भारत सरकार
Government of India
जल शक्ति मंत्रालय,
Ministry of Jal Shakti,
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग,
Department of Water Resources,
River Development and
Ganga Rejuvenation

केंद्रीय भूमि जल बोर्ड
Central Ground Water Board

NAQUIM 2.0

जलभृत प्रबंधन योजना
Aquifer Management Plan
कोरबा औद्योगिक क्षेत्र, कोरबा जिला, छत्तीसगढ़
Korba Industrial Area, Korba District, Chhattisgarh

North Central Chhattisgarh Region (NCCR)
Raipur
2024

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Aquifer Management Plan

कोरबा औद्योगिक क्षेत्र, कोरबा जिला, छत्तीसगढ़

Korba Industrial Area, Korba District, Chhattisgarh

प्राथमिकता प्रकार: औद्योगिक समूह और खनन क्षेत्र

Priority Type: Industrial Cluster and Mining Areas

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North Central Chhattisgarh Region (NCCR)

Raipur

2024

केंद्रीय भूमि जल बोर्ड
CENTRAL GROUND WATER BOARD

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
DEPARTMENT OF WATER RESOURCES,
RIVER DEVELOPMENT AND GANGA REJUVENATION

जल शक्ति मंत्रालय
MINISTRY OF JAL SHAKTI

भारत सरकार
GOVERNMENT OF INDIA

राष्ट्रीय जलभृत मानचित्रण और प्रबंधन योजना 2.0
NATIONAL AQUIFER MAPPING AND MANAGEMENT PLAN 2.0

कोरबा औद्योगिक क्षेत्र, कोरबा जिला, छत्तीसगढ़
KORBA INDUSTRIAL AREA, KORBA DISTRICT, CHHATTISGARH

CONTRIBUTORS

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Expert (Hydrogeology)-1	Suvam Prakash Dash	Hydrogeologist (AHG)
Expert (Hydrochemistry)	Rakesh Dewangan	Chemist (Scientist -D)
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उत्तर मध्य छत्तीसगढ़ क्षेत्र, रायपुर
NORTH CENTRAL CHHATTISGARH REGION, RAIPUR

JUNE 2024

डॉ. सुनील कुमार अम्बष्ट
अध्यक्ष
Dr. Sunil Kumar Ambast
Chairman

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन,
नदी विकास और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल बोर्ड
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvention
Central Ground Water Board

Message

National Aquifer Mapping and Management Programme (NAQUIM) was initiated by Central Ground Water Board (CGWB) in 2012 with the goal of mapping and managing aquifers across India to promote sustainable groundwater use. So far the entire mappable area of 25 lakh km^2 has been covered under the NAQUIM programme. While these initial efforts have been highly impactful, they faced certain limitations especially in terms of spatial resolution.

Taking it forward, CGWB has now initiated **NAQUIM 2.0,** the next phase of aquifer mapping designed to provide a deeper, more detailed understanding of India's groundwater systems. During 2023-24, CGWB had completed NAQUIM 2.0 studies in 68 study areas. The study areas were selected in consultation with the State/UT government agencies.

I am confident that this report of NAQUIM 2.0 study will serve as a critical resource for government agencies, research institutions, NGOs, and the general public. By fostering a collaborative approach to groundwater management, this report will play a key role in safeguarding and sustaining India's precious ground water resources.

(Dr. Sunil Kumar Ambast)

Chairman, CGWB

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भारत सरकार
जल शक्ति मंत्रालय
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केंद्रीय भूमि जल बोर्ड

Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation
Central Ground Water Board

Message

A realistic evaluation of the availability and utilization of a natural resource is imperative for formulating strategies to ensure its sustainable development and its management. This significance is heightened, especially in the context of groundwater in the Country, which faces escalating stress due to its extraction for diverse purposes. The consequence of this situation is a decline in groundwater levels, the desaturation of aquifers, and the deterioration of water quality, among other issues. Groundwater needs to be used and managed in a sustainable way to ensure its long-term sustainability.

The NAQUIM 2.0 study has involved meticulous fieldwork, advanced analysis, and detailed interpretation to ensure that our findings are both accurate and informative. The study covers various aspects, including availability, and potential for future development. The data and recommendations outlined after this study will be instrumental in guiding strategic decisions and supporting sustainable management of groundwater resources. The findings obtained after this study are of great importance not only to policymakers and stakeholders but also to the public. Understanding the status and potential of our groundwater resources is crucial for informed decision-making and fostering community engagement.

The report, titled "NAQUIM 2.0 study of "Korba Industrial Area, Korba district" serves as a comprehensive outcome of the exploration results. The report embodies water level behavior, ground water exploration, geophysical exploration, geochemical analysis, hydrometeorological aspects, statistical analysis, in Korba Industrial Area of Chhattisgarh state. This is the first attempt to synthesize the entire set of related data, analyze and interpret them and to present the findings on micro level in a format that appeal to the academicians, administrators and all the stakeholders in ground water.

The commendable endeavors undertaken by the Central Ground Water Board, North Central Chhattisgarh Region in the creation of the "NAQUIM 2.0 study of Korba Industrial Area, Korba district" Report deserve praise. I have every confidence that this report will offer substantial benefits to a wide range of stakeholders, academicians, administrators and the public alike and will go a long way in the planning and management of the ground water resources for the state of Chhattisgarh

(Dr. A. Asokan)

डॉ. प्रबीर कु. नायक
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Member (East)
भारत सरकार
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जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
केंद्रीय भूमि जल बोर्ड

Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation
Central Ground Water Board

Message

The Korba Industrial Area, nestled within the bounds of Korba Municipal Corporation in Chhattisgarh, has long been a crucible of industrial activity, serving as a vital hub for coal mining, thermal power generation, and urban development. In recent years, however, concerns over the sustainability of these activities have surfaced, particularly regarding their impact on groundwater resources. The NAQUIM 2.0 study marks a significant endeavor to assess the environmental and hydrological dynamics of this critical region.

This report encapsulates the findings of the NAQUIM 2.0 study, focusing on the Korba Industrial Area and its immediate surroundings. It examines the multifaceted challenges posed by extensive mining operations, the deposition of fly ash from thermal power plants, rapid urbanization, and their combined effects on the local groundwater ecosystem. Through meticulous field surveys, data analysis, and interpretation, the study aims to provide a comprehensive understanding of the complex interplay between industrial activities and groundwater dynamics.

I extend my sincere appreciation to Shri Uddeshya Kumar, Team lead (Scientist-C), Shri Rakesh Dewangan, Expert Chemist (Scientist –D), Shri Suvam Prakash Dash, Expert Hydrogeologist (Asst.Hydrogeologist)), Shri Suman Bharti, Expert Geophysics (Scientist-B) and Shri K C Naik (Executive Engineer). Their unwavering commitment, expertise, and tireless efforts have been instrumental in the meticulous execution and insightful interpretation of this study.

This report is intended to serve as a valuable resource for policymakers, environmentalists, researchers, and stakeholders alike, fostering informed dialogue and guiding prudent decision-making for the preservation and enhancement of groundwater resources in Korba Industrial Area.

(डॉ प्रबीर कुमार नायक)
क्षेत्रीय निदेशक

स्थान: रायपुर
दिनांक: 27.08.2024

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Sincere thank is extended to Sh. Rakesh Dewangan, Scientist-D, for his continuous guidance and support during the preparation of this report. The author is also grateful to Dr. A K Sinha, Sc-D, and Smt. Prachi Gupta, Sc-C, for their guidance and insightful suggestions. Acknowledgment is due to Sh B. Abhishek, Sc-C and Sh. Sidhanta Sahu, Sc-C, for the assistance provided in interpretation of different data sets.

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The author expresses gratitude to the Korba Municipal Corporation, CMPDI, SECL, NTPC, CSPGCL, BALCO, and other state agencies for providing essential data. Thanks are also extended to the Technical Section, Data Centre, Chemical Section, Report Processing Section, and Library of CGWB, NCCR, Raipur, for their support and provision of necessary data.

Uddeshya Kumar
Scientist-C & Team Lead

कार्यकारी सारांश

कोरबा औद्योगिक क्षेत्र, जो छत्तीसगढ़ के कोरबा नगर निगम की सीमा के भीतर स्थित है, लंबे समय से कोयला खनन और तापीय विद्युत उत्पादन जैसी औद्योगिक गतिविधियों का एक महत्वपूर्ण केंद्र रहा है। यह क्षेत्र, आर्थिक रूप से महत्वपूर्ण होने के बावजूद, विशेष रूप से भूजल स्थिरता से संबंधित पर्यावरणीय चुनौतियों का सामना कर रहा है। इन चिंताओं को दूर करने के लिए NAQUIM 2.0 अध्ययन को आदेशित किया गया था, जिसका उद्देश्य इस क्षेत्र की जलभूवैज्ञानिक स्थितियों और औद्योगिक गतिविधियों के भूजल संसाधनों पर प्रभाव का व्यापक आकलन प्रदान करना है।

NAQUIM 2.0 अध्ययन के प्रमुख उद्देश्य:

- **विस्तृत जलभूवैज्ञानिक आकलन:** भूजल स्तर, गुणवत्ता और प्रवाह की विस्तृत जानकारी प्रदान करना।
- **मुद्दा-आधारित वैज्ञानिक इनपुट:** कोरबा से संबंधित विशिष्ट समस्याओं पर ध्यान केंद्रित करते हुए, सूक्ष्म स्तर पर भूजल प्रबंधन के लिए वैज्ञानिक इनपुट प्रदान करना।
- **सतत विकास सिफारिशें:** कोरबा की विशिष्ट औद्योगिक और पर्यावरणीय चुनौतियों को ध्यान में रखते हुए, सतत भूजल प्रबंधन रणनीतियाँ विकसित करना।

NAQUIM 2.0 अध्ययन के प्रमुख निष्कर्ष

1. भूजल संसाधन और गुणवत्ता:

- बड़े पैमाने पर कोयला खनन और तापीय विद्युत उत्पादन गतिविधियों के कारण भूजल का अत्यधिक दोहन हुआ है, जिससे जल स्तर में गिरावट आई है।
- औद्योगिक संचालन से उत्पन्न भारी धातुएं और रासायनिक अपशिष्ट जलभृत में समा गए हैं, जिससे भूजल की गुणवत्ता प्रभावित हुई है और यह सार्वजनिक स्वास्थ्य के लिए जोखिम पैदा कर रहा है।

2. जलभूवैज्ञानिक गतिशीलता:

- औद्योगिक गतिविधियों और भूजल गतिशीलता के बीच जटिल अंतःक्रिया को बारीकी से मैप किया गया है। अध्ययन में उन क्षेत्रों की पहचान की गई है जहां अत्यधिक दोहन और प्रदूषण सबसे अधिक स्पष्ट हैं।
- जलभूवैज्ञानिक सर्वेक्षणों और डेटा विश्लेषण से उन महत्वपूर्ण क्षेत्रों की पहचान हुई है जिन्हें भूजल संसाधनों के और अधिक क्षरण को रोकने के लिए त्वरित ध्यान देने की आवश्यकता है।

3. शहरीकरण का प्रभाव:

