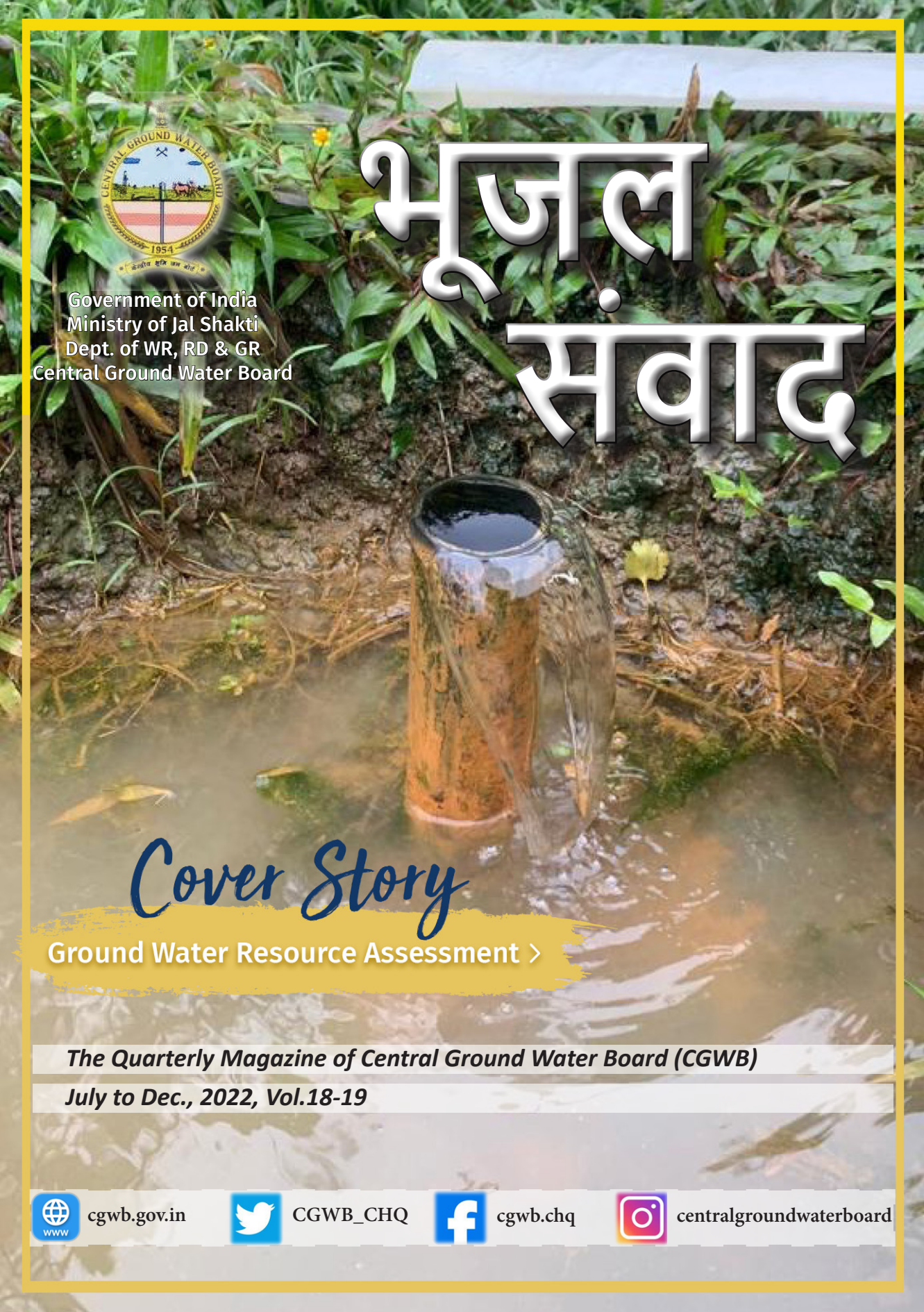

Government of India
Ministry of Jal Shakti
Dept. of WR, RD & GR
Central Ground Water Board

भूजल संवाद

Cover Story

Ground Water Resource Assessment >

The Quarterly Magazine of Central Ground Water Board (CGWB)

July to Dec., 2022, Vol.18-19

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The Quarterly Magazine of
Central Ground Water Board
Dept. of Water Resources,
River Development and
Ganga Rejuvenation,
Ministry of Jal Shakti, Govt. of India

Vol. 18-19 (July to Dec. 2022)

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Cover Photo: Autoflow Wells in Khowai Valley Tripura
P.C. CGWB, SUO Agartala.

Chairman's Desk

I take this opportunity to announce major accomplishments of Central Ground Water Board during July-Dec, 2022. It is a matter of immense pride to state that the Compilation on Dynamic Ground Water Resource of India 2022 was released by Hon'ble Union Minister, Jal Shakti Shri Gajendra Singh Shekhawat. Cover Story of this Section highlights a brief introduction on Ground Water Resource Assessment.

A section on Success Stories of NAQUIM studies presents 'A case study from Malda District, West Bengal on Aquifer Rejuvenation and Management Plans'. Artesian Zone Mapping in the Khowai Valley, Tripura is part of this issue in 'Report' section.

Officers and officials from Central Ground Water Board participated in Seventh India Water Week 2022 with full enthusiasm and presented an exhibition which was visited by honorable ministers and other dignitaries. Drawing the inspiration from Honorable Prime Minister Narendra Modi Ji's vision to institutionalize Swacchata, various cleanliness drives were organized in regional offices and headquarters of CGWB under Special Campaign 2.0 and these are covered under 'In Focus' Section.

The Pathshala Section aims to disseminate knowledge regarding different aspects of Hydrogeology and this issue incorporates "Pumping Test: An approach towards making the invisible visible" for better understanding. Shodh Section presents the research papers of officers of Central Ground Water Board in reputed journals.

Do communicate your thoughts, feedbacks and ideas with us to make Bhujal Samvad a success through our social media pages or send email to our editorial office (mediacell-cgwb@nic.in).

We are eager to hear from You!

Sunil Kumar
Chairman

In Focus

Seventh India Water Week 2022

Seventh India Water Week 2022 was held from 1-5 November 2022 at India Expo Center, Greater Noida with the theme "Water Security for Sustainable Development with Equity". Hon'ble President of India, Smt Draupadi Murmu ji inaugurated the programme.

Central Ground Water Board presented an exhibition stall which was visited by Hon'ble Minister of States Shri Prahlad Singh Patel Ji and Sh Bishweshar Tudu Ji.

GWRA 2022 released by Hon'ble Minister of Jal Shakti

Compilation on Dynamic Ground Water Resources of India 2022, released by Sh. Gajendra Singh Shekhawat Ji, Hon'ble Minister of Jal Shakti. The Assessment of Dynamic Ground Water Resources of each State/UT is being carried out jointly by Central Ground Water Board and State Nodal/Ground Water Department periodically as per the Ground Water Estimation Committee methodology (GEC-2015) under the guidance of the respective State/UT Level Committees (SLCs) and overall supervision of Central Level Expert Group (CLEG).

Meeting with Hon'ble Governor of Uttarakhand

A meeting was held between Hon'ble Governor of Uttarakhand, Lt Gen Sh. Gurmit Singh and Regional Director, Central Ground Water Board, Dehradun regarding groundwater issues in Uttarakhand.

संसदीय राजभाषा समिति की निरीक्षण बैठक

विज्ञान भवन, नई दिल्ली में संसदीय राजभाषा समिति ने केंद्रीय भूमि जल बोर्ड, जयपुर कार्यालय के साथ निरीक्षण बैठक की। इस दौरान समिति ने मंत्रालय एवं विभाग के वरिष्ठ अधिकारियों की उपस्थिति में हो रहे राजभाषा हिंदी के कार्यों का अवलोकन किया।

Visit of Secretary, (DoWR, RD & GR) Ministry Of Jal Shakti

Sh. Pankaj Kumar, Secretary (DoWR, RD&GR), along with Sh. Subodh Yadav, Joint Secretary, Ministry of Jal Shakti visited CGWB, CHQ. Secretary (DoWR, RD&GR) interacted with the Regional Directors and officers of Central Ground Water Board.

