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# A CASE STUDY: GROUND WATER SCARCITY AND MANAGEMENT IN EGRA-II BLOCK OF PURBA MEDINIPUR DISTRICT, WEST BENGAL, INDIA

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## ABSTRACT

Ground water is the water found underground in the cracks and void spaces in soil, sand and rock or geologic strata. It is stored in and moves slowly through geologic formation of soil, sand and rocks called Aquifers that is consisting of permeable material capable to store significant quantities of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with ground water is called the ground water table. It is also called subsurface water that is related through the hydrological cycle. The study of ground water is known as hydrogeology. Ground water scarcity is one of the most important concern of present day geographers. Ground water is essential for all socio-economic development and for maintaining a healthy livelihood in the world. At present reduction of ground water scarcity is prime goal of many countries and governments. Ground water scarcity is a regular threat for the people of Egra-II block in Purba Medinipur district which has great negative impacts on development. So it is very crucial to free the people of Egra-II block from this anathema of ground water scarcity. For this purpose this paper has been analyzed for the Ground water scarcity and management in Egra-II block in Purba Medinipur district.

**Keywords:** Aquifers, Geological strata, Ground water table, Hydrogeology, Permeable material, Subsurface water

## I. INTRODUCTION

Ground water is the water that occurs below the surface of Earth, where it occupies all or part of the void spaces in soils or geologic strata. It is also called subsurface water to distinguish it from surface water, which is found in large bodies like the oceans or lakes or which flows overland in streams. When rain falls to the ground, some of it flows along the land surface to streams, rivers or lakes, some moisturizes the ground. Part of this water is used by vegetation; some evaporates

  

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and returns to the atmosphere. Part of the water also seeps into the ground, flows through the unsaturated zone and reaches the water table, which is an imaginary surface from where the ground beneath is saturated. It is regulated by the quantum and speed of rains, extent of vaporization at the time of rain, temperature, slope of land, dryness of air, porosity and permeability of rocks, vegetative cover and water absorbing capacity of the soil etc. Ground water is recharged by rain water and snowmelt or from water that leaks through the bottom of some lakes and rivers. It also can be recharged when water supply systems leak and when crops are irrigated with more water than required. There are also techniques to manage aquifer recharge and increase the amount of water infiltration into the ground. The water table may lie deep or shallow depending on several factors such as the physical characteristics of the region, the meteorological conditions and the recharge and exploitation rates. Heavy rains may increase recharge and cause the water table to rise. But in the other hand, an extended period of dry weather may cause the water table to fall. It does not stand still in the aquifer. It normally will keep flowing but much slower than before reaching the aquifer. How fast ground water flows depends on the characteristics of the aquifer. The direction it moves from high to lower levels ruled by gravity, unless there is any anthropogenic impact such as pumping wells. It will move until it discharges into another aquifer or another water body like a lake, a river, the ocean or until it is extracted by a well. Total water existing on earth is 1384120000 cubic kms, out of which 8000042 cubic kms is ground water. So, ground water is 0.58% of the total water resources available in nature and it is 22.21% of fresh water part (2.6%) of total water reservoirs. Ground water is a very important natural resource and has a significant role in the economy. It is the main source of water for irrigation and the food industry. In general ground water is a reliable source of water for the agriculture and can be used in a flexible manner. In the rainy season, there is larger demand more ground water can be extracted and in the dry season, less ground water will need to be extracted. For the environment ground water plays a very important role in keeping the water level and flow into rivers, lakes and wetlands. Specially during the drier months when there is little direct recharge from rainfall, it provides the environment with ground water flow through the bottom of these water bodies and becomes essential for the wild life and plants living in these environment.

In general the main causes of ground water scarcity are climate change accompanies with high temperature, low precipitation and loss of vegetation cover but every geographical area should have some inborn causes related to its origin, structure, geographical location and setup. Egra-II block of Purba Medinipur is one of the most backward area of West Bengal and highly dependent on rural economy. But ground water scarcity is a regular phenomenon of Egra-II block. Ground water management is linked with poverty reduction especially in low income areas which are dependent on rural income. So it is very essential to identify the causes of ground water scarcity of the Egra-II block which is totally dependent on rural economy for the

  

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socio-economic development and to identify the management of ground water scarcity. Now I emphasize the ground water scarcity and management in Egra-II block of Purba Medinipur district, West Bengal, India.

## 2. SOURCE OF GROUND WATER

There are five source of ground water:

### 2.1. Connate water

At the time of rock formation water is trapped in the interstices of sedimentary rocks.

### 2.2. Meteoric water

It originates in the atmosphere, falls as rain and ultimately becomes groundwater by infiltration. It forms the major part of ground water.