- तेजी से बढ़ते शहरीकरण और कृषि आवश्यकताओं ने भूजल संसाधनों पर दबाव बढ़ा दिया है। अध्ययन इस बात पर प्रकाश डालता है कि औद्योगिक और शहरी जल आवश्यकताओं को संतुलित करने के लिए एकीकृत प्रबंधन दृष्टिकोण की आवश्यकता है।

सिफारिशें

1. सतत भूजल प्रबंधन:

- भूजल स्तर बढ़ाने के लिए प्रबंधित जलभृत पुनर्भरण (Managed Aquifer Recharge - MAR) तकनीकों को लागू करना।
- प्रदूषण स्रोतों का शीघ्र पता लगाने और उन्हें कम करने के लिए नियमित भूजल गुणवत्ता निगरानी।

2. प्रदूषण नियंत्रण उपाय:

- औद्योगिक अपशिष्ट जल के लिए सख्त नियम बनाना और निर्वहन से पहले उचित उपचार सुनिश्चित करना।
- पर्यावरणीय प्रभाव को कम करने के लिए स्वच्छ प्रौद्योगिकियों और सर्वोत्तम औद्योगिक अभ्यासों को बढ़ावा देना।

3. सार्वजनिक जागरूकता और भागीदारी:

- जागरूकता अभियानों और सहभागी प्रबंधन कार्यक्रमों के माध्यम से स्थानीय समुदायों को भूजल संरक्षण प्रयासों में शामिल करना।
- भूजल की स्थिति और प्रबंधन योजनाओं पर सुलभ जानकारी प्रदान करना ताकि सामुदायिक भागीदारी को प्रोत्साहित किया जा सके।

4. बुनियादी ढांचे का विकास:

- ताजे जल संसाधनों की मांग को कम करने के लिए अपशिष्ट जल उपचार और पुनर्चक्रण के लिए बुनियादी ढांचे को सुदृढ़ करना।
- भूजल पुनर्भरण को बढ़ाने के लिए वर्षा जल संचयन और तूफान जल प्रबंधन के लिए मजबूत प्रणालियों का विकास।

5. नीति और संस्थागत समर्थन:

- सतत भूजल प्रबंधन प्रथाओं का समर्थन करने के लिए नीति रूपरेखाओं को मजबूत करना।
- भूजल प्रबंधन रणनीतियों के प्रभावी कार्यान्वयन और निगरानी के लिए संस्थागत क्षमता निर्माण।

निष्कर्ष:

NAQUIM 2.0 अध्ययन कोरबा औद्योगिक क्षेत्र में भूजल संसाधनों के प्रबंधन के लिए एक समग्र दृष्टिकोण अपनाने की तत्काल आवश्यकता को उजागर करता है। वैज्ञानिक अंतर्दृष्टि को व्यावहारिक प्रबंधन रणनीतियों के साथ एकीकृत करके, यह अध्ययन औद्योगिक, शहरी और कृषि दबावों के सामने भूजल के सतत उपयोग को सुनिश्चित करने के लिए एक रोडमैप प्रदान करता है। प्रस्तुत सिफारिशें इस क्षेत्र के भूजल संसाधनों की सुरक्षा सुनिश्चित करने के लिए तैयार की गई हैं, ताकि वे भविष्य की पीढ़ियों के लिए उपलब्ध और उच्च गुणवत्ता वाले बने रहें।

कोरबा में भूजल का सतत प्रबंधन इस क्षेत्र की **आर्थिक जीवनशक्ति और पर्यावरणीय स्वास्थ्य** को बनाए रखने के लिए अत्यंत आवश्यक है। **NAQUIM 2.0** अध्ययन के निष्कर्ष और सिफारिशें नीति निर्माताओं, औद्योगिक हितधारकों और स्थानीय समुदाय के लिए इस औद्योगिक केंद्र की जलभूवैज्ञानिक चुनौतियों को संबोधित करने में एक महत्वपूर्ण मार्गदर्शिका का कार्य करती हैं।

EXECUTIVE SUMMARY

The Korba Industrial Area, located within the bounds of Korba Municipal Corporation in Chhattisgarh, has long been a significant hub for industrial activities, including coal mining and thermal power generation. This region, while economically vital, faces considerable environmental challenges, particularly regarding groundwater sustainability. The NAQUIM 2.0 study was commissioned to address these concerns, aiming to provide a comprehensive assessment of the area's hydrogeological conditions and the impact of industrial activities on groundwater resources. The primary objectives of the NAQUIM 2.0 study include:

- **Detailed Hydrogeological Assessment**: Providing detailed information on groundwater levels, quality, and movement.
- **Issue-Based Scientific Inputs**: Offering scientific inputs for groundwater management at a granular level, focusing on specific issues pertinent to Korba.
- **Sustainable Development Recommendations**: Developing strategies for sustainable groundwater management, considering the unique industrial and environmental challenges of Korba.

Key Findings of NAQUIM 2.0 Study can be summarized as follows:

1. **Groundwater Resources and Quality**:
    - Extensive coal mining and thermal power generation activities have led to significant groundwater extraction, resulting in declining water levels.
    - Contaminants such as heavy metals and chemical effluents from industrial operations have infiltrated the aquifers, compromising groundwater quality and posing risks to public health.
2. **Hydrogeological Dynamics**:
    - The complex interplay between industrial activities and groundwater dynamics has been meticulously mapped. The study identified areas where over-extraction and pollution are most pronounced.
    - Hydrogeological surveys and data analysis revealed critical zones that require immediate attention to prevent further degradation of groundwater resources.

3. **Impact of Urbanization**:
    - Rapid urbanization and agricultural demands have compounded the pressure on groundwater resources. The study highlights the need for integrated management approaches that balance industrial and urban water needs.

Recommendations:

1. **Sustainable Groundwater Management**:
    - Implementation of Managed Aquifer Recharge techniques to enhance groundwater levels in depleted areas.
    - Regular monitoring of groundwater quality to detect and mitigate pollution sources promptly.
2. **Pollution Control Measures**:
    - Establishing stringent regulations for industrial effluents and ensuring proper treatment before discharge.
    - Promoting the use of clean technologies and best practices in industrial operations to minimize environmental impact.
3. **Public Awareness and Participation**:
    - Engaging local communities in groundwater conservation efforts through awareness campaigns and participatory management programs.
    - Providing accessible information on groundwater status and management plans to foster community involvement.
4. **Infrastructure Development**:
    - Enhancing infrastructure for wastewater treatment and recycling to reduce the demand on freshwater resources.
    - Developing robust systems for rainwater harvesting and stormwater management to augment groundwater recharge.
5. **Policy and Institutional Support**:
    - Strengthening policy frameworks to support sustainable groundwater management practices.
    - Building institutional capacity for effective implementation and monitoring of groundwater management strategies.

The NAQUIM 2.0 study underscores the critical need for a holistic approach to managing groundwater resources in the Korba Industrial Area. By integrating scientific insights with practical management strategies, the study provides a roadmap for ensuring the sustainable use of groundwater in the face of industrial, urban, and agricultural pressures. The recommendations put forth aim to safeguard the region's groundwater resources, ensuring their availability and quality for future generations. In conclusion, the sustainable management of groundwater in Korba is imperative for maintaining the region's economic vitality and environmental health. The findings and recommendations of the NAQUIM 2.0 study serve as a crucial guide for policymakers, industrial stakeholders, and the local community in addressing the hydrogeological challenges of this industrial hub.

Contents

List of Figures:

List of Tables:

List of Annexures:

CHAPTER - 1

INTRODUCTION

1.1 NAQUIM 2.0

Aquifer mapping is a multidisciplinary scientific process wherein a combination of geological, hydrogeological, geophysical, hydrological and water quality data are integrated to characterize the quantity, quality and movement of ground water in the aquifers. To achieve this goal National Aquifer Mapping on a scale of 1:50000 was launched by CGWB in 2012 to delineate aquifers, characterize aquifers and prepare aquifer management plans. This study was very much helpful in identifying suitable areas for ground water based supply schemes, determine sustainability of groundwater development, prioritize aquifers for managed aquifer recharge, identify aquifers for various purposes in regions where new urban centers or industrial hubs are likely to come up, plan integrated ground water recharge schemes, issuing advisories to state agencies on repercussions of continued development of groundwater in select areas, and recommendations to state agencies in respect of areas that have prospects for ground water development.

However National Aquifer Mapping in the first phase was carried out on a large scale in which detailed observations of specific problems related to quantity and quality could not be addressed. So, keeping the above limitations in mind and considering the future requirements, the broad objectives proposed for NAQUIM 2.0 studies were as follows

i) providing information in higher granularity with a focus on increasing density of dynamic data like ground water level, ground water quality etc.

ii) providing issue based scientific inputs for ground water management up to Panchayat level,

iii) providing printed maps to the users and

iv) putting in place a strategy to ensure implementation of the recommended strategies. Involving state agencies in the studies for a sense of ownership.

NAQUIM 2.0 is designed to provide detailed information to support groundwater management decisions at ground level. Since the issues are different in different areas, the studies under NAQUIM 2.0 are proposed as issue specific and will be undertaken in prioritized focus areas. Broadly 11 Priority areas are identified based on ground water related issues as given below.

1: Water Stressed Areas; 2: Urban Agglomerate; 3: Coastal Areas; 4: Industrial Clusters and Mining Areas; 5: Areas with Springs as the principal source; 6: Areas with Deeper Aquifers; 7: Ground Water Contamination; 8: Auto flow zones; 9: Canal Command Areas, 10: Areas with poor ground water quality, 11: Other specific Issues

Keeping the above criteria Korba Industrial Area which have currently was selected under "Industrial Clusters and Mining Areas" for detailed studies under NAQUIM 2.0. Korba, situated in the state of Chhattisgarh, India, stands as a critical industrial center, renowned for its coal mines and thermal power plants. Amidst its industrial prowess, the city grapples with profound hydrogeological challenges, intricately intertwined with its socio-economic fabric. These challenges emerge from the intricate interplay of urbanization, industrial expansion, and agricultural demands, exerting immense pressure on the region's groundwater resources.

Furthermore, the industrial activities synonymous with Korba's identity, including coal mining and thermal power generation, introduce a myriad of pollutants into the groundwater system. Contaminants such as heavy metals and chemical effluents infiltrate the aquifers, compromising water quality and endangering public health. The confluence of over-extraction and pollution exacerbates the hydrogeological predicament, necessitating urgent interventions to safeguard Korba's groundwater reservoirs.

In light of these challenges, understanding the hydrogeological dynamics of Korba is paramount for devising effective strategies to mitigate water scarcity, ensure equitable access to clean water, and preserve the ecological integrity of the region.