Cleanliness Drive Under Special Campaign 2.0

Outdoor cleanliness drives were organized successfully under Cleanliness Drive Special Campaign 2.0 in different Regional Offices and Central Headquarer of Central Ground Water Board.

International Training Conducted by RGNGWTRI

Rajiv Gandhi National Ground Water Training and Research Institute, CGWB Naya Raipur inaugurated 4 day *"International training programme on Integrated Water Resources Management-India experiences"*, in collaboration with African-Asian Rural Development Organization (AARDO).

Success Stories of NAQUIM

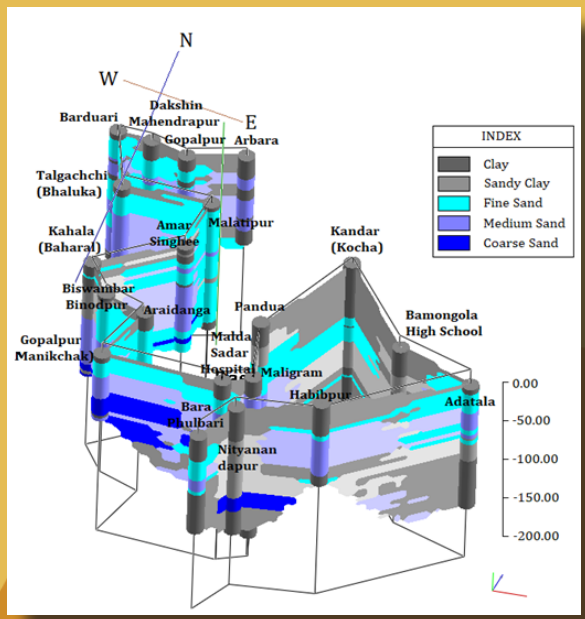
Malda District, West Bengal

- Eastern Region, Kolkata

Aquifer mapping and management study in Malda district has revealed presence of Older alluvial aquifer of Pleistocene age and Younger alluvial aquifer of Holocene age with markedly different hydrogeological characteristics. The Older alluvial aquifer occurs in the eastern part of Malda district in the Barind Tract. Analysis of lithological data from 53 exploratory wells and tube wells revealed a single aquifer system occurring under confining condition in Ratua-II, Habibpur, Old Malda and Harishchandrapur-II block. This is also supported by interpretation of Vertical Electric Sounding data, with a recommended drilling depth varying from 40 to 180 m for maximum sustainable yield. Aquifers consisting of medium to coarse sand and gravel are underlain by metavolcanic rocks of Garo-Rajmahal Gap at Araidanga (Ratua-II block), Mandilpur (Old Malda block) and Narendrapur (English Bazar block) in variable depth range of ~130 m to ~281 m.

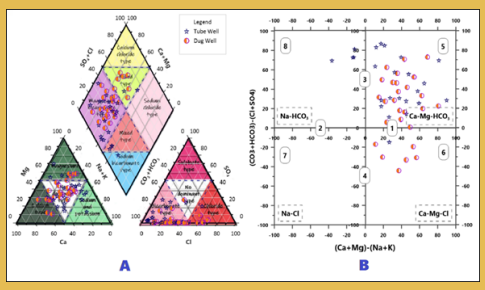
Eight blocks of Malda district have arsenic contaminated aquifers (Aquifer-IA) occurring in depth range of 20 to 95 m. Fluoride contamination was observed both in Aquifer-IA in variable depth range (30 – 62 m, 73 – 116 m) and in Aquifer-IB (150 – 162 m). High arsenic in the aquifers is brought into acceptable limit through Arsenic Removal Plants for piped water supply in urban and rural areas. The largest such plant is at Daripaur in Kaliachak-III block. Shallow aquifers tapped by privately owned tube wells in depth range of ~20 to ~35 m are frequently found to be infested with iron in Manikchak, Bamongola, Gazole, English Bazar and Kaliachak-III block. Analysis of samples through Wilcox Plot and U. S. Salinity Diagram shows that aquifers are safe for agri-irrigational use.

It is possible to implement block level aquifer management plans with active participation of the district administration and the stakeholders. Given the nature of water resource utilization, adoption conjunctive use is a must, thereby reducing the overall dependence of ground water for irrigation. Crop diversification is highly recommended in form of reduction in cultivation of water intensive crops. Cultivation of summer paddy needs to be reduced by at least 10% of the present production, especially in the Barind Tract

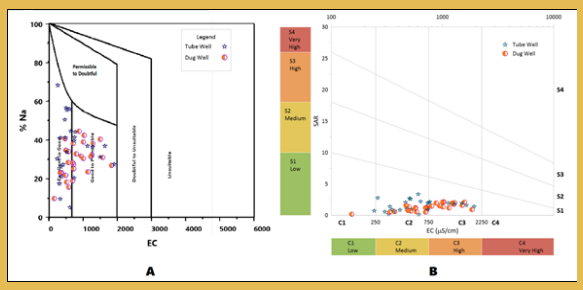


Fence diagram showing aquifer geometry and correlation, Malda district

where water scarcity in summer is a growing problem. Crops having higher water use efficiency (peanut, maize, jute, soya bean) needs to be grown, especially during the spring season. However, there should be a provision for crop subsidy by the state government for adopting the alternate cropping pattern, keeping in mind the poor socio-economic condition of the small and marginal farmers. However, because of comparatively safer stage of ground water development, it is recommended that only the top Phreatic aquifer (within 25 - 30 mbgl) may be included for short and intermediate term intervention in form of percolation tanks, re-excavation of existing tanks and ponds and shallow injection wells (beyond 10 m to puncture the top clay). The total cost of such intervention is roughly estimated at Rs. 52 Lakhs only.



Hydrochemical facies categorization of shallow aquifers in Malda district, plotted in Piper Trilinear Diagram (A) and Modified Piper (Chadha) Diagram (B)



Agri-irrigational suitability of groundwater in Malda district; shown in (A) Wilcox Diagram and (B) US Salinity Diagram

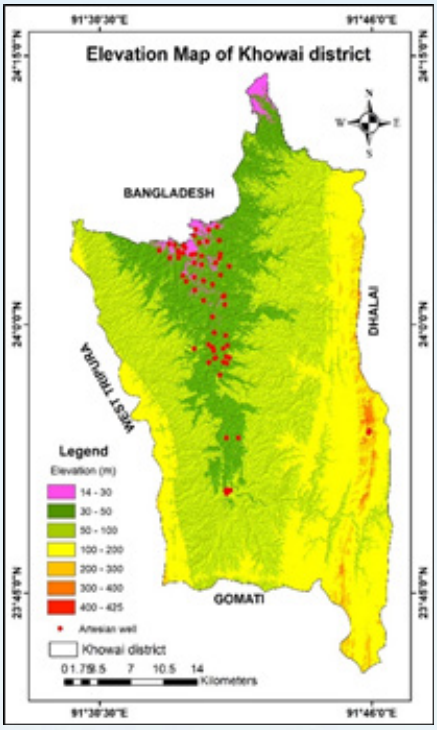
Inside view of Arsenic Removal Plant at Dariapur en route 16 Mile - Krishnapur – Kumbhira road, Kaliachak-III block. The plant has capacity of producing 3600 bottles of 1 litre under Prandhara Project of PHED, Government of West Bengal

Report

ARTESIAN ZONE MAPPING IN THE KHOWAI VALLEY, TRIPURA

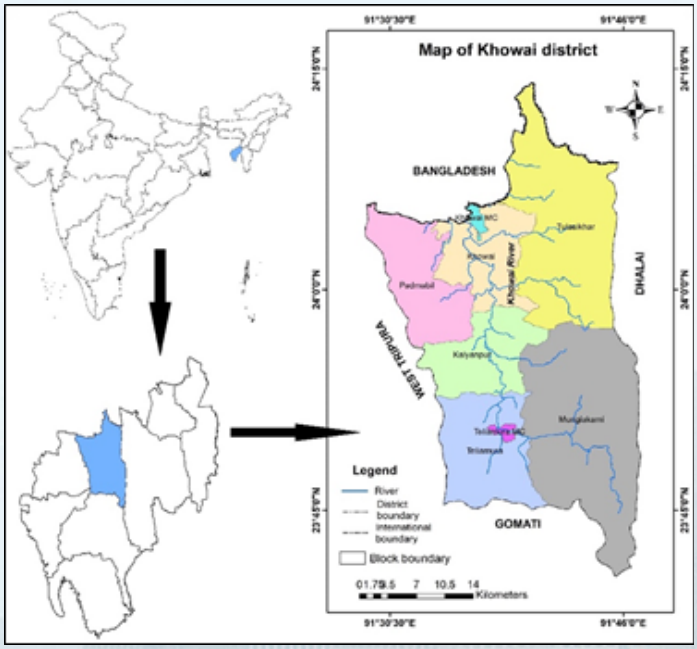
- Ritu K. Oraon, V Sophia, Rupam Chattaraj, Dr. R.R. Purohit
SUO, Agartala