### 2.3. Juvenile water

It originates in the earth's interior and reaches the upper layers of the earth's surface as magmatic water.

### 2.4. Condensational water

It is the prime source which replenishes water in deserts and semi-desert areas. During summer, land becomes warmer than the air trapped in the soil, which leads to a huge difference of pressure between the water vapour in the atmosphere and the water vapour trapped in the soil. Thus the atmospheric water vapour penetrates the rocks and gets converted into water due to falling temperature of the water vapour below.

### 2.5. Oceanic water

The sea water enters the ground through the cracks of the rock that creates the ground water reservoir.

## 3. OBJECTIVE

Ground water is a very important natural resource and has a significant role on socio-economic development of Egra-II block in Purba Medinipur district. In this study area the amount of ground water has decreased rapidly due to various natural and unnatural reasons. As a result, there is a shortage of ground water i.e. ground water scarcity. It is the main object for this study

  

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and analyzes the ground water scarcity and management in Egra-II block of Purba Medinipur district. Selection of this study area depends upon the following points:

1. To give the suggestion for better utilization of ground water,

2. To identify the causes of ground water scarcity,

3. How do we handle ground water,

4. How we will conserve ground water from misuse,

5. How we will increase the height of water table,

6. Protecting the ground water from pollution.

7. To identify different purpose of landuse,

8. To show different Landuse Planning,

9. To know the Socio-economic condition of people,

10. To know the causes of soil degradation,

11. Find out the reasons for the reduction in soil fertility,

12. To prepare suitable method for sustainable landuse,

## 4. METHODOLOGY

This study has been done on the basis of intensive visit of study area, extensive literature review, experimental documentary analysis and field observation to know the physical condition, socio-economic condition, agriculture, food processing etc. of this study area. Recent research papers published in different national and international journals, presented in different seminars and reports of Geological Survey of India are very essential and helping tools to ready this study.

## 5. LOCATION

In the district of Purba Medinipur, Egra-II block is a part of the Lower Ganga Plain. It is surrounded by Pataspur-II in north, Ramnagar-II in the south, Contai-I and III in the east and Egra-I in the west. The latitudinal extension is about 21°47´N to 22°3´N and longitudinal extension is about 87°25´E to 87°35´E.

  

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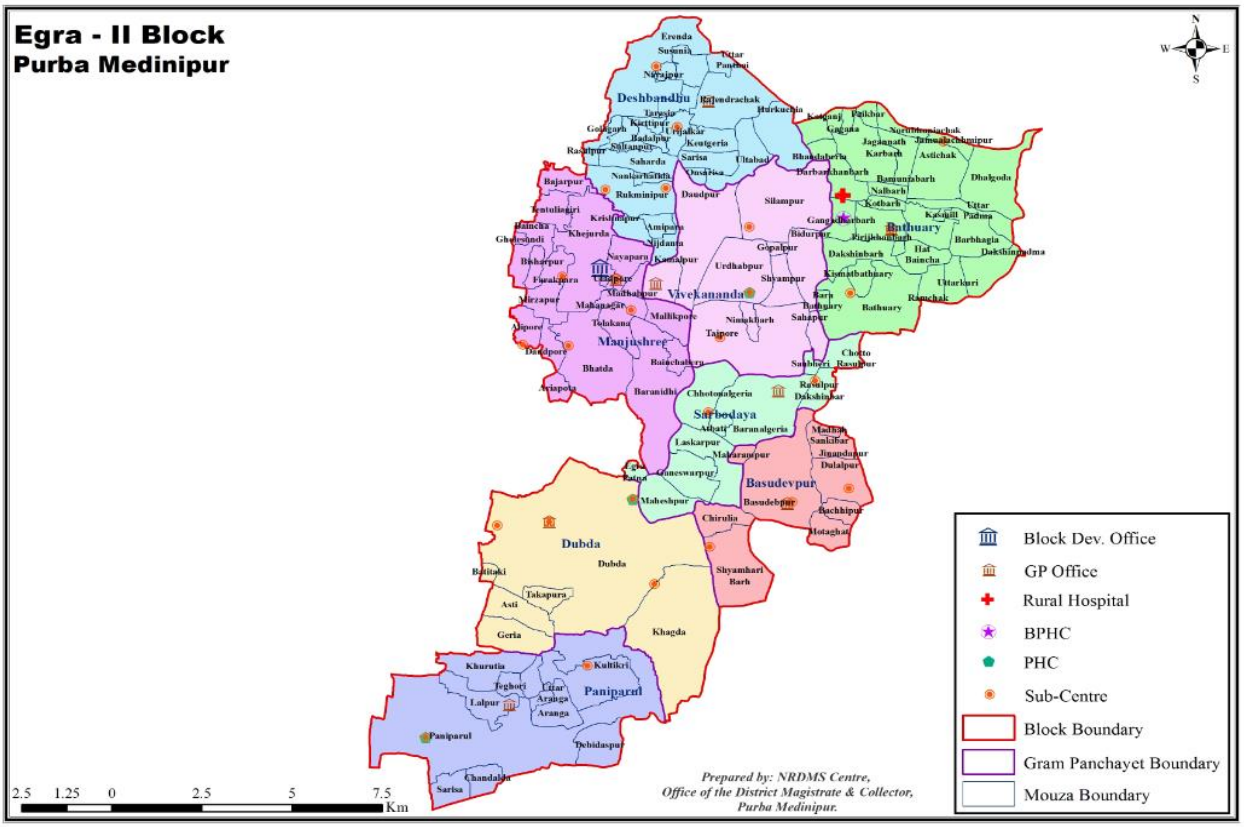
## 6. LOCATION MAP OF STUDY AREA