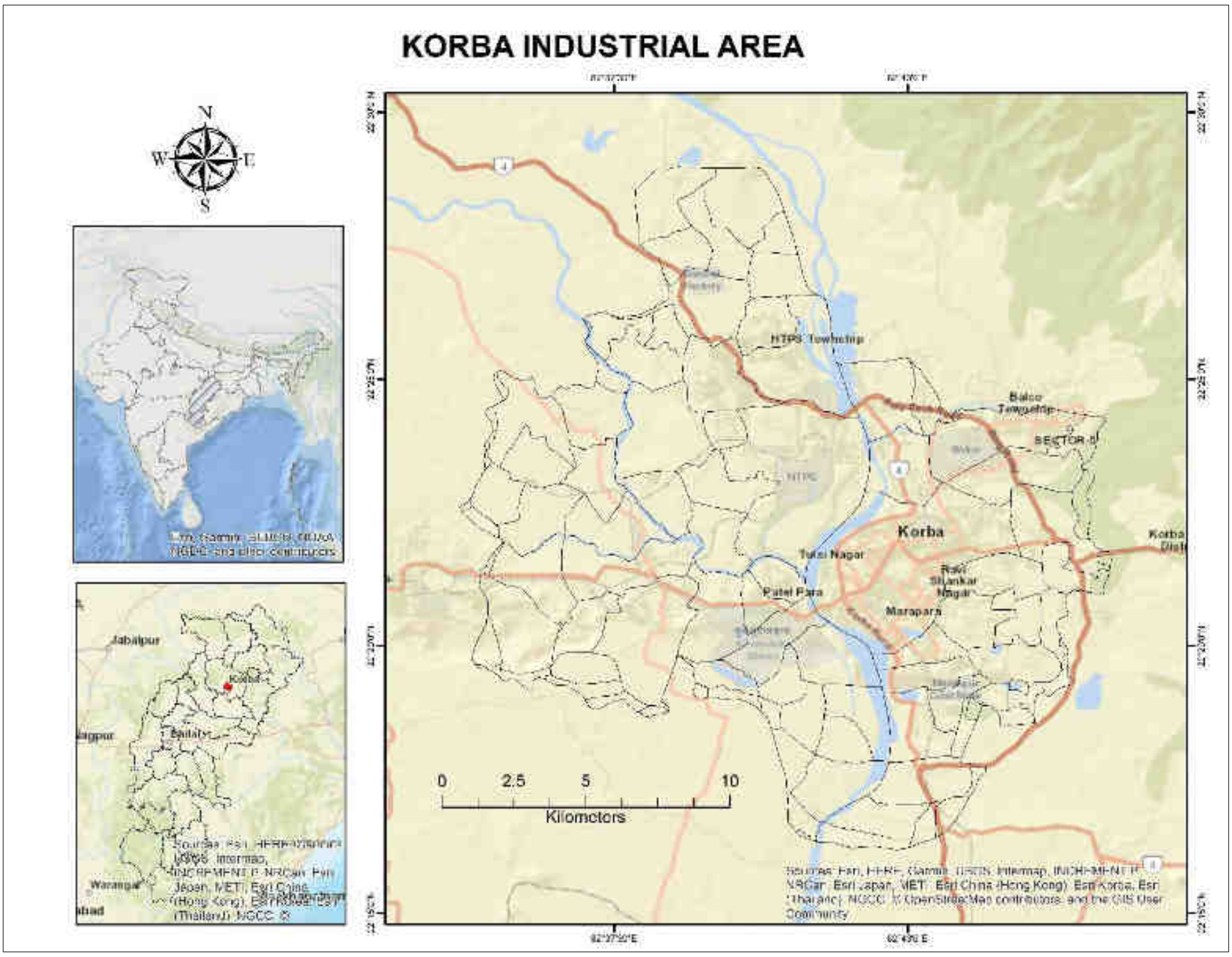


Figure 1 Location Map of the Study Area

1.2 About the study area

1.2.1 Location

The Korba Industrial Area spans both banks of the Hasdeo River within Korba district. Predominantly overlapping with the Korba Municipality area, the study zone encompasses additional villages incorporated for analysis. Korba is power generation hub of the Chhattisgarh state in India. It is situated in South-Central part of Korba district and North Eastern part of Chhattisgarh State. The study area covers about 280 sq. km. and comes under the Survey of India's topo Sheet Nos. 64J/11 and 64J/15 (1:50000 Scale) between latitudes 22^0 20' to 22^0 25'N and longitudes 84^0 40' to 82^0 45'E. The study area comes under the Korba town and it is head quarter of the Korba district. It is bounded by Pali block in the west, Katghora in the north-west and Kartala block in the east. The study area has a very well developed road network of metalled and state highways. Champa-Korba line of the South Eastern Railway connects the district headquarter Korba to the main line in the southern part.

1.2.2 Drainage

The area is mainly drained by Hasdeo river and its tributaries. The Hasdeo River flows from North to South in the centre of the city. The Belgiri nala and Dengu nala both are important water bodies of city, flowing through Nehrunagar, Parshabhata, Belgiribasti, Rungara, Bhadrapara, Lalghat, Chhatghat and Kohadiya from East to West and all these joining to the main river at confluence point of North and North East of Korba town. The drainage exhibits dendritic to sub-dendritic pattern in the area with more or less same drainage density.

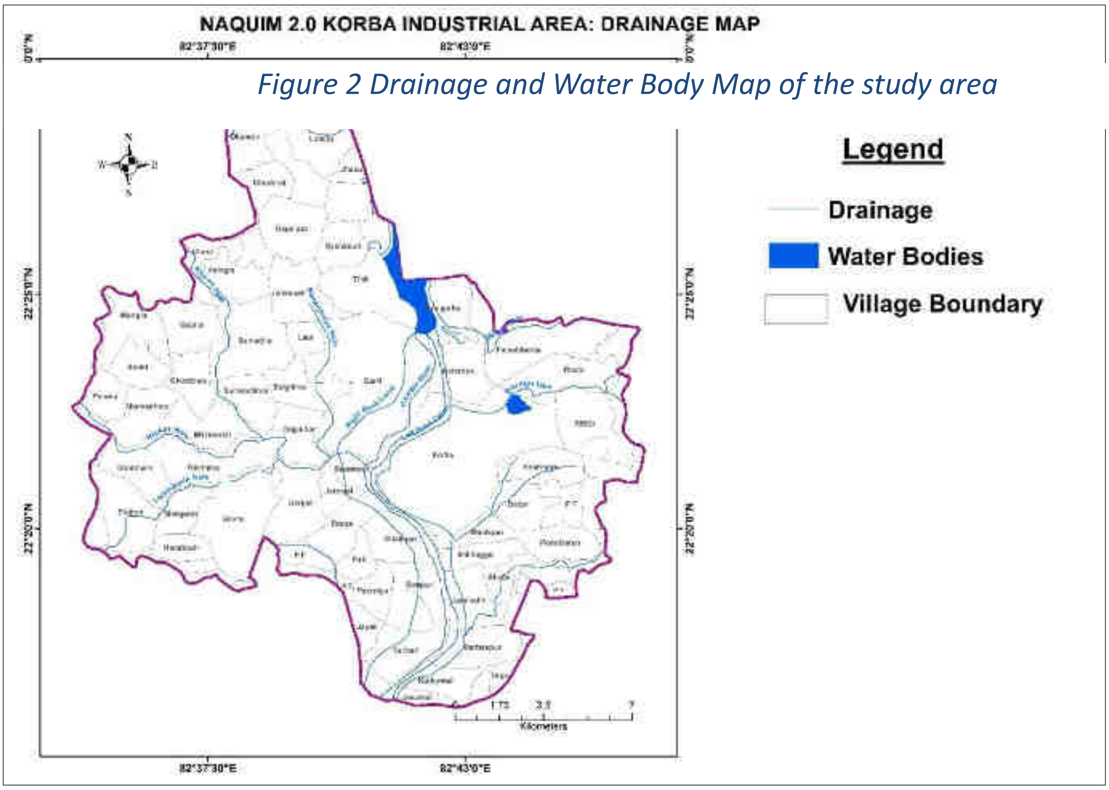


Figure 2 Drainage and Water Body Map of the study area

1.2.3 Demography

According to the 2011 census data, the population of Korba Municipal Corporation was recorded as follows:

Table 1 Population Details (Source: CG Census, 2011)

Korba UA	Total	Male	Female
Population	3,65,253	1,89,772	1,75,481
Literates	2,65,936	1,50,029	1,15,907
Children (0-6)	46,604	24,052	22,552
Average Literacy (%)	83.46%	90.53%	75.79%
Sex ratio	925		
Child Sex ratio	938		

1.2.4 Geomorphology

The geomorphology of Korba city and its surroundings reflects a diverse landscape shaped by geological processes, landforms, and human activities. Here's an overview:

1. **River Valleys and Floodplains:** Korba city is situated along the banks of the Hasdeo River, which traverses the region, influencing its geomorphology. The river valley and associated floodplains provide fertile land for agriculture and support diverse ecosystems. However, they are susceptible to periodic flooding, shaping the landforms and influencing settlement patterns.
2. **Plateaus and Uplands:** Surrounding Korba, plateaus and upland areas characterize the landscape. These elevated regions often consist of sedimentary rock formations, including sandstones and shales, sculpted by erosion processes over geological timescales. Plateaus offer vast expanses suitable for agricultural activities and human settlements, contributing to the region's socio-economic fabric.
3. **Coalfields and Mining Areas:** Korba district is renowned for its coal reserves, which have significantly influenced the geomorphology of the region. Extensive coalfields, marked by open-cast and underground mines, punctuate the landscape. Mining activities have altered the topography, leading to land subsidence, mine pits, and spoil heaps, which pose environmental challenges and impact the visual aesthetics of the area.
4. **Fly Ash Deposits:** The thermal power plants scattered across Korba have contributed to the accumulation of fly ash, a byproduct of coal combustion, in the surrounding areas. Fly ash deposits often form large mounds or embankments near power plants, characterized by fine-grained, loose sediments. These deposits can significantly alter local geomorphological features, including drainage patterns and soil composition. Over time, vegetation may colonize fly ash deposits, leading to the gradual transformation of these landscapes.
5. **Anthropogenic Modifications:** Human activities, particularly urbanization and industrialization, have left a profound imprint on the geomorphology of Korba and its surroundings. Urban expansion, industrial complexes, and transportation networks have transformed the natural landscape, leading to land reclamation, deforestation, and soil erosion. These anthropogenic modifications interact with natural processes, shaping the evolving geomorphic features of the region.

6. **Water Bodies and Wetlands:** Besides the Hasdeo River, Korba and its vicinity are dotted with smaller streams, ponds, and wetlands. These water bodies play a crucial role in the local hydrology, supporting biodiversity, groundwater recharge, and recreational activities. However, they are vulnerable to pollution from industrial effluents and seepage from fly ash sites, necessitating conservation efforts to safeguard their ecological integrity.

In summary, the geomorphology of Korba city and its surroundings is a complex interplay of natural processes and human activities. Mining sites, fly ash deposits, riverine landforms, and anthropogenic modifications collectively define the landscape, reflecting the dynamic interaction between geology, hydrology, and human intervention. Understanding these geomorphic features is essential for sustainable land management and environmental conservation in the region.