Introduction: The term "Artesian Zone" is defined by the area of free flowing wells. The Khowai valley of Tripura is bestowed upon with free flowing artesian wells. The Khowai district of Tripura occupies the northern to northwestern part of the state and the northern part of the state is bounded by Bangladesh (international border). The district is having an area of 1012.45 sq.km, which comprises of 516.85 sq.km of hilly areas and 495.60 sq. km of valley area. The climate in the district is humid sub-tropical monsoon in nature. The study area receives rainfall mainly from S–W monsoon which commences in the month of May and lasts till September. The average annual rainfall of Khowai & Teliamura rain gauge stations in the valley for last 5 years are 1939 mm &1858 mm and the average no of rainy days are 91 & 88 respectively.



Elevation map of Khowai district

The Khowai valley is bounded by Baramura range in the west and Atharamura range in the east. The hill ranges almost trend N-S and are tightly folded with increasing altitude from west to east ranging from 150 – 425 m above msl. The anticlinal hill range forms the watersheds, from which various drainage channels emerged. The common drainage patterns are sub-parallel to parallel and dendritic, which are structurally controlled. The Elevation of the area along with the location of artesian wells. The major river in the study area is Khowai and its tributaries are perennial in nature constituting the main drainage pattern of Khowai valley. Ultimately, it enters Bangladesh 1 km north of Khowai town.

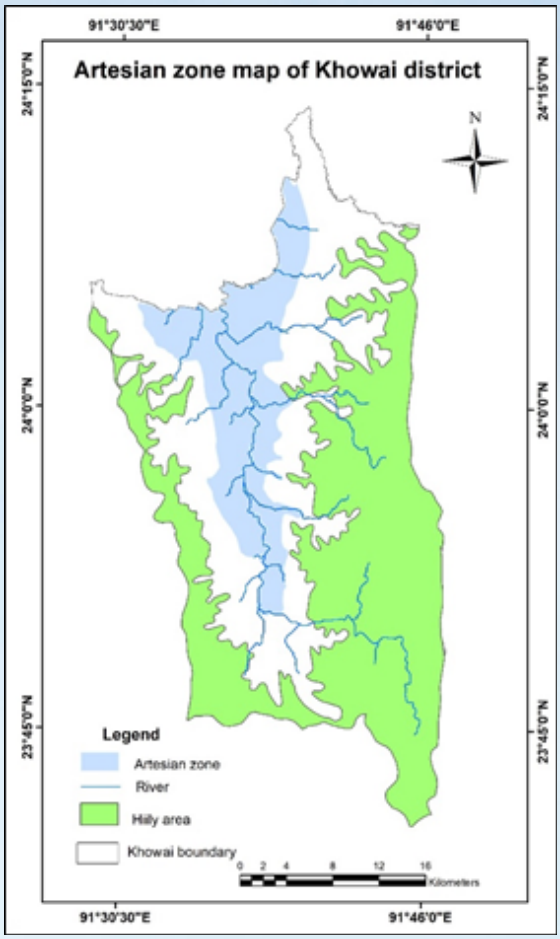


Map of the study area in the Khowai Valley in the Khowai District of Tripura

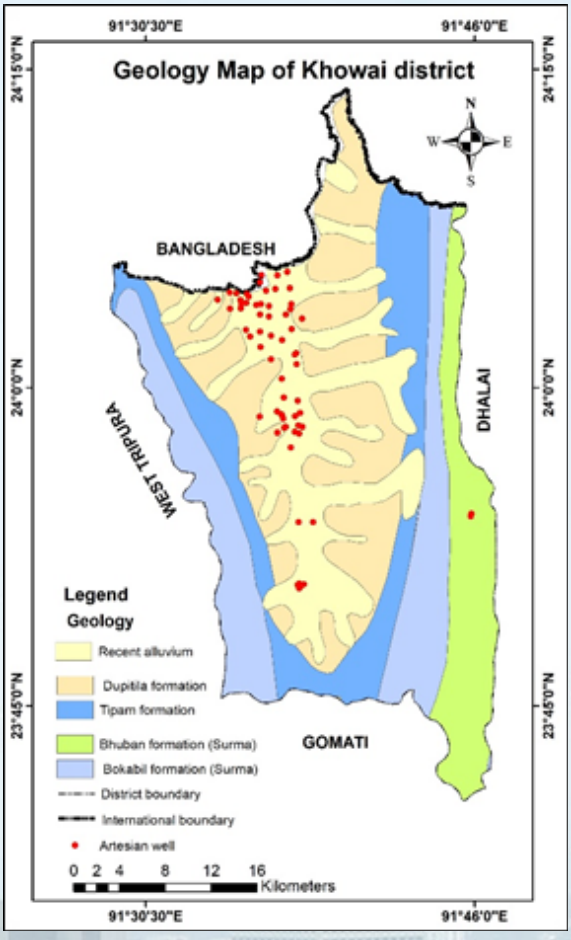
Aquifer System its Geometry and Characteristics: Khowai valley is occupied by Quaternary age of recent Alluvium & Upper Tertiary age of Surma, Tipam & Dupitila group of rocks. Recent alluvium occurs along the bank of river and thickness varies from 5 to 10 m with significantly high content of clay and sandy clay. The Dupitila formation is nearly horizontal in disposition and its thickness varies from 10 to 30 m. The formation consists of mainly clay and silt with some intercalations of gritty & ferruginous sandstones. Due to high clay content the formation has low permeability and low storage capacity.

Sandstones of Tipam formation forms the principal aquifer system in the study area. Permeability of this formation is much higher than that of Dupitila formation or Bokabil (Surma Group) formation. This formation consists of sub-rounded, fine to medium grained, friable sandstone with intercalated clay. The recharge area of these sandstones are the neighboring anticlinal hills. Ground water occurs under unconfined, semi-confined to confined conditions.

The aquifer system of the area is divided into two groups, viz, shallow aquifer and deeper aquifer. Shallow aquifer occurs within a depth of 50 m and deeper aquifer occurs from 50 to 300 m bgl. Northern part of Khowai valley is dominated by alluvial sediments comprising of clay, sand. In the southern part of the valley the first granular zone encountered at a depth range of 5 to 30 m and its thickness varies from 10 to 20m.