**Purba Mednipur Tehsil Map**





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## 7. REGIONAL SETTING

Egra-II block is accessible by road from Kolkata (180 km) by following NH-6 up to Kolaghat, NH-41 up to Nandakumar and SH-4 up to contai. This block has access from SH-4 at Contai, Otherwise from Kharagpur (90km) by road up to Egra. It is located about 80 km from Tamluk, the district headquarters.

## 8. PHYSICAL ENVIRONMENT OF STUDY AREA

Egra-II block is a famous block for its great physical environment. This block is characterized by alluvial plain and it is a flood prone area. The physical characteristics of this study area are given below:

### 8.1. Geology

This study area is gradually changing with alluvium deposit of Gangetic delta. This area consists of silt and clay covering successively. The clay is more in this study area than silt. Some fluviatile sediments are found. There is more water conservation capacity for mud spaces. So the infusion of surface water is low. As a result, the recharge rate of groundwater is comparatively lower.

### 8.2. Physiography

The general surface of this study area is very gentle gradient and is nearly flat surface with very slow run-off towards the east and south-east. This area belongs to the eastern gangetic alluvial plain. Physiographically this study area is situated in micro-region of contai plain in Purba Medinipur district. The average elevation is nearly 5-7 meters above MSL. This region is well cultivated in nature. Rasulpur river flows north of this block and a few small tributaries have flown over this region. The rivers are tidal in tides.

### 8.3. Climate

The climate of this study area is very much tropical and exercising monsoonal characteristics i.e. hot and humid climate condition. Four seasons are well marked for the entire area.

- Summer season ( March to May),
- Monsoon season ( June to September),
- Post-monsoon season (October to November),
- Winter season (December to February).

  

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The average rainfall occurs in this area is about 150cm. Most of its occurs in monsoonal period. The average annual range of temperature is about 30°C ( District Statistical Handbook of Purba Medinipur, 2011).

### 8.4. Hydrology

Ground water is a main component of Hydrology. Ground water is concerned with landforms geomorphology, soil characteristics, drainage system, topography, landuse, vegetation condition and also underlying geological characteristics like lithology or structure. In this study area a variation is found in respect of hydrologic condition. This block is a part of alluvial plain. Now, saline water intrusion and the extension of saline aquifers have also noticeable. The ground water level has gradually dropped. The ground water level in pre-monsoon varies from 25 mt. to 40 mt.below and in monsoon varies from 8 mt. to 12 mt. below.

### 8.5. River system

In general the drainage system of Egra-II block flows the west to east according to the slope. The entire river system consists of river Rasulpur and his many small tidal tributaries. In this river, saline water ingress during high tide passes through Contai-III, Egra-II and Bhagbanpur-II block and goes upto Chandankhali mouza in Potaspur-II block. This river bifurcates at Dakshin Coumukh mouza in Egra-II block and the left arm known as the Balighai Canal carries saline water upto southern part of Egra-II block in summer.

### 8.6. Soil

This study area consists of mainly alluvial soil with silt and clay covering successively. This soil is suitable for rice cultivation. Currently cultivation of groundnut is going well in this soil.

### 8.7. Natural vegetation

The natural vegetation of this study area is mainly of tropical deciduous type comprising of mixed forest trees, grass and shrubs. With the changing nature of soil character the natural vegetation has been changed. In the entire study area, the growing plant species are Simul, Sissoo, Khair, Babul, Bamboo etc.

