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Issues Related to Over Utilization of Ground Water, Special Reference to District-North 24 Parganas, West Bengal, India

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Abstract: ***Groundwater is an important source of water supply throughout the world. It's use in rural and urban areas continuous to increase. Maximum Villages and Municipalities of North 24 Parganas District of West Bengal, India depend on only water source - Ground water. This study primarily seeks to analyze the effects of overutilization of aquifers in the study area and fluctuation of Piezometric surface. The entire study is based upon data gathered through reconnaissance surveys, primary and secondary data and analyzing them in the present context.***

Keywords: Groundwater, Overutilization, Aquifer, Piezometric surface, Land subsidence

1. Introduction

Groundwater referred to without further specification is commonly understood to mean water occupying all the voids within a geologic stratum. It is the water found underground in the cracks and spaces in soil, sand and rock. The area where water fills the aquifer is called the saturated zone (or saturation zone). The top of this zone is called the water table. The water table may be located only a foot below the ground's surface or it can sit hundreds of feet below the surface. Water moves through geologic formations of soil, sand and rocks called aquifers. **Aquifers** are typically made up of gravel, sand, sandstone, or fractured rock, like limestone. Water can move through these materials because they have large connected spaces that make them permeable. Groundwater is the largest source of usable, fresh water in the world. In many parts of the world, especially where surface water supplies are not available, domestic, agricultural, and industrial water needs can only be met by using the water beneath the ground.

The U.S. Geological Survey compares the water stored in the ground to money kept in a bank account. If the money is withdrawn at a faster rate than new money is deposited, there will eventually be account-supply problems. Pumping water out of the ground at a faster rate than it is replenished over the long-term causes similar problems.

2. Aim & Objectives

This study aims to explore the problems of overutilization of groundwater in North 24 Parganas district of West Bengal. The aforesaid aim of the study is further sub-divided into the following objectives:

1) To study the about the increasing demand of groundwater.
2) To assess the fluctuation of Piezometric surface and other effects of overutilization of groundwater.

3. Limitations

The study is largely based on secondary data owing to the constraints of time and resource. However, limited primary survey was undertaken as deemed necessary.

4. Methodology

1) Collection of information available from secondary sources and the electronic data from the Internet.
2) Construction of sample.
3) A questionnaire schedule for the study of local peoples' perception collection of primary data. The data is collected to get the views of the victims.
4) G.P.S. and Clinometre etc instruments have been used in the field survey.
5) Array and analysis of the information gathered. Computation of primary and secondary data and their cartographic representation, and Interpretation.

Some difficulties had to face regarding the collection of primary and secondary data and to set proper response from the local people, during the survey.

5. Location of the Study Area

North 24 Parganas is situated in the southern part of the Bengal Basin. The geographical extent of the district lies between $88^0 19^/$ E, $23^0 20^/$ N to $89^0 10^/$ E, $22^0 01^/$ N. The district consists of 22 blocks. Officially there are 1582 inhabited villages in and 679 Municipal areas (known as wards) in North 24 Parganas district. Extending over an area of 4094 km^2.

5.1 Existing Scenario of the Study Area

The detailed account of the sector wise consumption pattern is given in Table 1 which shows that agriculture will continue to dominate as the major sector of consumption of

ground water. By 2020, we would by using 24.37 mhm ground water, which is about 99% of total consumption of ground water. The present groundwater utilization scenario of the study area is-

Table 1: Patterns of present utilization and future requirement of water. (Source: Primary survey)

Water Use By Purpose	Utilization-2012(mhm)	Utilization-2014(mhm)	Future Estimated Requirement:2020(mhm)
Irrigation	17.34	22.12	37.22
Domestic use	2.13	3.12	6.03
Municipal supply	1.32	3.01	9.32
Livestock need	1.23	1.26	1.35
Others	0.59	0.82	1.56

Source of ground water of maximum urban and rural areas of this district is groundwater.Tube wells are the main sources of drinking water in rural areas.In maximum urban areas groundwater is the only one source of drinking water supply.