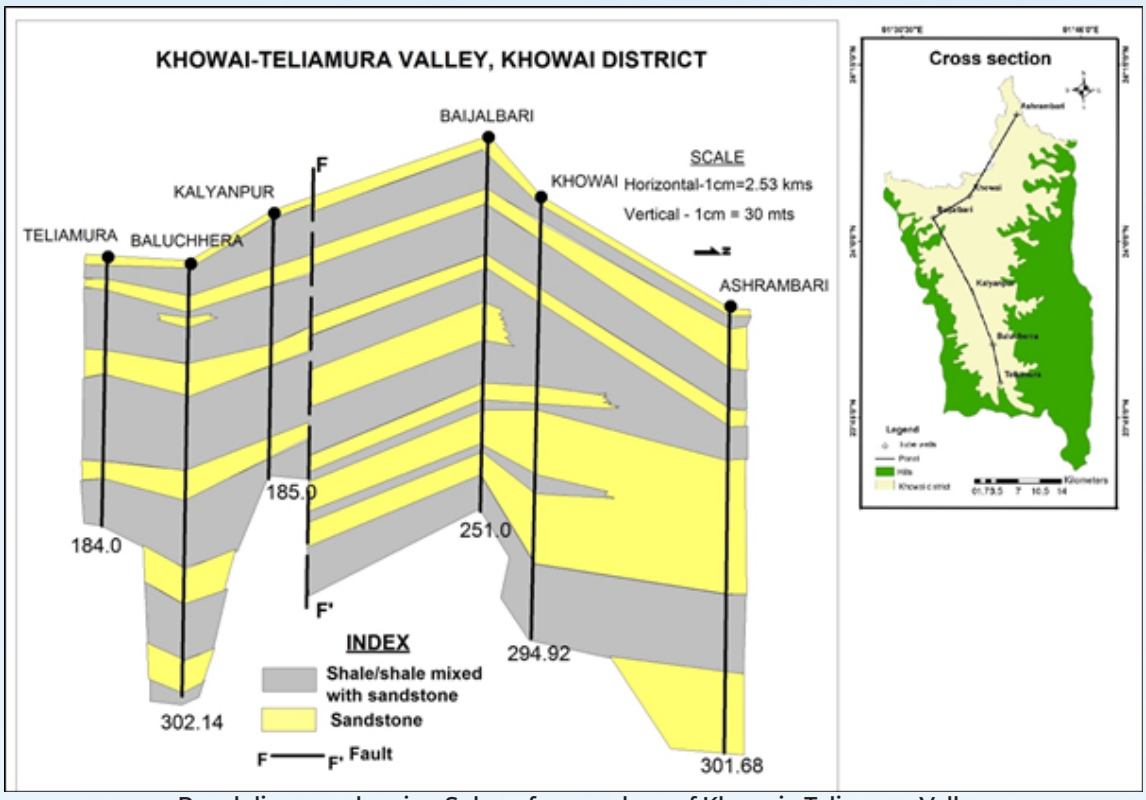


Artesian zone of Khowai valley



Geological map of Khowai district

Aquifer geometry can be interpreted on the basis of the lithological logs of boreholes drilled by Central Ground Water Board and various state government Agencies. The sub-surface configurations of different granular zones have been shown in panel diagram. In Khowai valley, four aquifers were identified. The aquifer horizons are occurring in the range of 40 – 64 m bgl, 72 – 112 m bgl, 90 – 216 m bgl and 250 – 300 m bgl. The aquifers show a dip towards north. Thickness of the granular zones increases towards north.



Panel diagram showing Sub surface geology of Khowai - Teliamura Valley

Details of artesian zones: Surveying of artesian zone has been carried in all the 6 blocks of Khowai district and out of which three blocks are found to have free flowing artesian zone. An isolated artesian flowing well is found at 45 miles area in Atharamura hill range under Mungiakami block.

During the fieldwork each village has been visited along the Khowai river and in nearby area for detailed artesian mapping. On the basis of field data, the free flowing artesian zone has been demarcated. Representative artesian wells were monitored and relevant data were collected in the field. To measure the actual piezometric head of free flowing artesian well, a transparent pipe of 2 to 3 m was erected above the parapet of the well. The locations are plotted in the google earth for demarcating the artesian zone and it is mapped to be about 180 sq km. The artesian zone is found along the Khowai river extending from Teliamura block in the south to Khowai block in the North.

The discharge of the artesian well is monitored using volumetric method. A total of 68 numbers of representative artesian wells have been inventoried & monitored periodically and data have been collected. The block wise details of discharge and piezometric head collected.

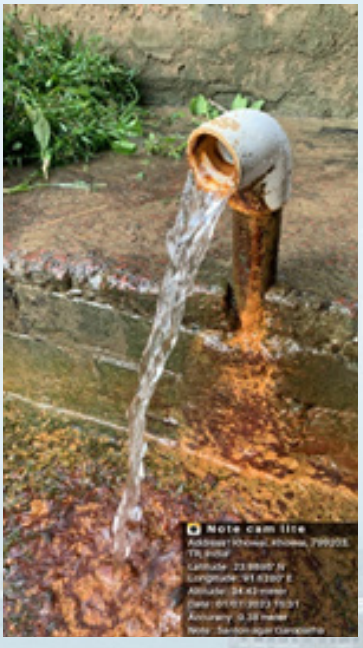
S.NO.	BLOCK	DISCHARGE RANGE (LPS)			
		NOV-2009	SEPT. 2022	NOV-2022	JAN-2022
1	Khowai	0.05 to 2	0.1 to 2	0.04 to 1.6	0.07 to 2
2	Teliamura	0.02 to 0.75	0.03 to 1.2	0.1 to 0.75	0.02 to 0.72
3	Kalyanpur	0.09 to 0.75	0.1 to 1.5	0.06 to 1.3	0.07 to 1.14

Block wise details of discharge (in lps) of artesian wells

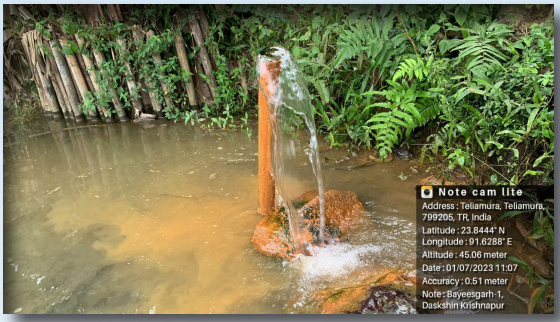
S.NO.	BLOCK	DISCHARGE RANGE (LPS)		
		SEPT. 2022	NOV-2022	JAN-2022
1	Khowai	0.5 to 3.5	0.4 to 3.5	0.18 to 3.5
2	Teliamura	0.22 to 1.38	0.5 to 1.36	0.23 to 1.35
3	Kalyanpur	0.5 to 2.7	0.46 to 2.7	0.49 to 3

Block wise details of Piezometric head (in m) of artesian well

Field Photographs



Artesian well at Khowai town, Khowai Block used for domestic purpose



Artesian well at Baishghar, Teliamura block used for pisciculture

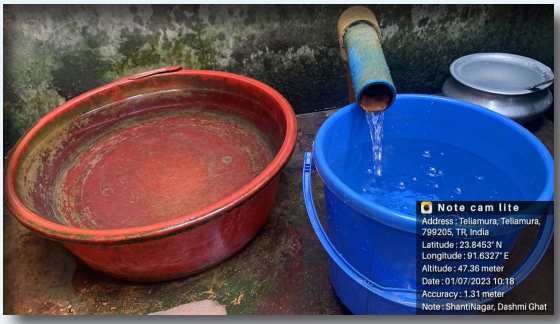
Auto flow well (discharge of 14.6lps) at Char Ganki

Jamirapara, Khowai block, Pz head- 2 m agl

Iron encrustation at Char Ganki, Khowai block

Monitoring of Piezometric Head at Khowai district, Tripura

Boro paddy cultivation from artesian well at Char Ganki, Khowai block



Dashmi ghat, Teliamura block (January, 2023 with Discharge of 0.079 lps)

Aman Paddy cultivation using Artesian well. Discharge (volumetric method): 0.75lps

Village- Kali Bari basti paharmura, Khowai block, Khowai district, used for irrigation and domestic

Iron deposition and slime formation at Ratia, Kalyanpur block

Result & Conclusion

- The geomorphic unit of tightly folded anticlinal hills with broad synclinal Khowai valley is favourable for artesian condition, whenever good thickness of impermeable clay beds underlie and overlie the saturated granular zones occurs.
- These anticlinal hills form watersheds from which drainage patterns emerge. The recharge zone of artesian at Khowai valley is anticlinal hills with sandy formation. Artesian zone is mostly confined along the Khowai River inferring the artesian zone acts as a discharge zone.
- The artesian zone is mapped to be about 180 sq km covering three blocks (Khowai, Kalyanpur and Teliamura) of Khowai district.
- Flowing conditions with auto-flow of 72 to 10800 litres per hour are found mainly in the central part of most of the synclinal valley of Khowai district.
- The Piezometric head ranges from 0.2 to 3 m agl.
- The free flowing artesian wells are mainly used for irrigation purpose. Some of them are also used for drinking & domestic purposes and few are used in fisheries.
- These artesian wells supports three times paddy cultivation in an year in this area, called Aman, Aus and Boro cultivation.
- Comparing with the previous study there is no significant change in the artesian zone and discharge of the wells are more or less same.
- A pipe of 2 m to 3 m with a cap may be erected to conserve and arrest the free flowing water and can be operated whenever required.

