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Innovation The Research Concept

The Study of Reconnaissance Hydro-Geological Investigation in Nowda, Murshidabad, West Bengal

Subhankar Samanta
Assistant Professor,
Deptt.of Geography,
Kaviguru Nobel Centenary Training College, Beldanga,
West Bengal

Nobendu Biswas
Student,
Deptt.of Geography,
Kaviguru Nobel Centenary Training College, Beldanga,
West Bengal

Abstract

"Water is life" the words are most important in our everyday life. In our state there is some arsenic and iron affected districts. Out of them Murshidabad is one of them. Out of 27 blocks Nowda is also suffering from polluted drinking water. It is our duty to aware to the people about safe drinking water. For this purpose this study is done on the base of hydro-geological survey. The aim of this study also to assess the overall ground water potential of the area and to know the quality of the ground water of the surrounding area. The quality of water depends on contamination of iron, arsenic, chloride, TDS, EC etc.

Keywords: Nowda, Groundwater Potential, Hydro-Geological, Hydrogeochemistry.

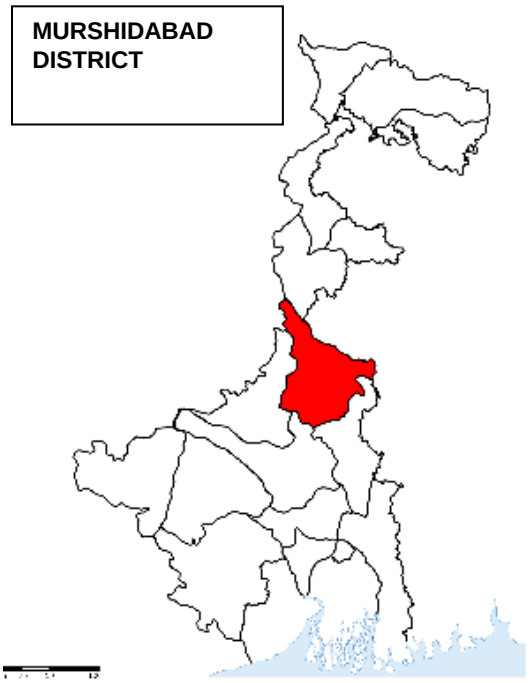
Introduction

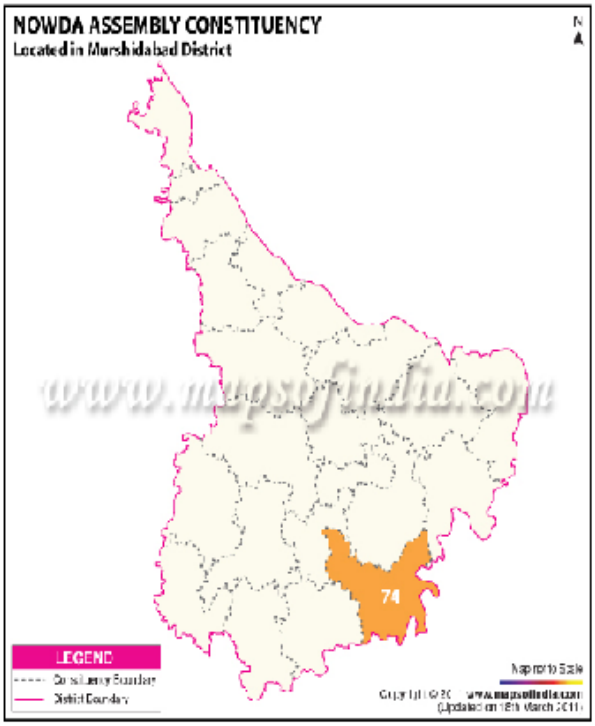
Beginning of late twentieth century marks the rapid increase of groundwater consumption throughout world. With the increasing intensity of extraction, the quality of groundwater can deteriorate to some extent. Several parts of the world experiences groundwater contamination due to mixing of different minerals both naturally and due to human activities. Although minerals in groundwater are necessary for human health, but to a certain limit. Above the permissible limit it may create health problem which may range from mild to severe depending on the duration and exposure. Among these minerals arsenic is considered as the problematic, even when consumed in lower quantities. World Health Organisation has set 0.05mg/l as the permissible limit in water for drinking (Chakraborti et al., 2008).