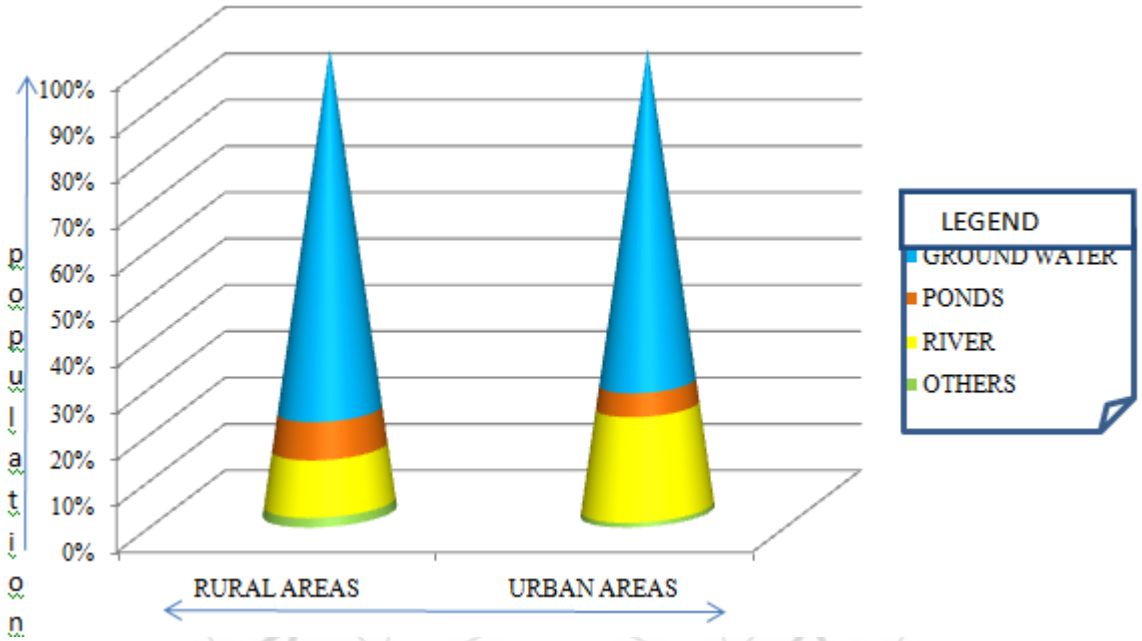

Figure 1: Sources Of Uses Of Ground Water, Source: Primary Survey

In view of the above scenario, it is difficult to specify the year by which the demand would exceed the maximum utilizable potential. However, it is certain that we would soon be facing water crises problems in a span of next 20-30 years. At local/regional level the problem of water scarcity may be witnessed much earlier either due to non availability of adequate water resources (even after tapping of adjoining water resources) or degradation of surface and ground water bodies due to industrial/domestic pollution or may be both. In urban/industrial towns, both these factors will play a vital role, as growing population will not only reduce per capita availability, but at the same time would cause pollution of existing water resources if sufficient control measures are not taken for its prevention. In domestic sector, the organized water supply is limited to urban areas, whereas rural population has to make their own arrangement to procure water for their daily requirements. Even in urban areas, with rapid pace of urbanization and industrialization in last two decades, the organized water supply does not cover up the entire urban population of that area and also the per capita availability of water is much below the stipulated standard of 300 LPCD (litres per capita per day) adopted by planners for planning and management of urban areas.

5.2 Effect of the Overutilization of the Ground Water

i. Collapse or Subsidence

Land subsidence occurs when there is a loss of support below ground. This is most often caused by over irrigation, mainly from the overuse of groundwater, when the soil collapses, compacts, and drops. Changes in groundwater levels or subsurface moisture conditions may be responsible for subsidence of land surface. Subsidence severely damage wells of Pifa, Nazhat, Tentulia, Charghat, Labongola, Chatra and too many irrigated area.Collapse of ground surface has been observed to occur when water is applied to certain types of soils, Particularly susceptible are:1) loose, moisture-deficient alluvial deposits, including mudflows and 2)moisture –deficient loess deposits. An example of loose, moisture-deficient alluvial deposits shallow subsidence is found Taki, Basirhat, Baduria, Tentulia, Swarupnagar etc area

Table 2: Areas of Major Subsidence Due To Groundwater Overdraft (Source: Field Survey)