Cover Story

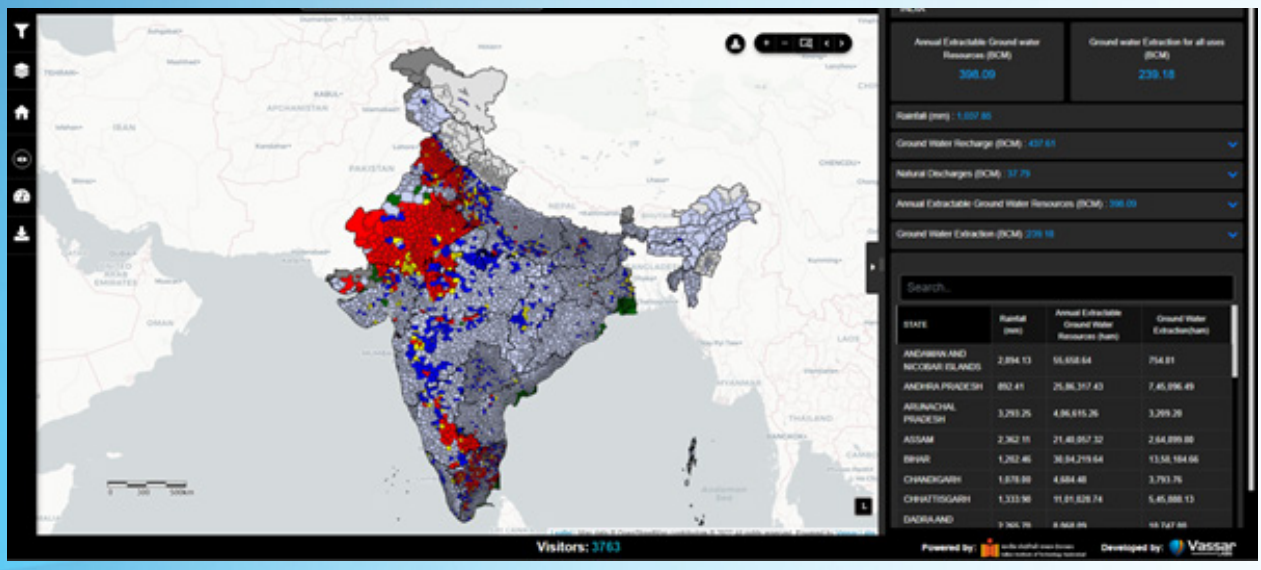
Ground Water Resource Assessment

Ground Water Resource Assessment

– *Subhra Satapathy, Ratikanta Naik*

The Assessment of Dynamic Ground Water Resources of each State/UT is being carried out jointly by Central Ground Water Board and State Nodal/Ground Water Department periodically as per the Ground Water Estimation Committee (GEC-2015) methodology under the guidance of the respective State/UT Level Committees (SLCs) and overall supervision of Central Level Expert Group (CLEG).

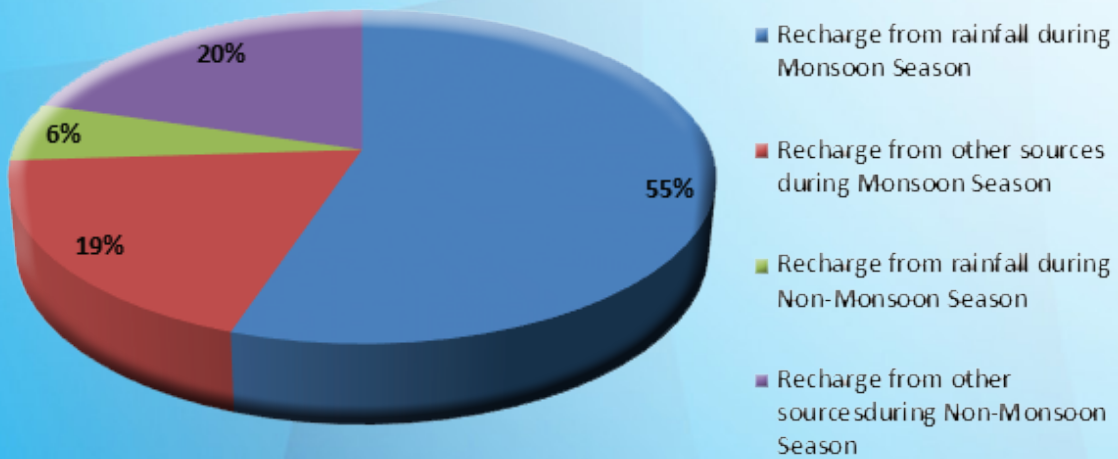
A software/ web-based application "INDIA-GROUNDWATER RESOURCE ESTIMATION SYSTEM (IN-GRES) has been developed by CGWB in association with IIT-Hyderabad for assessment of groundwater resources as per GEC Methodology. It provides a common and standardized platform for GW Resource Assessment for the entire country. GW Resource Assessment - 2022 (GWRA-2022) has been carried out through using IN-GRES (https://ingres.iith.ac.in/).

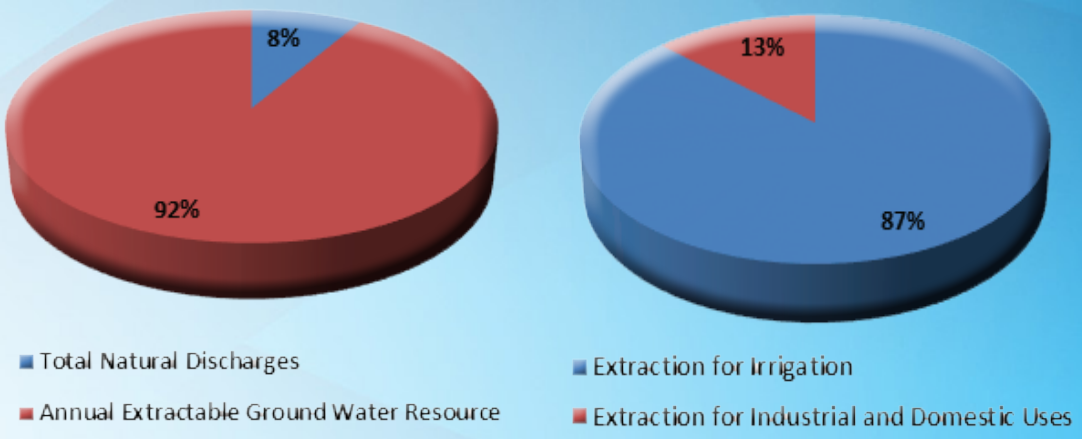


Web Page of IN-GRES

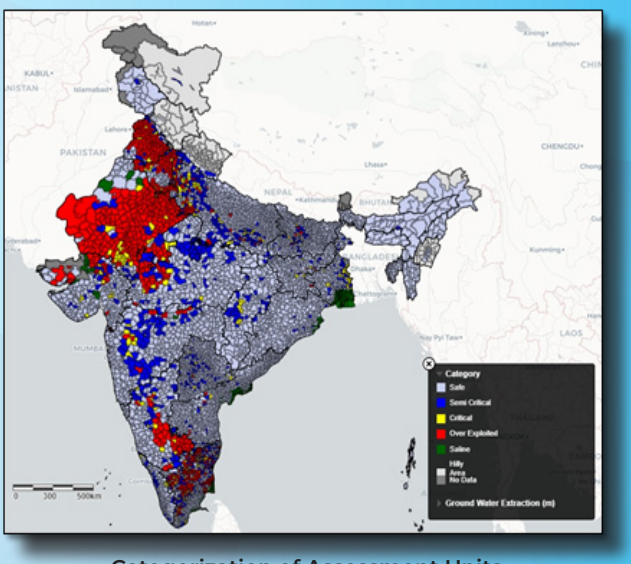
In the present assessment (2022), the total annual groundwater recharge in the country has been assessed as 437.60 billion cubic metre (bcm). Keeping an allocation for natural discharge, the annual extractable ground water resource has been assessed as 398.08 bcm. The annual groundwater extraction (as in 2022) is 239.16 bcm. The average stage of groundwater extraction for the country as a whole works out to be about 60.08 %.