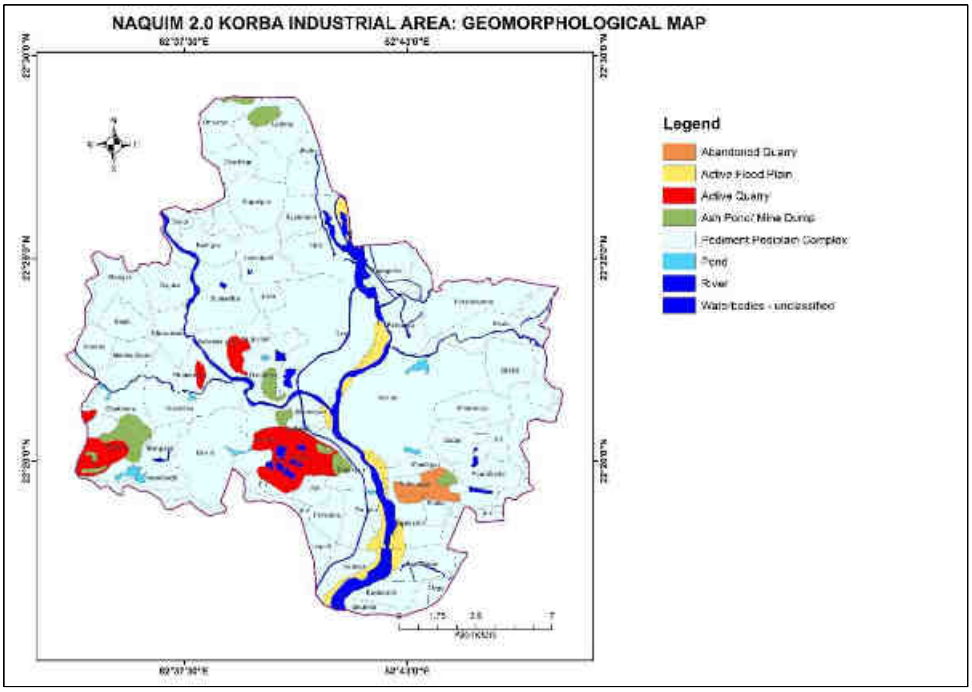


Figure 3 Geomorphological Map of the Study area

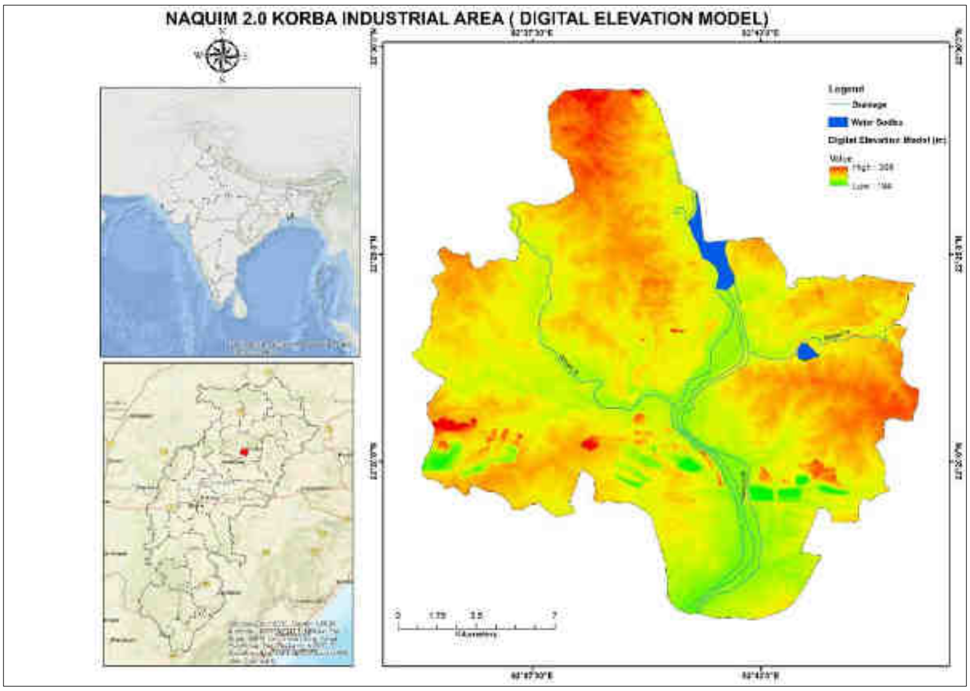


Figure 4 Elevation map of the study area

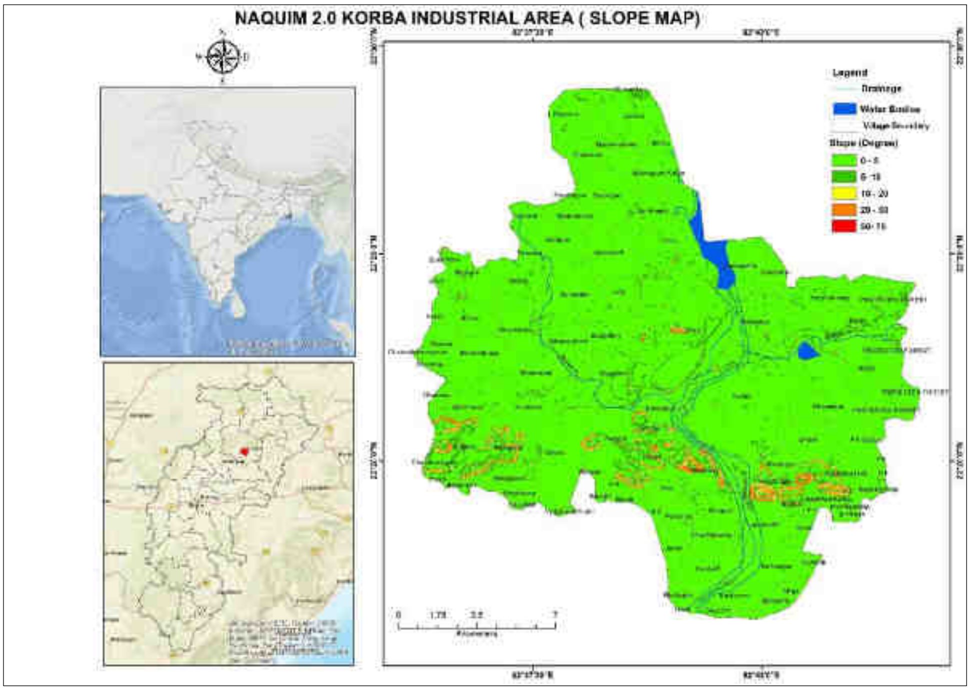


Figure 5 Slope Map of the Study Area

1.2.5 Geology

The area is underlain mainly by two distinct geological formations ranging in age from Achaean to recent.

The Chhota Nagpur Gneissic Complex of Archean to Proterozoic age consists of granite gneiss and granitoids, containing enclaves of metasedimentary and meta-igneous suites comprising schists, quartzites, amphibolites and dolomitic marbles. The unclassified metamorphics are composed of quartzites, mica schists, dolomitic marbles, phyllites and biotite chlorite schists (occasionally associated with quartzite bands). All these rocks are intruded by metabasic bodies/dykes and quartz and pegmatite veins.

The Gondwana Super Group is represented by Talchir, Karaharbhari, Barakar and Kamthi formations. Talchir Group occupies the large tract between Korba and Hasdo-Anand Coalfield. The base of this formation is typified by tilite with green shale, clay and siltstone constituting a dominant proportion of the lithic fill. Karaharbhari Formation is represented in the district as a narrow linear patch in the extreme north eastern part. It is composed of sub greywacke and pebbly sandstone containing reworked Talchir clasts. The Kamthi Group covers the major part of the study area. the Barakar group composed of medium to coarse grained arkosic sandstone, a few pebble beds, conglomerate and shales with coal seams. Usually the sandstone is feldspathic and ferruginous. The Kamthi Formation forms prominent ridges in the eastern part of the district. It comprises of coarse ferruginous sandstone with carbonaceous shale and very thin coal seams.