Locations	Depth Range Of Compacting Beds (Meters)	Maximum Subsidence (Meters)	Approximate Area Of Subsidence (Sq.KM)
Pifa Tentultala, Basirhat	20-90	4.05	22
Lobongola, Swarupnagar	30-80	4.50	18
Kakra-Mirzanagar and Malatipur,Basirhat	20-100	6.12	33
Kankrasuti and Jasaikathi,Baduria	10-100	3.90	14
Tentulia,Chandipur	15-120	4.89	18

ii. Sackung

Sackung-type movements have typical surface expression as uphill-facing (antislope) scarps, tension cracks, grabens, and anomalous ridge-top depressions running roughly parallel to the contours in steep topography. Individual scarps, grabens, and cracks (collectively referred to here as "linears") have a typical relief of 1–10 m and may be traced over distances of 100 m to more than 3 km. Linears may be arranged sub-parallel to one another, or en echelon, and comprise slope-movement complexes covering areas of 1–10 km^2 that are clearly visible on air photographs.

iii. Reduced Surface Water Supply

Groundwater and surface water are connected. When groundwater is overused, the ponds, streams, and rivers connected to groundwater can also have their supply diminished. For example Taki, Bangaon, Swarupnagar, Gobordanga etc

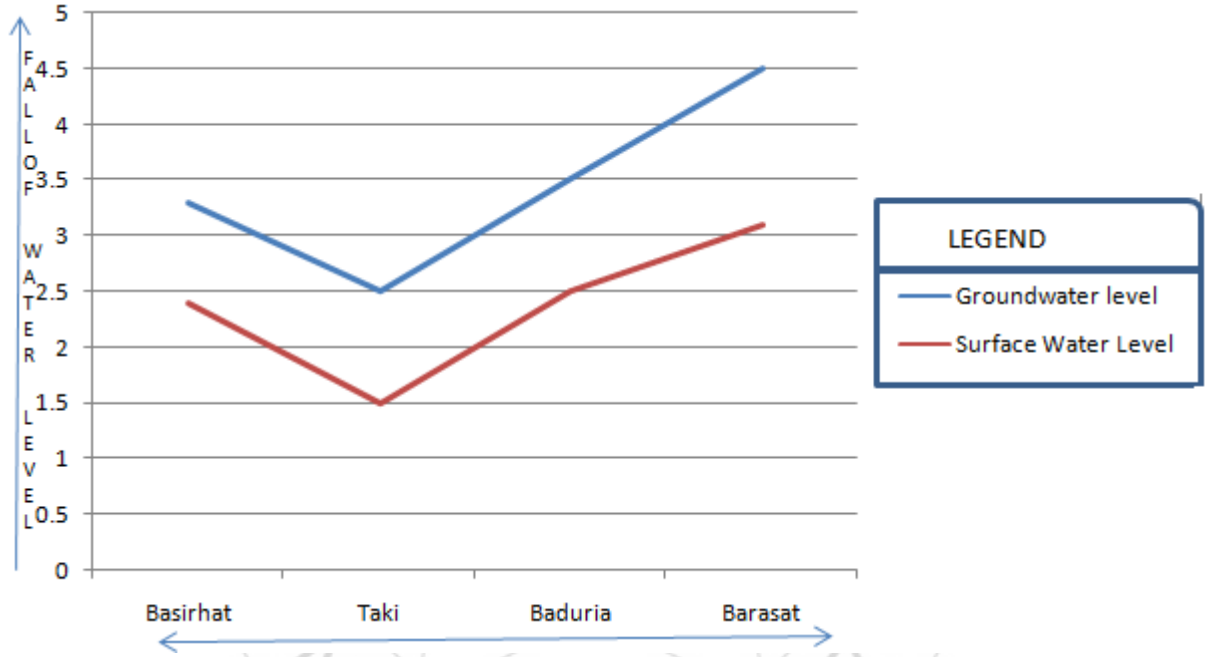

Figure 2: Changing Scenario of Ground Water Level During Summer (Source: Primary Survey)

IV. Lowering of Piezometric Level

Excessive pumping can lower the groundwater table, and cause wells to no longer be able to reach groundwater. Water level data of January 2014 was compared to January 2015 and the analysis shows that there is fall in water level in about 70.85% of the wells. 6% wells falls in the range of more than 4 m. 23% of the wells have shown fall in 0-2 m range. Maximum fall in water level has been recorded as 29.16 m in the district. Water Level Fluctuation (January 2015 to Premonsoon 2014) When compared the water level of January 2015, with Pre Monsoon 2014, the entire district shows Fall of water level is recorded in about only 9 % of the monitored wells in the district, out of which 7% lies in the range of 0-2 m. Fluctuation - January 2015 to January 2014. When compared the water level of November 2014, with Pre Monsoon 2014, the entire district shows fall of water level is recorded in about only 3 % of the monitored wells in the state, all of which lies in the range of 0-2 m. (primary survey)

V. Increased Costs

As the water table lowers, the water must be pumped farther to reach the surface, using more energy. In extreme cases, using such a well can be cost prohibitive. Mainly Barasat, Habra, Basirhat, Baduria etc Municipal area have to face this problem.