Ground Water Recharge Scenario in India, 2022





Out of the total 7089 assessment units (Blocks/ Mandals/ Talukas/Firkas) in the country, 1006 units in various States (14 %) have been categorized as 'Over-exploited' indicating ground water extraction exceeding the annually replenishable ground water recharge. In, 260 (4 %) assessment units the stage of groundwater extraction is between 90-100% and have been categorized as 'Critical'. There are 885 (12 %) "Semi-critical" units, where the stage of ground water extraction is between 70 % and 90 % and 4780 (67 %) 'Safe' units, where the stage of Ground water extraction is less than 70 %. Apart from these, there are 158 (2%) assessment units, which have been categorised as 'Saline' as major part of the ground water in phreatic aquifers in these units is brackish or saline.



Categorization of Assessment Units

Shri Gajendra Singh Shekhawat, Honourable Union Minister of Jal Shakti has released the Report of "National Compilation of Dynamic Ground Water Resources of India-2022" on 9th November, 2022 (http://cgwb.gov.in/documents/2022-11-11-GWRA%202022.pdf).

Pathshala

Pumping Test: An approach towards making the invisible visible

-Sujatro Ray Chowdhuri, Vikash Kumar, Rahul Kumar, Aditi Singh
Northern Region, Lucknow

India, being an agriculture based economy; the most valuable resource for the country is ground water. This invisible resource has been playing a very significant role in fulfilling the Nation's irrigation, domestic and industrial needs. Understanding its importance is very crucial as it is not visibly present right in front of us. The uneven distribution of the ground water resources based on climate, physiography, hydrogeological set up and its huge unplanned extraction in several parts of the country is the principle concern for its proper management.

Before formulating a scientific strategy for its management, it is important to get an idea about the existing ground water resources available in the different aquifers identified in the country. To determine the aquifer geometry, its disposition in space, their hydrologic characteristics, chemical characteristics, aquifer-wise dynamic /static resources availability and aquifer-wise feasible management plan formulation, Central Ground Water Board under Department of Water Resource, River Development & Ganga Rejuvenation, Ministry of Jal Shakti, Government of India had implemented National Aquifer Mapping and Management (NAQUIM) Programme in the country covering an area of 25.15 lakh sq.km.

Under NAQUIM, exploration studies play the most vital role. The Exploratory and Observation wells constructed are made to undergo pumping test for the determination of Aquifer Parameters like Transmissivity (T), Hydraulic Conductivity (K), Storativity (S), Specific Yield (Sy), Leakence (L) etc. of different aquifers. Pumping test is a field experiment in which an exploratory well is pumped at a controlled rate and water level response is measured in exploratory/pumping well and one or more surrounding observation wells tapping the same aquifer.

There are two types of Pumping Tests namely the Step Drawdown Test (SDT) and the Aquifer Performance Test (APT). The Step Drawdown Test is conducted to evaluate the well performance and its efficiency. In SDT the exploratory well is pumped at variable discharge rates (increased from an initially low constant rate through a sequence of pumping intervals to progressively higher constant rates) of 3 to 4 steps of equal duration depending on its discharge. The drawdown (i.e. difference between static and pumping water level) with respect to time is duly noted in the field. Well loss, formation loss and well efficiency is determined by using Jacob (1947),

Hantush (1964) and Bierschenk (1963) equation.

Under Aquifer Performance Test (APT), the drawdown response of an aquifer is observed in the exploratory and observation well under constant discharge rate and long duration pumping in the aquifer. The time vs drawdown data then plotted are compared with mathematical models /type curve as follows,

- Theim-Dupits method, Neuman (1972), Boulton (1963) methods for Unconfined Aquifer
- Theim (1960), Theis (1935), Jacob (1946), Chow (1952) methods for Confined Aquifer,
- De Glee, Hantush Jacob, Hantush (1955) / Walton, Hantush (1960) methods for Semi Confined Aquifer
- Moench (1984, 1988), Warren Root (1963) for fractured doubly pored aquifer.

Depending upon prevailing steady-state/ transient condition, the aquifer parameters (T, S, Sy, L etc.) of different aquifers are determined.

After the end of Pumping Test, water level inside the exploratory and observation wells starts to rise. The recovered water level data is measured in both the wells with respect to time which is termed as the Recovery Test. After complete recovery of the drawdown, water level becomes equal to static water level (i.e. water level before the initiation of Pumping Test). Residual drawdown (difference between static and recovered water level) vs time data is plotted and transmissivity (T) of the particular aquifer is determined by using Theis (1935), Agarwal (1980) mathematical model.

The average of aquifer parameters, obtained from different pumping test methods, is used in several hydrogeological calculations such as:

- Prediction of water level in areas with different stressed conditions in future by ground water modelling,
- Estimation of Dynamic and Static Ground Water Resources available in different aquifers,
- Dispersion mechanism of any contaminant within the aquifer,
- Scope of supply side management in any particular area under NAQUIM studies throughout the Nation.
- Prediction of safe yield for any pumping well.

- Simulation of Drawdown surfaces (cone of depression) and determination of optimum distance between two pumping wells within a same aquifer.

Being a concealed resource, understanding the distribution, movement and management of groundwater becomes supremely important. Determining the aquifer properties, is the crucial step towards understanding the aquifer and its characteristics which further helps in planning and implementation of the resources available in the subsurface.

Shodh

Research Publication by CGWB Officers in Reputed Journal

Sustainable aquifer management plan for basaltic aquifer system of Jalna district, Maharashtra, India

Journal of Earth System Science, 131, art.no. 250

Lamsoge B.R., Varade A.M., Verma J.R., Anu V., Venkatesam V.

Abstract: The Jalna district in the Marathwada region of Maharashtra State, India, represents the south-eastern Deccan Volcanic Province. The district falls under the drought-prone areas programme zone of low rainfall and receives 750 mm annual precipitation from the southwest monsoon. The region has experienced severe droughts for the last couple of decades, which have adversely affected the groundwater levels and yielded potentiality of Deccan Trap basaltic aquifers. As a result, the groundwater resources in the area are under severe stress. Aquifer-wise groundwater management is one of the best solutions to overcome water demand. Keeping this in view, the aquifer-wise groundwater management plan, considering the demand and supply management, is formulated for the Jalna district. As supply-side management, a total of 198 percolation tanks and 565 check dams are proposed, which will augment additional groundwater resources to the tune of 56.55 MCM. At the same time, as a part of demand-side management, micro-irrigation techniques in 14 km² areas of the district have been recommended, saving a total of 7.08 MCM water. Adopting this plan will store 186.53 MCM volume of groundwater and bring an additional 286.97 km² land area under assured groundwater irrigation by constructing 11,188 dug wells and 1242 borewells. Proposed plan targets maintaining the stage of groundwater development up to 60% to sustain the assured irrigation and protect the groundwater resources of the Jalna district area for future generations. © 2022, Indian Academy of Sciences.

Identification of Suitable Recharge Sites by Integrated Hydro-geophysical Approach for Augmenting Groundwater in Reodar Block, District Sirohi, Rajasthan

Journal of the Geological Society of India, 98, Page No. 1447-1454

Kanwar P., Singh K.P.

Abstract: The dependence of human beings on groundwater and ever-increasing demands of growing population, agriculture and industries, has resulted in its over-exploitation. This has led to the decline of groundwater levels and its shortage especially in lean season. The study area, Reodar block of Sirohi district, Rajasthan, is an over-exploited block with the stage of groundwater extraction at 159% and has an average declining water level trend at the rate of 0.24 m/year. Artificial recharge was proposed in the study area through the construction of recharge shafts and injection wells, after delineating the weathered thickness in the submergence area of existing ponds and check dams of the study area by carrying out vertical electrical sounding (VES). In all, VES were conducted at 178 sites and recharge structures were constructed at 76 out of 109 scientifically selected sites with suitable weathered thickness and attempt was made to establish their impact on water levels through pre-monsoon water level monitoring. The comparison of pre-monsoon water level observations spanning over four decades reveals its spatio-temporal decline in the study area. The construction of these recharge structures has resulted in significant increase in area from 38% to 68%, under 0 to 20 m below ground level water level range. This study demonstrates the importance of resistivity surveys in scientifically selecting the suitable sites for construction of recharge structures and significance of long-term water level monitoring in assessing the groundwater scenario and impact assessment, in poorly characterized hydrogeological areas. © 2022, Geological Society of India, Bengaluru, India.

Depthwise Variation of Selenium in Groundwater in Parts of Punjab, India

Journal of the Geological Society of India, 98, Page no. 1567-1572

Angurala M.L., Naik P.K., Behera S.C.