The researchers got a chance for carrying out a reconnaissance, Hydro-Geological Investigation in and around Mondapara, Khanpur, P.S – Nowda, Block – Nowda, District – Mursidabad, West Bengal with a radius of 3-5 km. to kmow the nature of the aquifer and other hydrological inpu t. with supervission and collection soil samples and preparation of a report for aware the people about the quality of drinking water of that area.

Location & Accessibility

The site with area is located within the P.S Nowda and within the block of Nowda with J.L no. 18, in the district of Mursidabad and it is about 30 km. from Berhampur town and is approximately 210 km. from Kolkata. The site is approachable from Berhampur towards Hariharpara following NH34 East and Beldanga I in the south and Berhampur in the north. The area lies within the Survey of India Topographical sheet no. 78D/8 & 78D/9 respectively. The area covers 6 sq km, comprising of 33 no of locations.





Climate & Rainfall

The area enjoys in humid-tropical climate, with average annual rainfall of 1300mm. Average yearly humidity is 82%. The temperature varies from 42°C in summer and 9°C in winter. Humidity reduces generally from October after the monsoon is over and become more low in late winter seasons. Sometimes the area has suffered from severe flood due to heavy downpour.

Aim of the Study

The objective of the Hydro-geological investigation is:

1. To assess the overall ground water potential of the area.
2. To indentify the promising water yielding horizon of the area.
3. To find out best location for installation of Tube well.
4. To know the sub surface geological formation of the area.
5. To know the chemical quality of the ground water of the surrounding area.

For this purpose principle of geology regarding hydro-geological investigation has been applied.

Scope of the Study

1. To carry out a reconnaissance hydro-geological investigation work in and around the area of 3-5 Km radius including selection of wells, collection of different hydro-geological data and collection of water samples for chemical analysis.
2. To suggest the feasibility of the site in respect of availability of ground water.
3. Construction of slim hole is to know the sub-surface lithology of the area and to delineate the aquifer disposition of the area.

Review of Literature

The problem of ground water quality has been addressed by different scholars in different ways. A comparative study was done by Das et al. (1995) by taking into account six districts of West Bengal. . Rahman (2001) worked on the similar lines but highlighted the arsenic concentration in Bangladesh. Sengupta (2003) discussed the concentration of arsenic in the Ganga-Padma-Meghna-Bramhaputra plain of India and Bangladesh. Chakraborti (2003) mainly focused on the arsenic concentration in the middle Ganga plain of Bihar and considered it as 'future danger' Kouras (2007) investigated upon the spatial variation of arsenic in the northern Greece while Roychowdhury (2010) extensively worked on arsenic contamination in 107 blocks of West Bengal' Panda (2015) discussed the long term effect and necessities of arsenic and other chemical contamination.

According to him "In some cases, the symptoms and signs of arsenic poisoning were reduced three years after the quality of drinking water improved. We should use more surface water after appropriate purification. Stop or reduce drastically the uncontrolled extraction of ground water and allow the aquifer and water tables to regenerate sufficiently. Finally, rain water harvesting and preservation should be widely used in urban and rural areas to have pollution free water round the year".

Land Use and Agriculture

A perusal of land use pattern of the area reveals that cultivable land and cultivable waste land constitute about 55% of the total area. In most of the cultivable land cropping is done once in a year and is totally dependent on monsoonal rain and to some extent from ground water. Double cropping is

practiced on a very local scale in some locality in areas where agricultureal wells are located. Several agriculrural practices have been found during field work.

Geomorphology

Physiographiy

The major portion of the area is characterized by low line flat topography, representing a depositional feature of younger alluvial. The area is divided into two geomorphologic unites:

1. Younger alluvium plain
2. Recent sediments of Bhairad River.

Drainage

The most important river of the area is river Bhagirathi and Jalangi.

