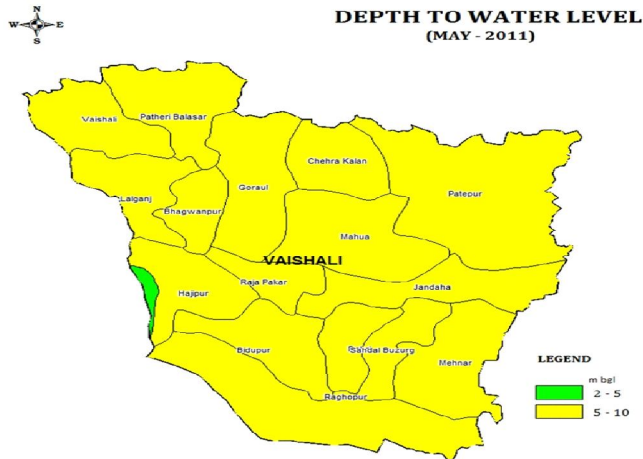


Figure 2. Blockwise Stage of Ground Water Development of Vaishali district, Bihar

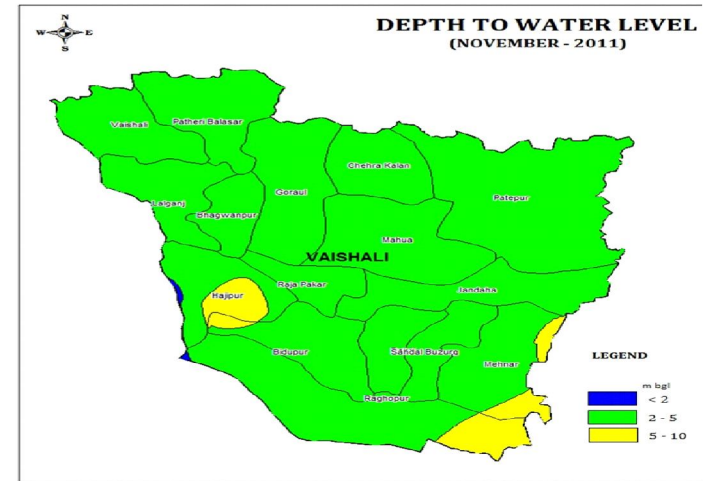


Figure 3. Blockwise Stage of Ground Water Development of Vaishali district, Bihar

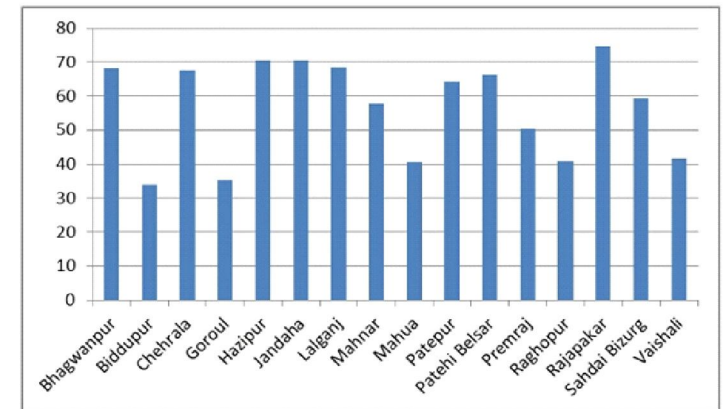


Figure 4. Blockwise Stage of Ground Water Development of Vaishali district, Bihar

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