Abstract: Selenium is an essential trace element in human diet with carcinogenic effect when consumed in excess. This paper examines the depth wise variation of selenium in the aquifers of north eastern Punjab (India) in the Indo-Gangetic Plains in a piedmont zone. Out of 210 km² hydro geologically studied area in parts of Hoshiarpur and Nawanshahr districts of Punjab State, about 50% of area was found affected by high selenium concentration problem in groundwater. Three aquifer groups were identified, i.e., aquifer group I, II and III with depth ranges of about 75–95 m (thickness ~90 m), 120–230 m (thickness ~110 m) and beyond 255 m, respectively. A clay horizon of about 15–35 m thickness separates aquifer group of I and II and that of about 15–30 m thickness aquifer group of II and III. Aquifer group I is unconfined, aquifer group II is semi-confined and aquifer group III is confined in nature. High concentrations of selenium is observed in aquifer groups I and II with concentrations decreasing with depth. Aquifer group III is devoid of selenium. The symptoms of high contents of selenium started emerging when people deepened their wells in the 1970s to a depth of 20–45 m in a sandy clay horizon. This, however, is yet to be verified and warrants further investigation. © 2022, Geological Society of India, Bengaluru, India.

Aquifer characterization and hydrogeological modelling for devising groundwater management strategies for the Chennai aquifer system, southern India

Environmental Earth Sciences, 81, art. No. 187

Senthilkumar M., Gnanasundar D.

Abstract: The Chennai aquifer system, which occupies an area of 6629 km², is one of the most stressed aquifer systems in southern India and is under severe threat of over exploitation and quality deterioration. This is due to the increasing groundwater abstraction for irrigation, domestic, industrial purposes and for drinking water supply to the ever-expanding Chennai city. To offset the effect of this heavy extraction a paradigm shift towards groundwater management was imperative. A multidisciplinary integrated approach was used to map the aquifers, delineate their geometry, to determine the hydraulic behaviour of the aquifer system, and to formulate an aquifer management plan through the development of a groundwater flow model. The main aquifers in the area include weathered and fractured crystalline rocks and recent alluvial formation. Alluvium is the most significant aquifer system in the study area, and this aquifer contains potable quality groundwater except in the eastern part of the study area that has been affected by seawater intrusion. A two-layered groundwater flow model was developed using Visual MODFLOW classic version 4.6 with a 1 km² grid pattern to simulate groundwater flow for a period of 9 years. The model was calibrated under steady and transient state conditions and allowed components of the water balance of the system to be determined at a regional scale. The simulated results indicate that this aquifer system is under tremendous stress at the prevailing groundwater withdrawal rate of 899 million cubic meter (mcm)/year and would become unstable with the predicted 25% increase in groundwater withdrawal by 2025. However, the interventions to recharge an additional 54 mcm of water could help mitigate the current decline in potentiometric heads and could partially help to arrest the further advancement of seawater intrusion. A scenario of maintaining flow in rivers for a period of 120 days each year coupled with the construction of an unlined canal shows increase in groundwater head and development of the groundwater mounds, which are positive signs for arresting the decline of the water table and pushing saline groundwater in a seaward direction. As a result of the high rate of groundwater depletion in the area, management strategies need to be implemented urgently in the region. These strategies should include the regulation of groundwater abstraction and maintaining an extended flow period in the rivers. These measures are required to improve the sustainability of the available groundwater resources of the region. © 2022, The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature.

A multiparametric approach for rejuvenation of the Gaurikund geothermal spring system in the Northwest Himalayan region

Contributions to Geophysics and Geodesy, 52, Page No. 157-183

Khanna A., Bagchi D., Kannaujiya S., Sarkar T.

Abstract: The Gaurikund town falls on the way of the famous trekking route to Kedarnath that faced the wrath of the 2013 flood disaster. This fateful event severed more than 5000 casualties, demolished several infrastructures, and shifted the course of Gaurikund spring from its original position. Nevertheless, the Gaurikund geothermal spring system located in the Himalayan Geothermal Belt of the Garhwal region is preeminent for religious beliefs, balneotherapeutic values and a gateway to delve within the geothermal and hydrological characteristics of the area. In this perspective, restoration of Gaurikund geothermal spring system becomes a necessity. A multiparametric approach comprising geospatial, geology, hydrochemistry and geophysics has been used to study and justify these aspects at Gaurikund. The geological studies infer that the geothermal spring gets recharged by the steep, southerly dipping joints in granite gneiss. Subsequently, the deep percolated water heats up due to the high geothermal gradient and then emerge along the Vaikrita Thrust and its sympathetic minor fault-thrust system by advection. Moreover, four spring outlets are inventoried, with discharge varying from 7.46 to 95.54 L/min. The normal emissivity model uses the pre and post-disaster satellite data and generates maximum kinetic temperature images, showing a positive correlation between land surface temperature and spring discharge. Two-dimensional Electrical Resistivity Tomography (Schlumberger, Wenner and Gradient configurations) survey revealed two low resistivity zones proximal to the geothermal spring on the right bank of the Mandakini river. The engineering interventions carried out by bank protection and construction of small gully plugs in the catchment area is recommended along Gaurikund-Sonprayag section on the right bank of Mandakini river. © 2022 Sciendo. All rights reserved.

Hydrochemistry for the assessment of groundwater quality in the Kathua region, Jammu and Kashmir, India

Applied Water Science, Art.No. 143

Kouser B., Bala A., Verma O., Prashanth M., Khosla A., Pir R.A.

Abstract: Groundwater is a vital natural resource in the Kathua region of the Union Territory of Jammu and Kashmir, Northern India, where it is used for domestic, irrigation, and industrial purposes. The main purpose of this study was to assess the hydrochemistry of the groundwater and to determine its suitability for drinking, irrigation, and industrial uses in the Kathua region. In this study, 75 groundwater samples were collected and analyzed for the physicochemical parameters such as electrical conductivity (EC), total dissolved solids , pH, and various cations and anions. The analyzed data were computed for designing groundwater quality index to know the suitability for drinking purposes. The EC, sodium percentage, permeability index, and magnesium hazard were assessed to evaluate groundwater suitability for irrigation. Further, the corrosivity ratio was assessed to find the groundwater quality criteria for industrial purposes. The comprehensive results obtained from the water quality index indicate that almost all groundwater samples are suitable for drinking. The ionic abundance is in the order of Ca2+ > Na+ > Mg2+ > K+ for cations, and HCO3− > SO42− > Cl− > NO3− for anions, respectively. The Piper diagram shows that hydrochemistry of the groundwater is dominated by alkaline earth metals (Ca2+, Mg2+) and weak acids (HCO3−). According to the Gibbs diagram, the chemistry of groundwater is mainly controlled by the rock–water interaction process, indicating that most of the groundwater samples of the area are of bicarbonate type. The EC results classify the groundwater as excellent to good; the sodium percentage also indicates that the water is fit for irrigation. According to the Wilcox and USSLS diagrams, and permeability index, a majority of samples are suitable for irrigation with a few exceptions. The magnesium hazard depicts that there are few samples (19%), which are unsuitable for irrigation. According to the corrosivity ratio, 65 samples are safe for industrial use while the remaining 10 samples are considered to be unsafe. Thus, it is found that most of the groundwater in the area can be used for drinking, irrigation, and industrial purposes. © 2022, The Author(s).

Human Health Risk Assessment of Harmful Heavy Metals and Uranium Exposure in Shallow Aquifer of Nagaon, the Highest Populated District of Assam, India

Journal of the Geological Society of India, 98, page No. 1407-1416

Barman R., Dutta S., Radhapyari K., Datta S., Raj R., Ray B., Srivastava S.K.