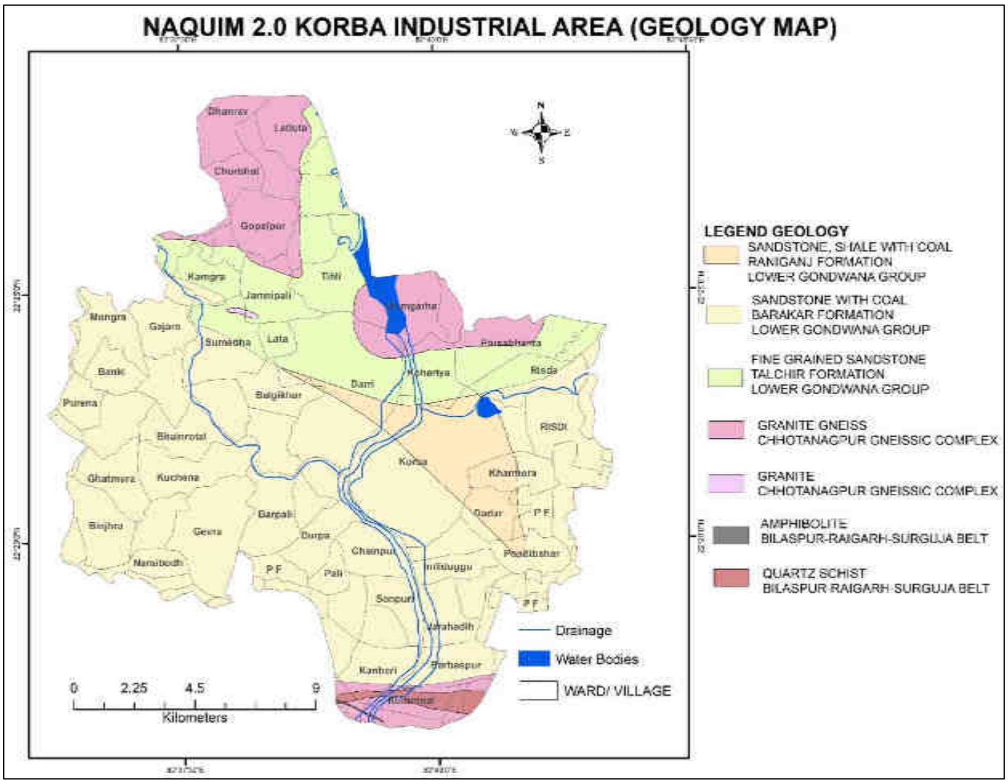


Figure 6 Geological Map of the study area

Table 2 Generalized Geological Succession

Age	Group	Formation	Lithology/	Nature and Characteristics
Cenozoic	**Recent**	Laterite	Laterite with lenses of bauxite	Reddish brown to dark brown, hard and massive, pisolitic
Upper Cretaceous to Palaeogene	**Deccan Trap Complex**	Deccan Trap	Basalts	Black to dark grey, fine to medium grained, hard and compact volcanic rock; shows speheridal weathering
Upper Cretaceous		Lameta formation	Calcareous sandstone and cherty silicious limestone, ferruginous sandstone	Greenish, brownish green, medium grained calcareous sandstone. Ash grey, cherty/siliceous limestone with occasional clay bands
Permian to Early Triassic	**GONDWANA SUPERGROUP**	Kamthi formation	Sandstone, ferruginous sandstone	Brownish to red, medium to coarse grained, porous, ferruginous to variegated sandstone with carbonaceous shale and coal seams (very thin). Pebbly and conglomeratic at places.
Carboniferous to Lower Permian		Barakar formation	Arkosic sandstone, shale, coal seams	Grayish white to milky white, medium to coarse grained arkosic sandstone with bands of siltstone and dark grey to black coal seams
		Karaharbari formation	Sub-greywackes, sandstone, pebbly sandstone	White to grayish white, feldspathic grey wackes, sandstone with pebbles, hard and porous; thin shales and pebble bed at base.
		Talchir formation	Shale, sandstone and boulder bed	White, grayish white, fine to medium grained sandstone. Boulder bed with sub angular to sub rounded clasts in greenish grey, fine to medium grained matrix. Buff and khaki green shale with splintery fragments. The base is greenish grey to dark green tillite
Upper Proterozoic	**CHHATTISGARH SUPERGROUP**	Raipur Group	Unclassified shales, limestone and dolomite	Grey to dark grey, fine grained to medium grained, hard and compact shale, grey to dark grey hard and compact limestone and dolomite
		Chandrapur Group	Sandstone and Conglomerate	White to reddish brown, medium to coarse grained hard sandstone, clayey arenite and polymictic Conglomerate
Middle Proterozoic	Quartz and Pegmatite Veins			Grey, white, compact medium to coarse grained with massive clusters of tourmaline. Pegmatite contains medium to coarse quartz and feldspar
	Basic Intrusives			Dark grey to grayish black, hard and compact basic rocks
Archean to Proterozoic	**Chhota Nagpur Gneissic Complex**	Unclassified Granite gneiss		Grey/dark grey, medium to coarse grained granites/biotite gneisses
		Unclassified Metamorphics		Grey to dark grey, fine grained phyllite (occasionally associated with quartzite); grey to brownish grey, medium to fine grained quartzite; Greenish grey, fine grained biotite chlorite schists interbedded with quartzite bands; grey to brownish, hard dolomitic marble; mica schists and other schistose rocks

Table 3 Geological Formation Percentage Distribution in Korba Industrial Area

LITHOLOGIC	AGE	GROUP_NAME	Area_SqKm	Percentage
SANDSTONE WITH COAL	EARLY PERMIAN	LOWER GONDWANA	169.97	60.79
FINE GRAINED SANDSTONE	LATE CARBONIFEROUS - EARLY PERMIAN	LOWER GONDWANA	48.53	17.36
GRANITE GNEISS	PROTEROZOIC	CHHOTANAGPUR GNEISSIC COMPLEX	40.66	14.54
SANDSTONE, SHALE WITH COAL	LATE PERMIAN	LOWER GONDWANA	17.86	6.39
QUARTZ SCHIST/ QUARTZITE	ARCHAEAN-PALAEOPROTEROZOIC	BILASPUR-RAIGARH-SURGUJA BELT	2.48	0.89
AMPHIBOLITE	ARCHAEAN-PALAEOPROTEROZOIC	BILASPUR-RAIGARH-SURGUJA BELT	0.12	0.04

1.2.6 Rainfall

The rainfall of the study area for 40 years were analyzed. The data was obtained from ClimateSERV. The normal rainfall of the block is 1399.91 mm whereas the lowest rainfall was observed in the year 1992 that was 839.39 mm and the highest rainfall of 1858.62 was observed in the year 1994.

The average ambient temperature remains 25.8°C, varies from 7.6°C to 41.7°C for Korba city.

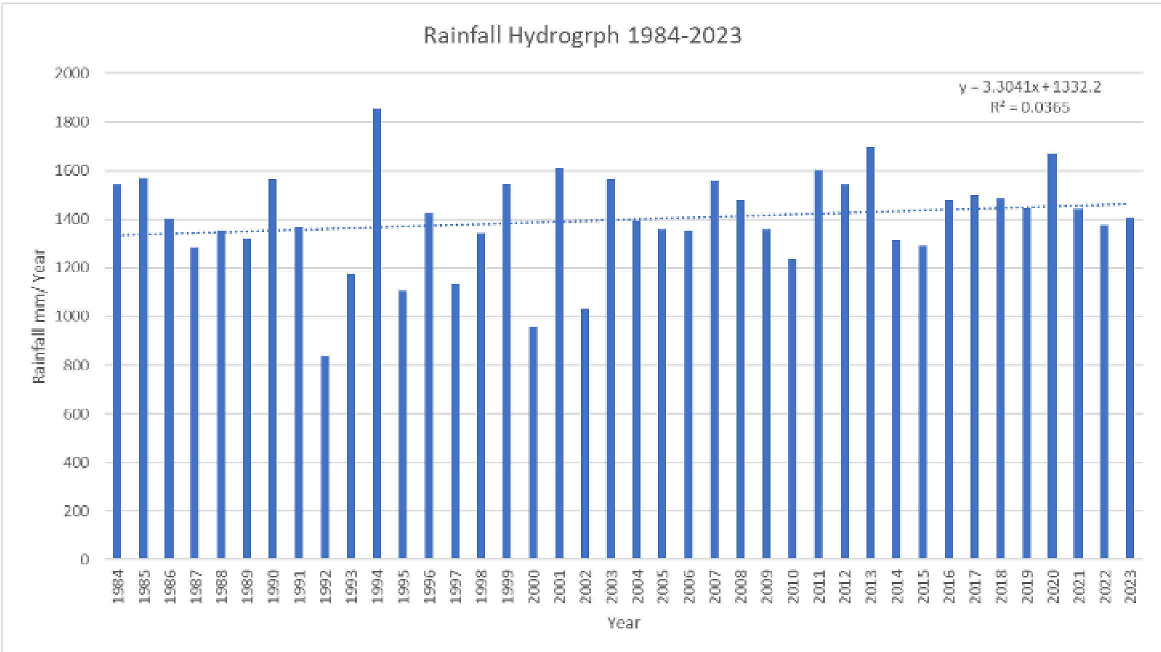


Figure 7 Rainfall Hydrograph of Study Area from year 1984 to 2023. Source (ClimateSERV)

Table 4 Rainfall Distribution of Korba Industrial Area

Year	Rainfall	Year	Rainfall
1984	1543.87	2004	1395.31
1985	1567.39	2005	1357.18
1986	1401.99	2006	1353.14
1987	1286.31	2007	1558.16
1988	1356.33	2008	1480.36
1989	1321.06	2009	1358.42
1990	1566.59	2010	1235.29
1991	1365.59	2011	1602.61
1992	836.40	2012	1542.30
1993	1175.96	2013	1697.89
1994	1858.62	2014	1314.33
1995	1106.60	2015	1293.22
1996	1425.22	2016	1478.62
1997	1136.27	2017	1499.19
1998	1344.92	2018	1485.03
1999	1545.52	2019	1446.36
2000	958.89	2020	1671.07
2001	1609.73	2021	1441.88
2002	1032.23	2022	1377.16
2003	1563.78	2023	1405.96

Source: ClimateSERV

1.2.7 Land Use/Land Cover

The land-use and land-cover (LULC) data for study area are presented in the table 5, outlining the distribution of various classes across the region. LULC for 2023 base year have been analyzed and map being prepared on the basis of data of Sentinel-2 10m Land Use/Land Cover (Source: Esri Inc.). Water bodies occupy a minimal percentage, accounting for 3.35% of the area. Trees and forest cover constitute 7.72 %, crop land contributes about 24%. Builtup land, which includes infrastructure and urban developments, occupies 27.63% of the area, indicating the presence of settlements and human activities. Range land, comprising 35.43% of the landscape.

Table 5 Percentage area covered by different Land use classes

Land use classes	2023	
	Area_SqKm	Percent
Waterbody	9.3556	3.35
Forest/ Trees	21.5727	7.72
Flooded Vegetation	1.9428	0.69
Cropland	66.9509	23.94
Built-up Land	77.2578	27.63
Barren land	3.4691	1.24
Grass Land	99.0629	35.43

Historical data of land use/land cover of 1985 base year have also been analyzed which has been accessed from (https://daac.ornl.gov/VEGETATION/guides/Decadal_LULC_India.html) and map prepared. It has been observed that there is significant decrease (about 21 %) in crop land during 2023 compare to 1985.

Table 6 Percentage area covered by different Land use classes

Land use classes	Area_Sq_Km	Percentage
Deciduous Broadleaf Forest	16.27	5.81
Cropland	127.22	45.46
Built-up Land	67.1	23.98
Mixed Forest	5.95	2.13
Shrubland	27.49	9.82
Barren Land	1.19	0.43
Fallow Land	17.36	6.20
Waterbody	14.17	5.06
Plantations	3.07	1.10

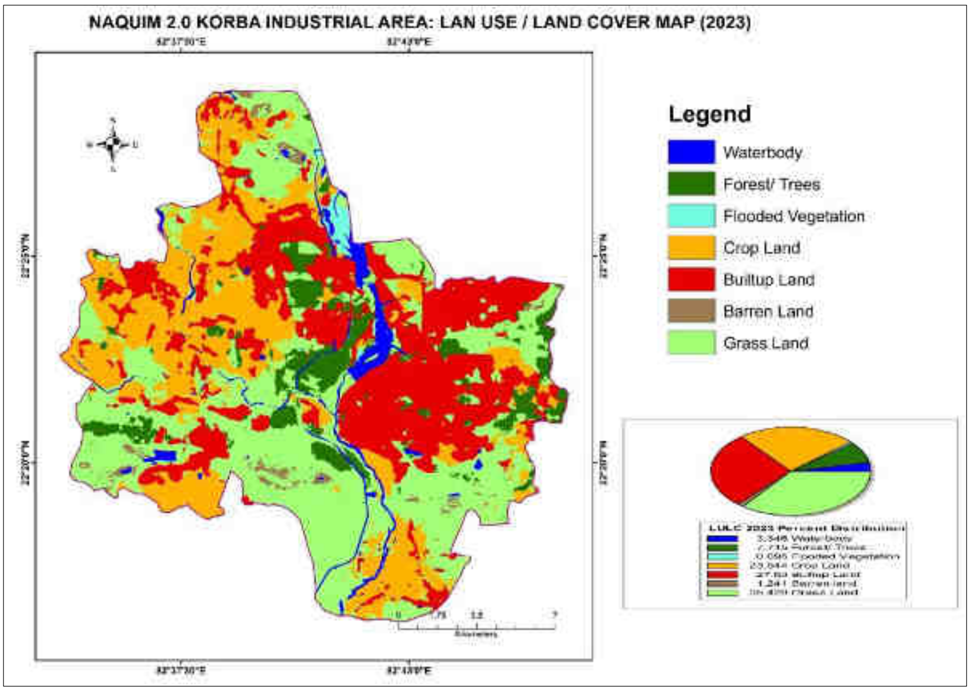


Figure 8 Land Use Land Cover Map (2023) of the study area.