VI. Water Quality Conceerns

Excessive pumping in coastal areas can cause saltwater to move inland and upward, resulting in saltwater contamination of the water supply. Hingalgunge, Sandeshkhali-1 and 2, Hasnabad blocks are suffering for the problems.

VII. Settlement Subsidece

Groundwater-related settlement subsidence is the subsidence (or the sinking) of land resulting from groundwater extraction, and a major problem in North 24 Parganas as major swell without adequate regulation and enforcement.. One estimate has53% of serious settlement subsidence problems associated with the excessive extraction of groundwater, making it a growing problem throughout the world. Groundwater is considered to be one of the last 'free' resources, as anyone who can afford to drill, can draw up merely according to their ability to pump. Hingalgunge, Hasnabad, Aturia, Bagdah etc areas have to face this

problem. Subsidence is much more common than heave. The most common causes are: - Drying out and shrinkage of clay subsoil beneath the house foundations during drought periods, such as exceptionally hot summers. Heave is normally caused by the swelling of clay during wet winters after hot summers The effect of certain types of trees close to a property which can aggravate the subsidence/heave situation where clay subsoil exists. - Leaking drains and water mains can soften the ground beneath house foundations, or even wash away the material from beneath the foundations, thus causing subsidence.

VIII. Circular Scar

Rockbed subsidence, due to heavy pumping of confined aquifer is known as Circular scar, which is observed Barasat and Basirhat Municipal Area.

IX: Planer Scar

Cracks and faults of the ground surface, due to overutilization of aquifer is known as Planer scar, which are observed at different parts of Basirhat Subdivision.

X: Ground Water Contamination

At North 24-Parganas in use for drinking, cooking and 29.2% of the tubewells were found to have arsenic above 50 microg/L, the maximum permissible limit of World Health Organization (WHO) and 52.8% have arsenic above 10 microg/L, WHO recommended value of arsenic in drinking water. Out of the 22 blocks of North 24-Parganas, in 20 blocks arsenic has been found above the maximum permissible limit and so far in 16 blocks people have been identified as suffering from arsenical skin lesions. From the generated data, it is estimated that about 2.0 million and 1.0 million people are drinking arsenic contaminated water above 10 microg/L and 50 microg/L level, respectively in North 24-Parganas alone. Out of the 22 blocks of North 24-Parganas, in 20 blocks arsenic has been found above the maximum permissible limit and so far in 16 blocks people have been identified as suffering from arsenical skin lesions. From the generated data, it is estimated that about 2.0 million and 1.0 million people are drinking arsenic contaminated water above 10 microg/L and 50 microg/L level, respectively in North 24-Parganas alone. (J Environ Sci Health A Tox Hazard Subst Environ Eng. 2003 Jan;38(1):25-59).This contamination is also the effect of overutilization of groundwater.

XI. Crustal Uplift

The opposite of land subsidence, crustal uplift can occur over large areas subject to heavy groundwater pumping. The crustal uplift, involving an elastic expansion of the lithosphere, is caused by the removal of large masses of groundwater. The phenomenon has been noted in part of Bagdah and Basirhat.

XII. Others

Earthquake, rockfall, earthfall, debris fall etc rotational slide may be occurred due to overutilization of aquifer. Overulization of ground water also effect on hydrological cycle.

6. Conclusion

Water is essential to people and the largest available source of fresh water as well as drinking water lies underground. Increasing demands for fresh water have stimulated development of underground water resource. The present study attempts to investigate the effect of overutilization of ground water and concepts of water resource management have been established and research has contributed to a better understanding of the subject. Thus the knowledge of overutilization of aquifer, once veiled in mystery, has grown rapidly in recent decades.

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