Soil

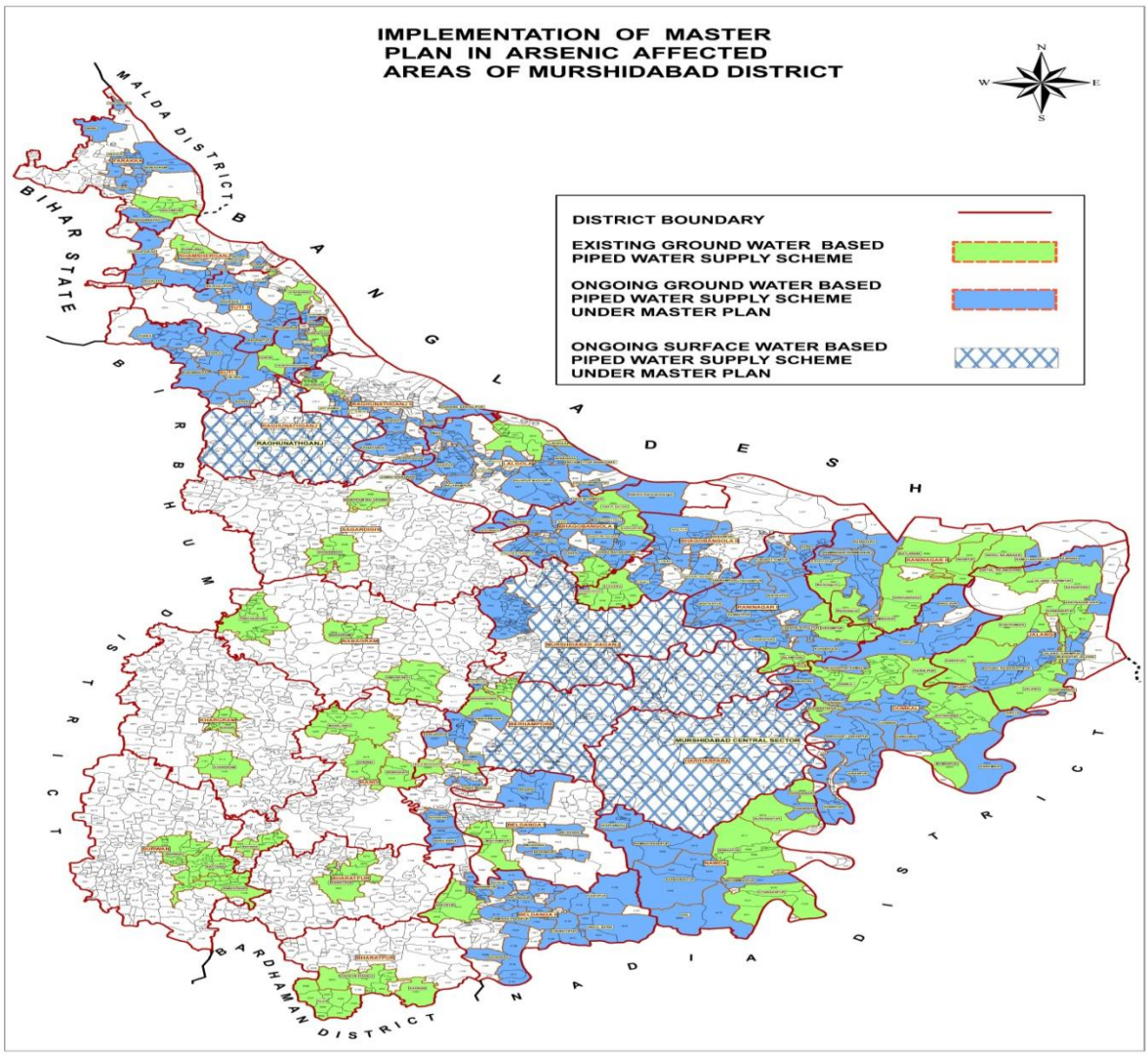
The area has high moisture content in the soil which is contributed from merely land and water logged areas. The soil of this area silty-loam to silty clay and loam type soil. Most of the areas are agricultural lands. The common trees are found nearby villages and also along the bank of the river. They are mostly bamboo, mango, sugar cane, cool etc.

Geological Set Up

The studied area is covered by quaternary alluvium sediments from Recent to sub Recent sediments. After studying the surface and subsurface geology of the area, it is found that the alluvium sediments are in the form of flood plain deposit consists of clay, silt, sand. Sand varies from very fine to medium, white and highly micaceous. The general succession is as follows

Recent Sediments
Younger alluvium

Ground Water is Contributed by the above two Units.