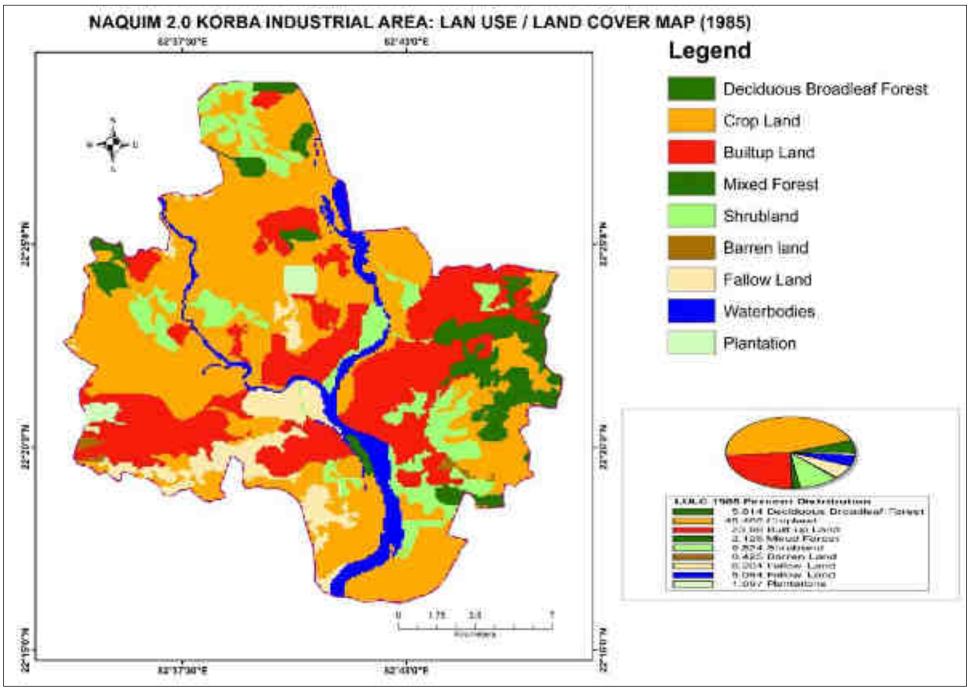


Figure 9 Land Use Land Cover Map (1985) of the study area

CHAPTER-2

PRIORITY TYPES

Korba is often referred as the Industrial centre of Chhattisgarh state in India. Coal mining, Thermal Power Plants and Vedanta Balco aluminium plant are the major industries in this area. The thermal power plants generate power as well as fly ash due to combustion of coal and the industrial effluents are discharged at various points in the surrounding area. The fly ashes, ore flushing and other chemicals effluents generated from the industries are let out in dumping sites like ponds, lagoons etc. which is discharged in to the surface water drains as a final liquid effluent containing various kinds of pollutant which in turn may contaminate ground water. Coal, a fossil fuel is the largest source of energy for the generation of electricity worldwide, as well as one of the largest worldwide anthropogenic sources of green house gases, acids, metals, organic compounds, etc (C.A. Palmer et al). The ash content of coal is >30% and found to be contaminated with toxic inorganic and organic compounds (S.K. Sahu et al). Changes in groundwater quality are due to variation in climatic conditions, residence time of water with aquifer materials and inputs from soil during percolation of water (CGWB). Many hydro geochemical processes have been highlighted in the control of the chemical composition of groundwater, like carbonates & silicates weathering and ion exchange (B.K. Mitra et al). Several land and water-based human activities are causing pollution of this precious resource (P.S.V. Shankar et al). The ground water as well as surface water is seriously deteriorated due to rapid industrialization and urbanization.

Type of Industries

Coal mining, Thermal Power Plants and Vedanta Balco aluminium plant are the major industries in this area.

Table 7 List of Mines Located in Study Area

Sl No	Sub-Area	Name of Coal Mines	Year of Start	Current Status	Lease Area (ha)	Coal Production 2022-23(MT)	Overburden Removal 2022-23(MT)
1	Manikpur	Manikpur	1966	Open Cast	1944	3.2	
2	Kusmunda	Kusmunda	1979	Open Cast	2659.48	43.05	51.86
		Lakshman		Open Cast	420.35		
3	Gevra		1981	Open Cast	2945.67	52.5	69.07
4	Surakachhar	Surakachhar	1963	Underground	5040	1.8	
		Balgi	1984	Underground			

Table 8 List of Major Industries Located in Study Area

Sr.	Name of the Unit	Generation	Capacity	Year of Commissioning
1	Bharat Aluminium Company Ltd., Vidyut Nagar, Korba (BALCO)	Aluminium Rod	350 Kilo Ton/yr	1975
		Aluminium Roll	40 Kilo Ton/yr	
		excretion	70 Kilo Ton/yr	
		Aluminium Ingot and Others	180 Kilo Ton/yr	
		Electricity (CPP 2)	135 Megawatt	2005
			135 Megawatt	2005
			135 Megawatt	2005
			135 Megawatt	2005
2	IBP Co. Ltd. Gopalpura (Closed and currently under Indian Oil)	Industrial Explosive	31000 MT	1978
3	Hasdeo Thermal Power Station, Vidyut Nagar, Korba (CSEB)	Electricity	840 Megawatt (4 x 210)	1983
4	NTPC, Jamnipali	Electricity	2100 Megawatt (3 x 200), (4 x 500)	1983
5	Bharat Aluminium Company Ltd., Kendri Khar, Korba (BALCO)	Electricity (CPP)	270 Megawatt	1987
6	IBP Co. Ltd., Kusmunda (Closed and currently under Indian Oil)	SMS Bulk Explosive	500 MT	1994
7	Korba West Mini/Micro Hydel Power Station	Electricity	1.7 Megawatt (2 x 0.85)	2003

8	Himadri Chemicals and Industries, Jhagrah	Coal Tar Pitch	30000 MT	2008
9	Shyama Prasad Mukherjee Thermal Power Station (CSEB)	Electricity	500 Megawatt (2 x 250)	2008
10	Korba west extension thermal power station(C.S.E.B)	Electricity	501 Megawatt	2013
11	Swastik Power and mineral resources private limited Khairbhona and sonpuri/kanberi	Electricity and coal washery	25 MW and 0.9mtpa	

CHAPTER-3

PREVIOUS STUDIES

- AQUIFER MAPPING AND MANAGEMENT PLAN KORBA BLOCK, KORBA DISTRICT, CHHATTISGARH (2018-19) – Under NAQUIM programme study has been taken up where water zones of Sandstone and Granite identified. 3-D maps for the Korba block has been prepared. Issues identified as low yield in part of the block and several contamination issues. Under supply side intervention 393.43 Sq Km area identified for artificial recharge to arrest the huge non-committed run-off and augment the ground water storage in Korba block.

- REPORT ON AQUIFER MAPPING IN KATGHORA & KARTALA BLOCKS (KORBA DISTRICT) AND DHARAMJAIGARH, GHARGHODA & TAMNAR BLOCKS (RAIGARH DISTRICT), CHHATTISGARH (2015-16) Under NAQUIM programme study has been taken up where 3-D maps for the Katghora block has been prepared. Impact of dewatering from coal mines is highlighted in the study. Under supply side intervention 58.56 Sq Km area identified for artificial recharge to arrest the huge non-committed run-off and augment the ground water storage in Katghora block.

- GROUND WATER BROCHURE OF KORBA DISTRICT CHHATTISGARH 2022-23 Hydrogeological scenario along with activities of CGWB has been summarized in report. Groundwater contaminated villages identified. Report highlighted the issues of drilling difficulties in areas where geological unit is Sandstone.

- INDUSTRIAL POLLUTION SYUDY OF KORBA INDUSTRIAL AREA 2010-12 The study revealed that in Korba city, heavy industrialization has result the ground water pollution. The present study revealed that the ground water is polluted by fluoride, nitrate, phosphate, in certain locations. Iron and manganese in ground water have their concentration well above the standard norms for the drinking water. Copper, zinc, chromium also preset in concentration below the permissible limit. The industrial effluent discharges by the industries containing high Fluoride and phosphate that may be contaminate the nearby ground water sources. Industries should be fullfill the criteria decided for industrial effluent disposal for the effluent. Nitrate pollution are exists up to shallow aquifer, it is due to poor sanitation condition prevailing around the well. The iron and manganese are observed beyond the permissible limit due to geological formation. Chromium also observed at one places is due to local pollution, otherwise no chromium and lead contamination is prevailing in the study area. The thermal power plant and other industries discharging their effluent in the surfaces water drainage and nearby shallow ground water in most of the area has deteriorated and turned pale to yellow colour of surface water.

- INDUSTRIAL POLLUTION SYUDY OF KORBA INDUSTRIAL AREA 2016. The report reveals that water pollution is polluted by fluoride, nitrate, phosphate, in certain locations. Iron and manganese in ground water have their concentration well above the standard norms for the drinking water. Copper, zinc and chromium also present in water of study area but mostly below the permissible limit. The industrial effluent discharges by the industries containing high fluoride and phosphate that may be contaminate the nearby ground water sources. Industries should be fulfilling the criteria decided for industrial effluent disposal for the effluent. Nitrate pollution are exists up to shallow aquifer, it is due to poor sanitation condition prevailing around the well. The iron and manganese are observed beyond the permissible limit due to geological formation. Chromium also observed at few places is due to local pollution, otherwise no chromium and lead contamination is prevailing in the study area. The thermal power plant and other industries discharging their effluent in the surfaces water drainage and nearby shallow ground water in most of the area has deteriorated and turned pale to yellow colour of surface water. Not much variation is observed with time in most of the parameter however, some parameters are recorded slightly higher than the previous study. Overall ground water of the study area is suitable for the drinking, agriculture and industrial purpose.

Study area fall under Katghora and Korba block of Korba district. As per GWRE-2023 the stage of groundwater extraction for Katghora block is 74.48% and categorized as Semi Critical. The annual extractable groundwater resource is 60.26 MCM, whereas the total draft is 44.89 MCM. Industrial draft contribution is 43.4% of total extraction. Although for Korba block stage of groundwater extraction, is 30.45% and categorized as Safe. The annual extractable groundwater resource is 86.01 MCM, whereas the total extraction is 26.19 MCM.

CHAPTER-4

OBJECTIVE OF THE PRESENT STUDY

The objectives of the present study are to delineate:

1. Aquifer Dispositions: The primary goal is to obtain a comprehensive understanding of the aquifer layouts within the study area. This involves detailed geological and geophysical surveys to map out the aquifer characteristics such as their size, shape, depth, and the extent of the weathered zones. Weathering refers to the breakdown of rocks into smaller particles, and its thickness can greatly influence the storage and movement of groundwater. By mapping this weathered thickness, the study aims to identify the most efficient zones for groundwater extraction and recharge.
2. Aquifer-wise Groundwater Levels: This objective focuses on monitoring and recording the water levels in different aquifers over time to determine their fluctuations and long-term trends. Understanding the seasonal and annual changes in groundwater levels is crucial for assessing the aquifer's health, recharge rates and sustainability. It also helps in developing models to predict future changes in water availability and to plan accordingly for water resource management.
3. Delineation of Recharge Areas and Detailed Artificial Recharge Plan: Identifying areas where groundwater recharge is naturally occurring, as well as those that could benefit from artificial recharge, is essential. Following the delineation, the study will propose a detailed artificial recharge plan, which may include structures like percolation tanks, recharge wells, and check dams designed to enhance the natural replenishment of aquifers.
4. Estimation/Refinement of Parameters Used for Resource Assessment: Accurate estimation of parameters such as canal seepage factors and seepage from ponds is crucial for assessing the overall groundwater resources. This aspect of the study will refine these parameters using both field measurements and modeling techniques, thereby improving the reliability of the water resource assessment. It aims to provide a better quantification of the available groundwater and the contribution of various sources to aquifer recharge.
5. Ground Water Quality: Assessing the quality of groundwater is vital for ensuring its safety for consumption and other uses. This part of the study involves the collection and analysis of water samples from different aquifers to measure parameters such as pH, salinity, hardness, and the presence of contaminants. The data gathered will guide

the management practices to address any quality issues and to maintain the standards required for drinking water.