## 9. AGRICULTURE

The economy of this study area is based on agriculture. So, the development of standards of living of the people depends solely on the advancement or development of agriculture. Out of total cultivable area in entire study area, about 80% of land area is used for rice production. Groundnut, Betel vine cultivation and horticulture are also found in this area. In the winter

  

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season and pre-monsoon season, excessive withdrawal of ground water for cultivation leads to the scarcity of ground water.

**10. CAUSES OF GROUND WATER SCARCITY IN EGRA-II BLOCK**

Now ground water scarcity in Egra-II block of Purba Medinipur is a serious threat to the environment. Surface water is not always safe for consumption and is much more difficult to filter than ground water. So, ground water is particularly valuable. Recently the gap between demand and supply of water is widening day by day due to rapid growth of population and increase of boro paddy cultivation. The main causes of ground water scarcity are given below.

1. Frequent pumping of ground water : We pump the ground water more quickly than it can renew itself, leading to a dangerous shortage in the ground water supply.

2. Slowly replenish : We continuously pump groundwater from aquifers and it does not have enough time to replenish itself.

3. Agricultural needs : A large amount of ground water goes to farming mainly rabi crop cultivation, but the availability of ground water is steadily declining.

4. Increasing irrigated land : One of the major reasons for groundwater scarcity in this area is that as the area of irrigated land has increased, the level of groundwater has declined.

5. Indiscriminate water tapping : Indiscriminate tapping of ground water has made the situation even more alarming. Due to the uninterrupted exploitation of ground water by deep wells and tube wells to meet the shortage of ground water.

There are also other reasons –

6. Decreasing jungle or natural vegetation,

7. Global warming,

8. Wrong agricultural practices,

9. Increase salinity of groundwater of upper layer for intrusion of saline water,

10. Without any Govt. restriction to pump groundwater, further subsidized electricity,

11. Increasing living home for over population,

12. Day-to-day wet-land filling is increasing,

  

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13. Increasing the rabi crop cultivation,

14. Saline river water in summer season and less number of ponds and water bodies,

15. Increase the misuse of groundwater etc.

## 11. MANAGEMENT OF GROUNDWATER

At present, the rate of ground water shortage is increasing. If this is going on, in the near future farmers will not get water to cultivate and also the lack of drinking water in this study area will reach the extreme. If the crop is not good in crop production, there will be a shortage of human food and its impact will be on the socio-economic development of the people. So there is a need to manage the ground water in this block. The way to manage the ground water is given below.

1. Limit of ground water extraction : To deal with excessive tapping of groundwater, maximum depth should be determined in this area. Deep tube wells should be filled up and groundwater can be removed only upto 400-500 feet. Thus water level will not fall below this.

2. Change in crop pattern : Ground water can be preserved by the determination of crop cycle. Low water consuming crops should be cultivated in this area.

3. Building new pond and wetland : There is a need to deepen old ponds and wetlands along with building new ponds to reserve surface water for irrigation.

4. Plantation : Several measures need to be taken to protect the earth from the threat of climate change, including undertaking extensive plantation.

5. Increasing people awareness : Many schemes have been made at the Government level for ground water conservation, but the lack of awareness among the people and due to official apathy, the schemes have not been able to achieve the desired level. So, increase the people awareness for importance of ground water.

6. The river has to be reformed,

7. The wetlands should be retrieved,

8. To avoid wastage of ground water,

9. Limitation for pumping ground water,

10. Artificial recharge of ground water,

11. To implement roof top rain water harvesting,

  

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12. Government rule enactment (W.B. Groundwater Resources Act, 2005),

13. The population growth rate will be reduced.

## 12. CONCLUSION

The economy of Egra-II block is largely dependent on agricultural work. Meanwhile, two important crops are Boro pady cultivation and ground nut cultivation, which is in winter season and is dependent on irrigation. So a lot of deep well developed. As a result, there is a shortage of ground water. Ground water is a valuable resource in this block and throughout the world. It plays an import role in ensuring food security and agricultural sustainability in the country. Presently ground water scarcity affects all social and economic sectors and threatens the sustainability of the natural resources base. Ground water scarcity calls for multidisciplinary approach to water resource management. Therefore, it is necessary to conserve ground water, that is, keeping in mind the future generation, it is necessary to use ground water for scientific and proper use. In particular, there should be restrictions on the usage of ground water in this region. At the same time, digging new ponds and reforming old ponds- wetlands for rainwater harvesting. This will reduce the use of ground water for winter and summer cultivation. As a result of rainy season, the incidence of floods will be reduced slightly. There will also be emphasis on increasing the cultivation of grains that require less water.