Source: Public Health Engineering Department, West Bengal

Sub Surface Geology

To have an idea about the subsurface lithology of the surrounding area studied from the drilling history and boring method. It ex there exist vast area of sand deposit which contain huge quantity of ground water for extraction for various uses. Ground water in this area may be developed through ground water structures by means of low and medium duty tube well up to a depth of 180m. The ground water extraction may be done with 100mm X 150mm diameter well fitted with submersible pump upto a depth of 80.00m.

Methodology

The methods used in this study include literature review, field investigation, laboratory analysis and data analysis. The topographic sheet was used as base map in the field to mark the lithologies, their contacts and trends and to develop detailed geological and hydrogeological maps of the area. Primary geological and hydrogeolgical data were collected in the field after having the secondary data. In the watershed, due to the unavailability of the piezometer and recovery data, the analyses have been performed only for constant rate pumping test by using the pumping borehole data. The water samples were collected into properly cleaned and labeled one litter plastic bottles.

The sub surface lithological succession has been established from the drilling history and boring method. It ex succession is as follows:

Lithological Succession From Hand Boring At Mandalpara, Khanpur.
Site: Madhupur P.S: Nowda, Dist – Murshidabad

Sl No.	Depth IN (m)	Lithological Character
01.	0.00 – 6.09	Clay, pale yellow, sticky
02.	6.096 – 30.48	Sand, white (yellow tint), micaceous, fine, partly medium
03.	30.48 – 48.76	Sand,white,fine, micaceous
04..	48.76 – 54.86	Sand, white , fine, partly medium, micaceous
05.	58.86 – 68.58	Sand, medium, partly fine, white, micaceous

Filter – 6.00m
Blank – 60.00m
GI – 2’
Clear water comes after 45 mins of washing

Table – I
Details of inventoried wells: Madhupur, Block: Naoda

Sl No.	Locations	Block	Latitude	Longitude	Depth of WelL (M)
1.	Choa	Hariharpara	24º01.744’	88º26.906’	4.52
2.	Gaznipur	Do	24º00.234’	88º27.294’	5.23
3.	Mamudpur	Do	23º59.269’	88º27.220’	6.54
4.	Khanpur, Sardarpara	Noada	23º59.183’	88º27.262’	5.91
5	Madhupur	Do	23º57.278’	88º28.016’	5.23
6	Dangapara	Do	23º57.634’	88º28.754’	6.32
7	Kishoritala	Do	23º58.315’	88º29.519’	3.98
8	Moktarpur	Do	23º57.267’	88º29.564’	6.23
9	Dokia	Do	23º57.218	88º29.653’	7.34
10	Ghoshpara Madhupur	Do	23º56.811	88º28.224	4.87
11	Madhupur Colony	Do	23º57.192’	88º27.209’	4.32
12	Amtala	Do	23º55.732’	88º27.361’	6.12
13	Bagachara	Do	23º55.637’	88º26.324’	5.64
14	Sabdarnagar	Do	23º55.295’	88º22.362	4.98
15	Trimohini	Do	23º55.543’	88º20.310	4.12
16	Dighirdhar, Amtala	Do	23º56.234’	88º20.302	6.09
17	Mirpur	Do	23º56.612	88º20.210	5.45
18	Kalyanpur	Do	23º57.351’	88º25.645	4.23
19	Bhabanipur	Hariharpara	23º58.460’	88º25.284’	3.98
20	Durlabhpur	Naoda	23º58.844’	88º26.416	4.09
21	Piprakhali	Do	23º58.953’	88º27.385	6.12
22	Gholdaba	Do	23º57.868	88º27.836	5.37
23	Adharpara	Hariharpara	24º01.467’	88º26.361	6.28
24	Chhatimtala	Do	24º01.220’	88º26.916	7.12
25	Shripur	Do	24º00.387’	88º25.580	6.34
26	Nazimpur	Do	24º00.007’	88º27.918	5.12
27	Sahajadpur	Do	24º00.310’	88º26.530	3.78
28	Gangadhari	Naoda	23º59.857’	88º26.320	7.23
29	Gangadhari Jot talapara	Do	23º58.685’	88º26.031	5.34
30	Gadigacha	Do	23º57.240’	88º26.712	5.12
31	Raipur	Do	23º57.090’	88º26.164	4.65
32	Dubtala	Do	23º55.266’	88º25.215	4.98
33	Trimohini	Do	23º55.524	88º25.315	3.87