6. Impact of Mining or Industrial activities: Mining and industrial activities have significant impacts on groundwater, often leading to contamination and depletion of this crucial resource. The extraction processes associated with mining can disrupt the natural flow of groundwater, causing a decrease in water levels. This depletion can affect local water supplies and harm ecosystems reliant on consistent groundwater flow. As Korba area have various thermal power plants (TPP) which has Fly ash, as by-product of coal combustion, poses significant risks to groundwater quality when not properly managed. When fly ash is disposed of in landfills or ponds, these toxic substances can leach into the groundwater, especially if containment measures are inadequate. This leaching process can result in the contamination of drinking water sources, leading to severe health issues like cancer, neurological disorders, and kidney damage in communities reliant on this water. Additionally, contaminated groundwater can adversely affect agricultural activities, as plants may absorb these harmful elements, entering the food chain. Therefore, stringent regulatory frameworks and improved waste management practices are crucial to prevent the infiltration of fly ash contaminants into groundwater systems, safeguarding public health and environmental integrity.
7. Identification of potential aquifers for drinking water supply: Not all aquifers are equally suitable for providing drinking water due to differences in water quality and yield. This objective entails identifying which aquifers have the potential to serve as reliable and safe sources of drinking water. It involves both quantity and quality assessments and taking into account the sustainability of extracting water from these aquifers.
8. A plan for drinking water source sustainability: The final goal is to ensure the long-term sustainability of drinking water sources. This requires a strategic plan that includes both the protection and sensible use of groundwater. It will focus on demand-side management, which looks at water use efficiency, conservation practices, and altering consumption patterns to reduce the strain on water resources. The plan will also include public education campaigns, policy recommendations, and the integration of water saving technologies.

CHAPTER-5

AQUIFER CHARACTERIISTICS

5.1 Aquifer Disposition

5.1.1 Objective

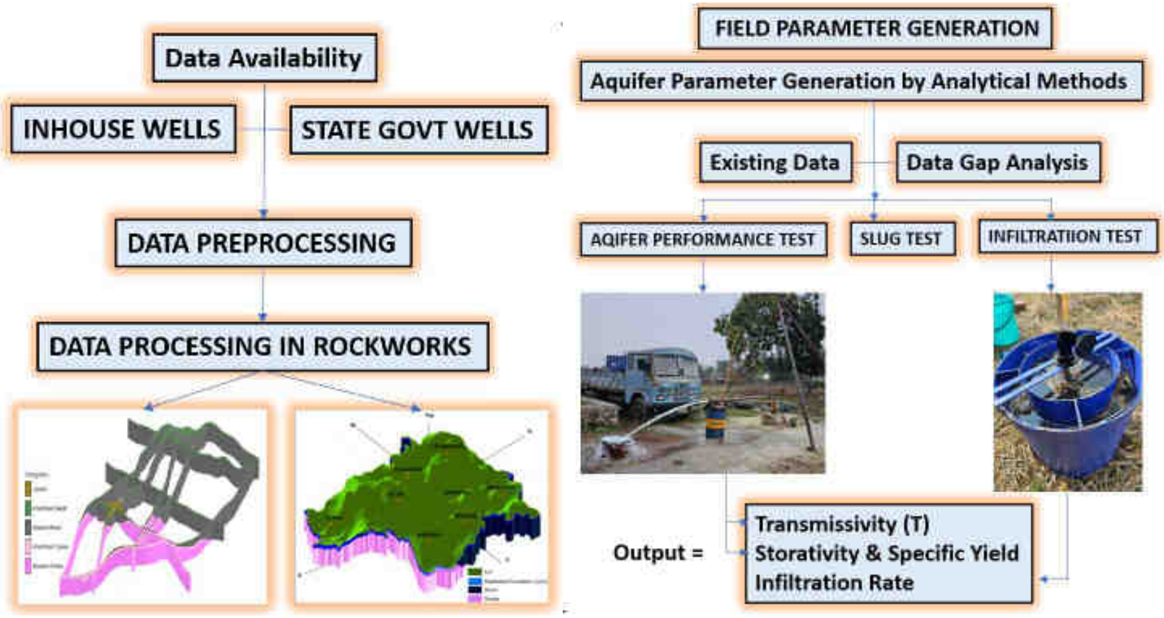
The primary objective is to characterize the spatial distribution and properties of aquifers within geological formations. This includes defining lithological boundaries, mapping stratigraphic layers, and determining the geometry of aquifer units. RockWorks allows for the integration of diverse data types, such as borehole logs, geophysical surveys, and hydrogeological measurements, to facilitate a holistic understanding of the aquifer disposition.

RockWorks offers tools for interpolating and modeling these parameters in three-dimensional space, aiding in the creation of accurate hydrogeological models. Decision-making regarding aquifer disposition objectives also involves considerations for groundwater flow and contaminant transport analyses. By setting clear objectives, users can tailor RockWorks to generate visual representations, cross-sections, and volumetric calculations that align with specific project goals. Ultimately, the chosen objectives should align with the overarching aim of enhancing the understanding of aquifer disposition for informed groundwater resource management and exploration.

The goal of an aquifer test is often to determine key aquifer properties, such as hydraulic conductivity, transmissivity, and storativity. These objectives guide the selection of appropriate testing methods, including pumping rates, well configurations, and monitoring well locations. Additionally, aquifer tests may aim to assess the aquifer's response to stress, such as variations in pumping rates, to understand its dynamic behavior and recharge capacities.

The objectives of an aquifer test can also extend to evaluating well efficiency, identifying potential aquifer boundaries, and estimating sustainable pumping rates for water supply wells. Clear objectives help in choosing the appropriate mathematical models for data analysis and interpretation, ensuring that the test outcomes align with specific project goals. Furthermore, aquifer tests may serve to validate conceptual hydrogeological models or refine existing ones, contributing to a more accurate understanding of groundwater flow within the aquifer system. Ultimately, well-defined objectives are integral to the success of an aquifer test, providing a roadmap for data collection, analysis, and interpretation to derive meaningful insights into the aquifer's hydraulic properties and behavior.

5.1.2 Material and Methods



5.1.3 Results and Discussion

A total of 04 Exploratory well (EW), 01 Observation well (OW) and 02 Piezometer already exist in the area constructed by CGWB during previous studies. As per the AAP 2023-24 additional 05 Piezometer were constructed under NAQUIM 2.0.

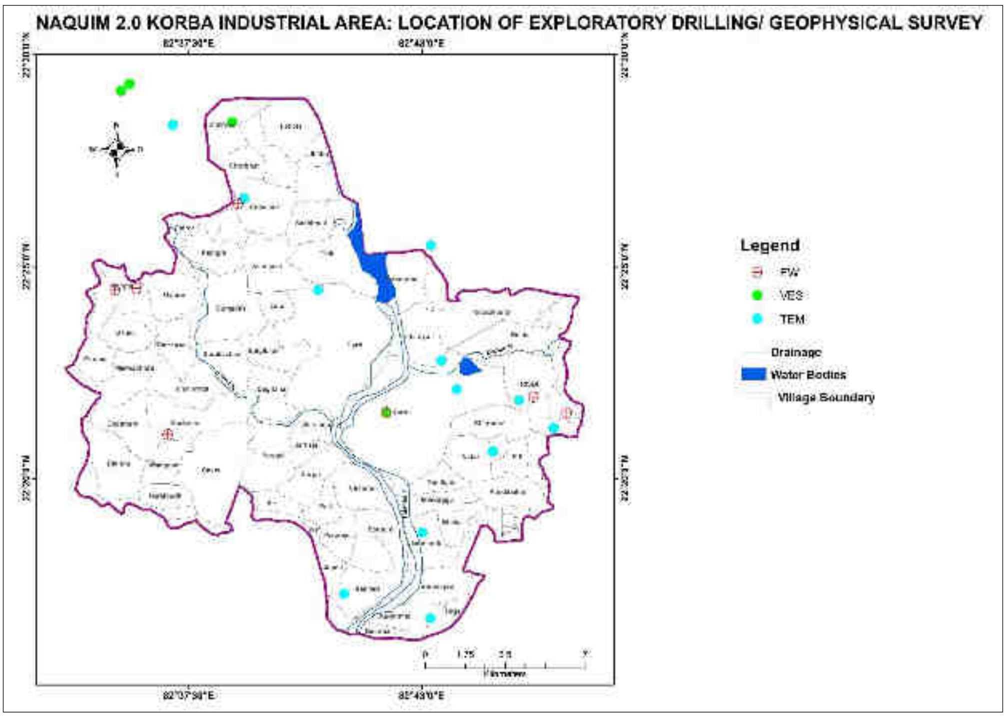


Figure 10 Location of Exploratory wells and Geophysical Sites

5.1.3.1 Aquifer System

There are two major aquifer system viz. Granite Aquifer system and Sandstone Aquifer system. Both the aquifer system has the shallow aquifer and deeper aquifer which occurs in phreatic and Semiconfined condition respectively.