Abstract: The present investigation attempts to assess the harmful heavy metals and uranium exposure in shallow aquifers of the highest populated district Nagaon in the central Brahmaputra floodplain of Assam, India. Spatial distribution using the inverse distanced weighted interpolation method in Arc GIS, various pollution indices and health risk assessment indices pooled with statistical studies were employed to appraise the pollution scenario and potential health risk. The contamination degree index for the three locations was 14.09, 21.43 and 25.95, signifying a considerable degree of contamination. The excess cancer risk due to the radioactivity of uranium in adults and children of Nagaon district is negligible compared to the prescribed limit of 1.67×10^{-4} set by the Atomic Energy Regulatory Board. The average concentration of the analyzed heavy metal follows the order Mn > Fe > Zn > Cu > Ni > U > Pb > Cr > Cd. The notch box plot study reveals that the risk associated with the ingestion of water contaminated with heavy metals is higher than the dermal absorption. The HQIngestion of manganese in children shows a higher range (0.003–6.85) than in adults (0.002–4.12), with a median value of 0.14 compared to 0.08 in adults. Both adults and children are vulnerable to non-carcinogenic risks, and the risk is higher in children than in adults. © 2022, Geological Society of India, Bengaluru, India.

Social Media Highlights

Top Tweet earned 2,118 impressions

Monitoring of Piezometric Head at Khowai district, Tripura
@MoJSDoWRRDGR
pic.twitter.com/19Z7egjten

8 25

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Central Ground Water Board
Published by केंद्रीय भूमि जल बोर्ड · 23 November 2022 ·

Demonstration of DWLR and Telemetry system by M/S Four ITS, New Delhi at Piezometer site, GGM Science college, Jammu, J&K.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Central Ground Water Board
· 18 January at 21:00 ·

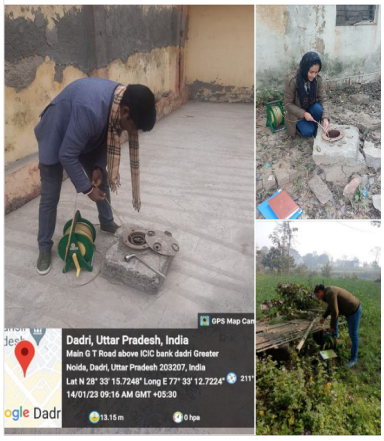
Autoflow wells in Khowai district of Tripura.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Central Ground Water Board
12 December 2022 ·

Scientists of CGWB, NCR shared NAQUIM Report of Annupur district with District Administration, Dindori. The meeting was chaired by Sh. Abhay Singh Ohariya, District Collector Annupur, M.P. Officials from various state departments were present during the meeting.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Central Ground Water Board
Published by केंद्रीय भूमि जल बोर्ड · 14 January at 12:49 ·

Monitoring for January month is being carried out in different parts of Uttar Pradesh.
Ministry of Jal Shakti, Department of Water Resources, RD & GR



Top Tweet earned 1,193 impressions

Sh. Pankaj Kumar, Secretary (DoWR, RD&GR), along with Sh. Subodh Yadav, Joint Secretary, Ministry of Jal Shakti interacted with the Regional Directors and officers of Central Ground Water Board.
@MoJSDoWRRDGR
pic.twitter.com/6JtJAEvLxG

10 25

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Central Ground Water Board
Published by केंद्रीय भूमि जल बोर्ड · 25 December 2022 ·

Scientists of CGWB, NR, Lucknow conducted Pumping Test at Bhadeicha site, block- Sursa, district- Hardoi. SDT of 3 hours (each step of 60 minutes) , APT of 1000 minutes at constant discharge of 2028 lpm for determination of aquifer parameters under National Aquifer Mapping and Management Study.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Top Tweet earned 4,148 impressions

Release of National compilation on Dynamic Ground Water Resources of India 2022 by sh @gssjodhpur , Hon'ble Minister of @MoJSDoWRRDGR @CWCOfficial_GoI @NHPConnect @nwda @NWDA_MOWR @wapcosofficials
pic.twitter.com/qH22aBRR7Y

3 12 51

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Top Tweet earned 1,896 impressions

#Jalshaktiabhiyan: Catch The Rain 2022 field visit to Ghaziabad district, Uttar Pradesh under the supervision of Dr Vijay Mittal, JS, Ministry of Heavy Industries (CNO) & Sh Upendra Dhonde, Scientist, Central Ground Water Board (TO). **@MoJSDoWRRDGR**
pic.twitter.com/GWDSkqYWyQ

Central Ground Water Board
Published by Yuvranjan Sachdev · 12 December 2022 ·

Scientists of CGWB, CR shared and presented the outcomes of Aquifer Mapping and Manag ne. District Collector has accepted to utilize the outcomes of NAQUIM in ongoing schemes. Officials from various state departments were present during the meeting.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Central Ground Water Board
5 November 2022 ·

Hon'ble Vice President of India Shri. Jagdeep Dhankhar Ji graced the Valedictory Session on 7th #IndiaWaterWeek and appreciated the hardwork put in to make this event a success.
Ministry of Jal Shakti, Department of Water Resources, RD & GR Central Water Commission WAPCOS Limited National Institute of Hydrology (NIH)

2 15 42

Central Ground Water Board
Published by केंद्रीय भूमि जल बोर्ड · 30 November 2022 ·

Officers of CGWB, NR shared the NAQUIM report of Auraiya district, U.P. with District Magistrate, Auraiya. DM, Auraiya praised the work done by CGWB
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Top Tweet earned 2,159 impressions

Officers of CGWB, Jaipur conducted Pumping test at Munjasar Exploratory Well site, Lohawat Block, Jodhpur District, Rajasthan. NGRI has recommended this as a potential site where Heliborne Survey has been taken up. **@MoJSDoWRRDGR**
pic.twitter.com/QaXtJEuHtA

7 18

Top Tweet earned 1,681 impressions

Ground Water Exploration activity in Purulia, the most water scarce, drought affected and Irrigation deprived district of West Bengal. Drilling carried out at Sirkabad, Arsh Block, Purulia, West Bengal, having a discharge of 10 lps. **#harekkaamdeshkenaam** **@MoJSDoWRRDGR**
pic.twitter.com/WnxapfXhR6

14 25

Central Ground Water Board
8 November 2022 ·

Sh. Sunil Kumar, Chairman CGWB along with Sh. Satish Kumar, Member, CGWB graced the Inaugural function of Induction Level Training Course at RGNGWTRI, Raipur.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Central Ground Water Board
12 December 2022 ·

CGWA, HQ organized two days training program on "NOCAP software and related issues" at CGWA, HQ, New Delhi with CGWA regulated Regions in 2 batches. The training program was inaugurated by Chairman, CGWB.
Ministry of Jal Shakti, Department of Water Resources, RD & GR

Collectable

01 Scientists of CGWB, SER, Bhubaneswar Conducted APT at Kunjamura village, Natkidaula Block, Sambalpur district, Odisha.

02 Officers of CGWB, Jaipur conducted Pumping test at Munjasar Exploratory Well site, Lohawat Block, Jodhpur District, Rajasthan.

03 Officers of Central Ground Water Board, Jaipur carrying out Ground Water level monitoring and sampling of Uranium in all the districts of Rajasthan.

04 Surface Water, Ground Water & Rainfall samples collected by Scientists of CGWB, Lucknow in Ramganga Basin, Uttar Pradesh.

05 Officers of Central Ground Water Board, Jaipur carrying out sampling of Uranium in all the districts of Rajasthan.

06 CGWB, Chandigarh has participated in Mega-exhibition "Aspiring Haryana 2022" held in Hisar.

07 Geophysicist of CGWB, WR, Jaipur, conducted VES at Khatoo village, Danta Ramgarh, Sikar district, Rajasthan.

01 State Level Committee has approved GW Resource Assessment of, 2022 of Uttarakhand State.

02 Ms. Lata Udsaiya, Scientist, CGWB, Bhopal presented and shared NAQUIM report of Agar Malwa district to the District Administration.

03 SLC meeting on GWRA of Mizoram 2022 convened under chairmanship of Secretary PHE Mizoram. RD NER Guwahati and team presented the GWRA of Mizoram as on 2022.

04 तिरुवनंतपुरम में संसदीय राजभाषा समिति ने केंद्रीय भूमि जल बोर्ड, तिरुवनंतपुरम कार्यालय के साथ निरीक्षण बैठक की।

05 Scientist from CGWB represented as mentors in Smart India Hackathon 2022 organized in Welingkar Institute of Management, Mumbai.

06 Central Ground Water Board, Ahmedabad organised Public interaction program at Panas, Valsad district Gujarat.

07 Regional Directors' Meeting at Central Ground Water Board, CHQ, Faridabad chaired by Sh. Sunil Kumar, Chairman, CGWB.