## REFERENCES

[1] Basack, S., Bhattacharya, A.K., Sahana, C., and Maity, P. (2010). ―A Study on Saline Water Intrusion and Fresh Water Recharge relevant to Coastal Environment‖, *WSEAS Transaction on Fluids Mechanics* (ISSN: 1790-5087 ) Including in ISI/SSI Web of Science and Web of Knowledge, issue 3, Volume 5, July 2010, pages 80-90, [www.wseas.org].

[2] Bhattacharya A.K. (2002) ―Saline water Intrusion into Coastal Aquifers of West Bengal, India‖, *International Conference on Low Lying Coastal Areas Hydrology and Coastal Zone Management, Bremerhaven, Federal Republic of Germany*, pp. 197-200.

[3] Bhattacharya, A. K. and Basack, S. (2003) ―Analysis and Control of Saline Water Intrusion in Coastal Aquifers with Special Emphasis on East Coast of India‖, Final Technical Report, AICTE No. 8022/RID/NPROJ/RPS-82-4 dated 22/3/2004.

[4] Bhattacharya, B. (2012). Significance of Hydro-geological and Hydro-chemical Analysis in the Evaluation of Groundwater Resources: A Case Study from the East Coast of India. *IOSR Journal of Engineering*, 2(9).

  

ISSN: 2455-8834

Volume:03, Issue:07 "July 2018"

[5] Government of India,1991, Districts statistical abstracts, Purulia district, Department of Census operations, Kolkata.

[6] Government of India,2006, Ground water information booklet, Purulia district, Central Ground Water Board, Ministry of water resource, Kalkata.

[7] Government of India,2011, Districts statistical abstracts, Purulia district, Department of Census operations, Kolkata.

[8] Goswami, A.B. (1968) ―A Study of Salt Water Encroachment in the Coastal Aquifer at Digha, Midnapore District, West Bengal, India‖, *Bulletin, International Association of Scientific Hydrology*, Vol.13, No.3, pp.77-87.

[9] http://www.rainwaterharvesting.org/

[10] Karanth, K.R (1990) ―*Groundwater Assessment Development and Management*‖, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

[11] Lakshmi P.C. and Narayanan R.M. (2015). Study on Groundwater Modeling of Aquifers Using Visual Modflow. *International Research Journal of Engineering and Technology*, 2(2), pp. 23-26.

[12] Lasya, C.R. and Inayathulla, M. (2015). Ground water flow analysis using Visual Modflow. *IOSR Journal of Mechanical and Civil Engineering*, 12(2), pp. 5-9.

[13] Mahesha, A (2009) ―Conceptual Model for the Safe Withdrawal of Freshwater from Coastal Aquifers*", Journal of Environmental Engineering,*Vol. 135, No. 10, October 1, 2009.asce, ISSN 0733-9372/2009/10, pp. 980–988.

[14] Maity, P.K., Das, S. and Das, R. (2017a). Assessment of Groundwater Quality and Saline Water Intrusion in the Coastal Aquifers of Purba Midnapur District, West Bengal, India. *Indian Journal of Environmental Protection*, 37(1), pp. 31-40.

[15] Maity, P.K., Das, S. and Das, R. (2017b). Methodology for Groundwater Extraction in the Coastal Aquifers of Purba Midnapur District of West Bengal in India under the Constraint of Saline Water Intrusion. *Asian Journal of Water, Environment and Pollution*, 14(2), pp. 1-12.

[16] Maity, P.K., Das, S. and Das, R. (2017c). A Geochemical Investigation and Control Management of Saline Water Intrusion in the Coastal Aquifer of Purba Midnapur District in West Bengal, India, National Conference on Sustainable Advanced Technologies for Environmental Management, SATEM-2017. IIEST Shibpur. Accepted.

  

ISSN: 2455-8834

Volume:03, Issue:07 "July 2018"

[17] Mandal, M. 2013. Digha Sankarpur littoral tract- A geographical case study. *Int. J. Human. Soc. Sci. Inv.*, 2(4): 46-54

[18] Raghunath,H.M.,2014, Ground Water, New Age International(P) Limited, Publishers, 7/30A, Daryaganj, New Delhi.

[19] Roy, A, 2014, Availability, Scarcity and Potentiality of Ground Water Resources of Purulia District, West Bengai: An Appraisal, International Journal of Scientific Footprints, Vol2(1).

[20] Sinha, b.r.k,2009, Population, Environment and Development, A Global Challenge for the 21st Century, New Century Publications, New Delhi, India.

[21] Water Scarcity,2013, International Decade for ' Action water for Life-2005-2015, 20 October, 2013.

  