In Mursidabad district, socio-economical factor have a significant influence over land use in rural and urban areas. The principle crops grown in the district are paddy, wheat, pulses, potato, oil seeds, vegetable etc. The agro-climatic zone in which the district Mursidabad belongs to the following crop pattern i.e. Kharrif paddy- wheat/ Vegetables – paddy-maize-pulses vegetables-maize/ wheat/ potato. Irrigation of the area mainly done by rain water and by ground water extracting from deep tube well and shallow tube wells.

Hydrochemistry

The hydro-geological study of a particular region remains incomplete without the knowledge of geochemical characteristics of the concerned area. It provides a better understanding of probable changes in quality and helps in delineation of ground water sensitive zones thereby provides information about the limits of total withdrawal from the concerned area and finally can permit planning for its appropriate treatments.

Ground water comes into intimate contact with various minerals which are soluble in water to varying degrees. The dissolved minerals determine the usefulness of the water for various purposes and the presence of some minerals beyond certain limit may make it unsuitable for irrigation, drinking, or industrial purposes, and may result in corrosion or incrustation of tube well screens.

The chemical quality of ground water of an area depends on many factors like surface geology, geomorphology, hydrology, rainfall, drainage pattern, weathering nature of underlying rocks etc. of that area. Generally, the water is characterized on the basis of various physical, chemical, and biological characteristics such as-

1. Physical Characteristics: Colour, Dissolved Oxygen, Insoluble Substances, Corrosive Properties, Radio–Activity, Temperature Range etc.
2. Chemical Characteristics: Chemical Oxygen Demand (COD), pH (Acidity or Alkalinity), Hardness, total Carbon, Total Dissolved Solids, Chlorine demand, Some organic, in-organic components such as Cl, Sulphate, Nitrate, Iron, Pb, Cloride, Electrical Conductivity etc.
3. Biochemical Characteristics: Biochemical Oxygen Demand, Presence of Pathogenic bacteria etc, and toxicity to man, aquatic organisms, plants and other life forms.

Ground water is relatively free from surface contaminations as it remains away from land and get filtered or screened by underlying layers of soils, sands and stone pieces. Out even it gets some contamination arising from leaching of minerals below earth surface.

As stated earlier, assessment of ground water quality rigorously maintained the quality standard in the interest of public health and irrigation prospect and also for industrial use. Here the water quality of the area has been determined and the components analyzed in the samples collected from the study area are pH, Specific, Conductivity (Ec), bicarbonate, Chloride, Iron content, Total Dissolved solids, Arsenic etc.

5 nos of water samples have been collected from the tube wells in and around of the study area and have been analyzed chemically and details of the analysis have been shown in each of the parameters as analyzed.

Details of Chemical Analysis (Ppm)

pH Content

pH is a term used rather universally to explore or alkaline condition of a solution. Generally a solution with a pH<7 is acidic, pH > 7 is alkaline. And pH = 7 is neutral. In the study area pH varies from 6.40 to 8.62 which mean that there is a tendency of alkaline in nature.

Specific Conductivity (Micromohos / Cm) SC

Electrical Conductivity or Specific conductivity is the ability of a substance to conduct the electric current. Electrical conductivity is also helpful in finding out TDS present in it. The values depict the salinity hazards which enable quality rating of irrigation water. EC content of the study area varies from 370 to 690.

Chloride

Chloride occurs naturally in all types of water. Its concentration remains low in natural fresh water. The concentration in water above 250mg/l gives a salty taste to water which is objectionable to the human taste. the chloride content of water which is solely responsible for salinity factor is the vital of all parameters analyzed in water samples. In the study area the chloride concentration values ranges from 70 ppm to 160 ppm that is within permissible limit.

Iron

Iron is also an essential component to maintain the hardness of the water. The permissible limit for iron within water is 0.0 – 1.00 ppm. The iron content of the study area varies between 0.45-1.05 ppm.

Total Dissolved Solids (TDS)

Total Dissolved Solids are essentially the salts of Ca, Mg, Na, Fe, K and Zn in the form of bicarbonates, chlorides, sulphates and nitrates. The TDS content of the study area falls within the limit of 187 ppm-531 ppm.

Arsenic

0.01-0.09ppm

5 numbers of water samples have been analyzed and the detail of analysis data has shown in the following table – 2,

List of water samples

Sl.No.	Sample No.	Location	Block	Depth In Ft
1.	WS/1	Choa	Harihrpara	29.00
2.	WS/2	Madhupur	Naoda	62.00
3.	WS/3	Amtala	Do	34.00
4.	WS/4	Trimohini	Do	37.00
5.	Ws/5	Kalyanpur	Do	65.00

Table 2
Chemical analysis data of Madhupur, Murshidabad

Sl. No	Location	pH	Electrical Conductivity (Micromohs/c)	Total Hardness as CaCO3	Chloride As CL	Iron as Fe	Arsenic As	Total Dissolved Solids (ppm)
1.	Choa	8.46	510	145	70	1.05.	0.03	187
2.	Madhupur	8.55	620	210	142	0.45	0.09	531
3.	Amtala	8.40	360	145	110	1.02	0.06	284
4.	Trimohini	8.62	690	186	160	0.63	0.01	442
5.	Kalyanpur	8.57	370	153	91	0.76	0.005	282

Findings and Conclusion

From the above hydro-geological survey work on the basis of present status of ground water development it may be concluded that ground water can be extracted from the shallow aquifer up to a depth of 55.00m but for heavy withdrawal the aquifer should be tapped beyond 150.00m for irrigation and other purposes which may yield substantial quantity of ground water. The exact location should be fixed after proper consideration. The distance between two tube wells should be at least 200.00m for low duty tube well and 400.00m for medium duty tube well and that of heavy duty tube well it should of 600.00m as per prevailing Government norm. The pumping hours should be restricted for 6 hrs up to a maximum of 8 hrs.

The chemical quality of ground water of the project area is good from the point of view of drinking purposes but the concentration of arsenic and iron in ground water is to be considered and it is alarming. So proper care should be taken before installation of any filter for good drinking water in the concerned area. At the same time it is suggested that restriction of withdrawal of ground water should be done and Rain water harvesting practices should be carried out by both storing of ground water in a suitable depressed areas as well as by ground water recharge by adopting suitable method to compensate the withdrawal of ground water. So it is to be implemented very soon so that ground water extraction can be balanced and to retain from the lowering of water level.

Acknowledgments

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References

1. Saha.S and Dhar.Y, 2012, Hydrogeological aspects of arsenic contamination of Maner Block, Patna, Bihar, India , *Elixir International Journal.*
2. Public Health Engineering Department, West Bengal
3. Roy Chowdhury ,I, (2012) Quality analysis of water of two districts (murshidabad and birbhum) of west bengal, *International Journal of Scientific & Engineering Research Volume* 3, *Issue* 5, 2229-5518.
4. Ghosh, T. (2014), Identification and Spatial Analysis of Groundwater Vulnerability Zones of Murshidabad District (West Bengal), Department of Geography, Faculty of Science The Maharaja Sayajirao University of Baroda.
5. Mollah, S. and Khatoon, N. (2013) Water Scarcity in Agricultural Sector in Murshidabad, West Bengal, *Global Research Analysis, Volume: 2* , 2277 – 8160.
6. Acharyya, S.K., Lahiri, S., Raymahashay, B.C., Bhowmik, A. 2000. Arsenic toxicity of groundwater in parts of the Bengal basin in India and Bangladesh: the role of Quaternary stratigraphy and Holocene sea-level fluctuation. Environ. Geol., 39, pp.1127−1137.
7. Acharyya, S. K., Chakraborty, P., Lahiri, S., Raymahashay, B. C., Guha, S. and Bhowmik, A. 1999. Arsenic poisoning in the Ganges delta. Nature, 401, pp. 545–546.
8. Panda,B.K,(2015) A Brief Review on the Scenario of Ground Water Pollution by Arsenic in West Bengal, *International Journal of Ecosystem*, Vol. 5 No. 3A, 2015, pp. 75-85.
9. http://www.mapsofindia.com