Spatially the study area is divided in two hydrogeological provinces:

i. Granite Aquifer system
ii. Sandstone Aquifer system

Vertically the aquifer can be categorized into two group viz.

i. Top Unconfined weathered Aquifer.
ii. Bottom Fractured Aquifer (Semiconfined/ confined)

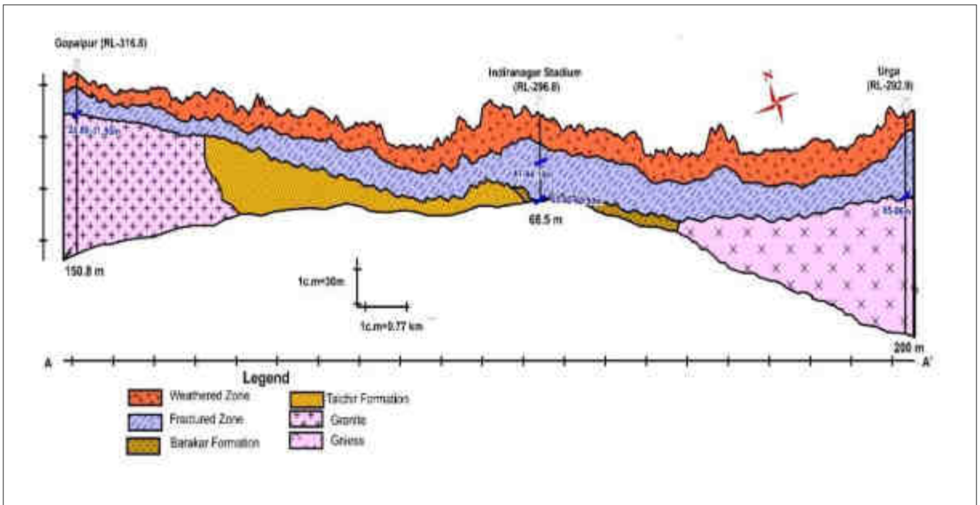


Figure 11 Hydrogeological Cross Section A-A'

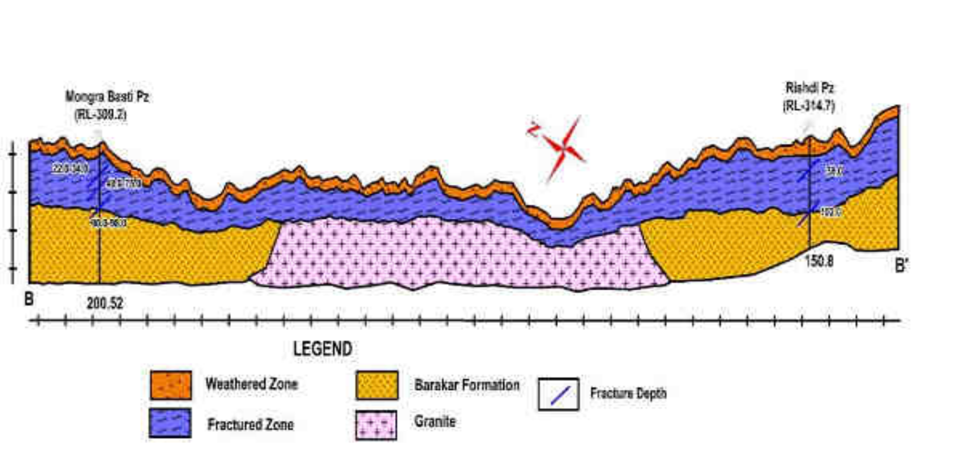


Figure 12 Hydrogeological Cross Section B-B'

Sandstone Aquifer System: The average thickness of the weathered portion in the area is around 21 m. In general, the discharge varies from 1 lps to 9.8 lps with an average yield of 4.5 lps. The average drawdown of the formation is around 24.40 m. Drilling by combination rig is preferred in sandstone aquifer where well construction is required depending upon the water zone and formation encountered. Water zone has been encountered up to 200 meter. Transmissivity range observed is 3.74 to 115.28 sq meter/day with average of 21.86 sqm /day. Details of the aquifer characteristics and water zone encountered is shown in annexure.

Granite Aquifer System: The average thickness of the weathered portion in the area is around 10.5 m. In general, the discharge varies from negligible to 1 lps. The average drawdown of the formation is around 27 m. DTH drilling technique is preferred in Granite aquifer where well construction is required depending upon the thickness of weathered zone. Water zone has been encountered up to 85 meter in the block. Transmissivity range observed is upto 7.38 sq meter/day.

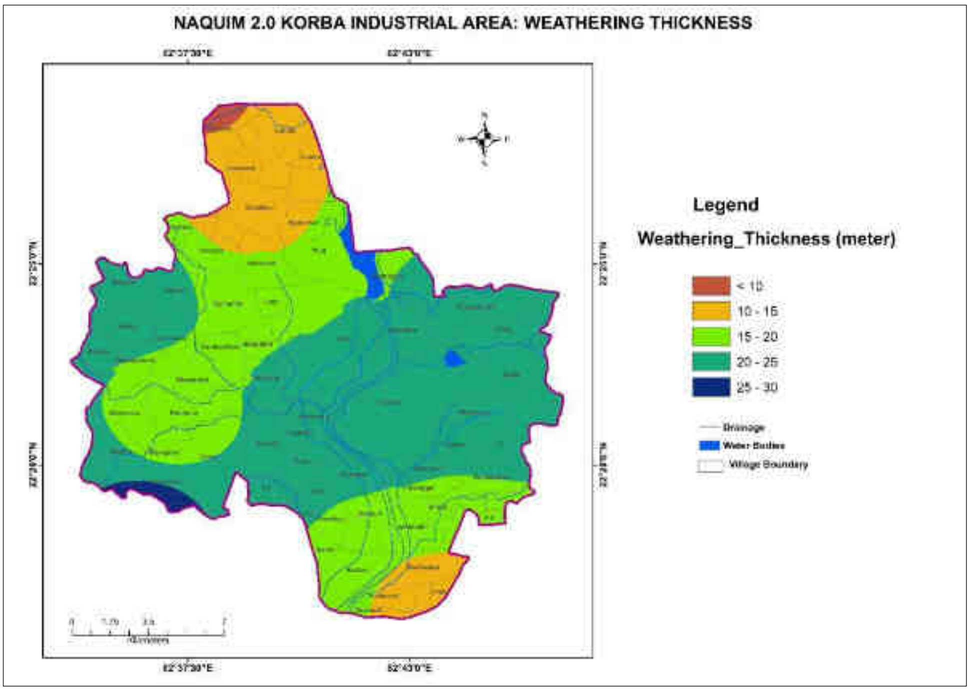


Figure 13 Weathered Zone Thickness Map

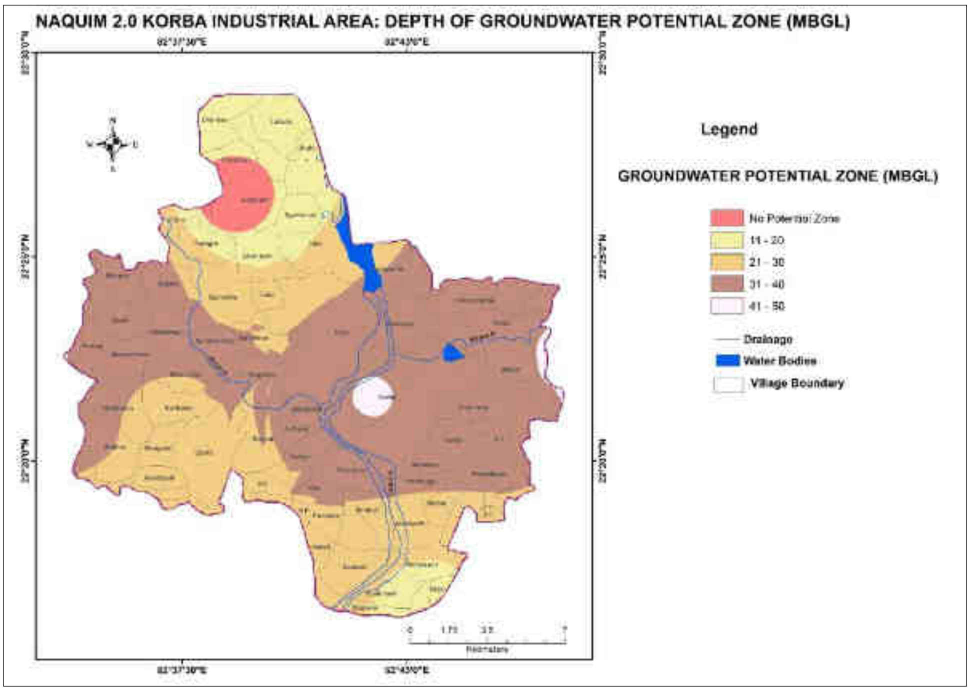


Figure 14 Map showing distribution of Groundwater Potential Zone

5.1.3.2 Aquifer Parameter

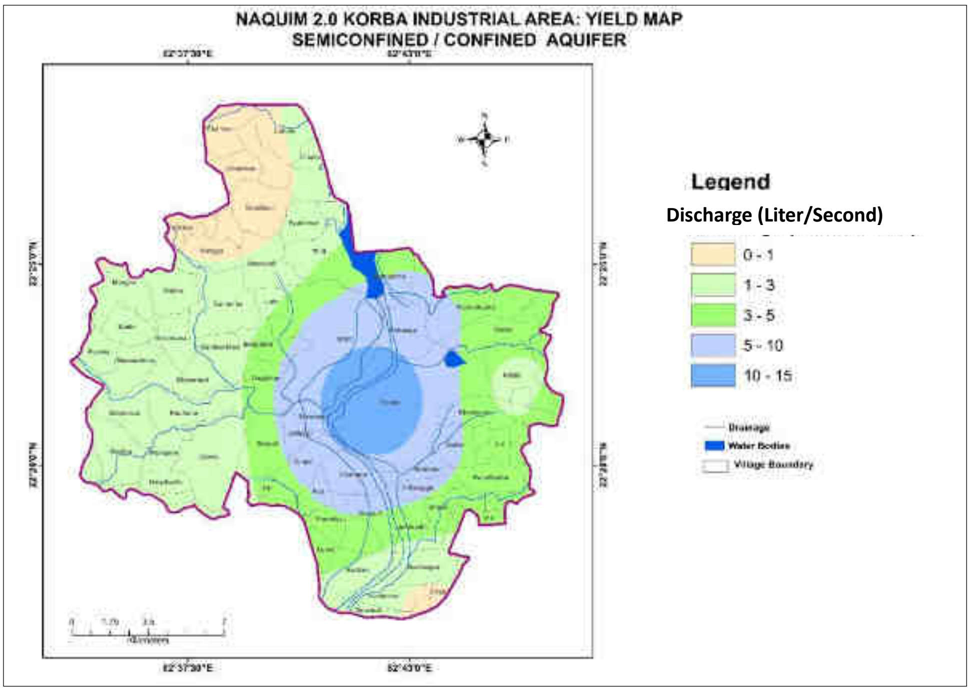


Figure 15 Aquifer Yield Map

Table 9 Aquifer Type and its qualities

Aquifer	Prominent Lithology	Characteristics of Aquifer	Suitability of Drilling Rig	Suitability for Drinking	Remarks
Granite	Granite Gneiss	Weathering zone followed by fracture limited to depth of 30 m	DTH	Fluoride contamination reported	
Sandstone	Sandstone, Shale	Medium to high yield aquifer, water zone in granular sandstone	Combination Rig	Yes	

Table 10 Aquifer Characteristics in Spatial Extent

Aquifer	Explored Depth (m bgl)	Static Water Level range (mbgl)	Fluctuation (meter)	Yield Potential range (lpm)	Trans-emissivity (m^2/day)	Remarks
Granite	Upto 203	**Pre** 3.96 – 24.84 **Post** 3.13 – 15.01	**Range** 0.17-9.83 **Mean** 2.74	30-126	6.33 at EW Bhaisma	Low Discharge
Sandstone	Upto 300	**Pre** 6.54-17.88 **Post** 4.55-17.55	**Range** 0.27-9.09 **Mean** 1.975	16.8-900	33.23 at Gharuproda	Moderate with occasional high discharge

Table 11 Vertical Aquifer Disposition Ranges

Aquifer Type	Weathered Thickness Range (mbgl)	Average Weathered Thickness (mbgl)	1st Fracture Depth Range (mbgl)	2nd Fracture Depth range (mbgl)
Granite	6.06-22.3	12.23	16-20	25-133 (High variation)
Sandstone	15-30	23.15	25-28	45-48

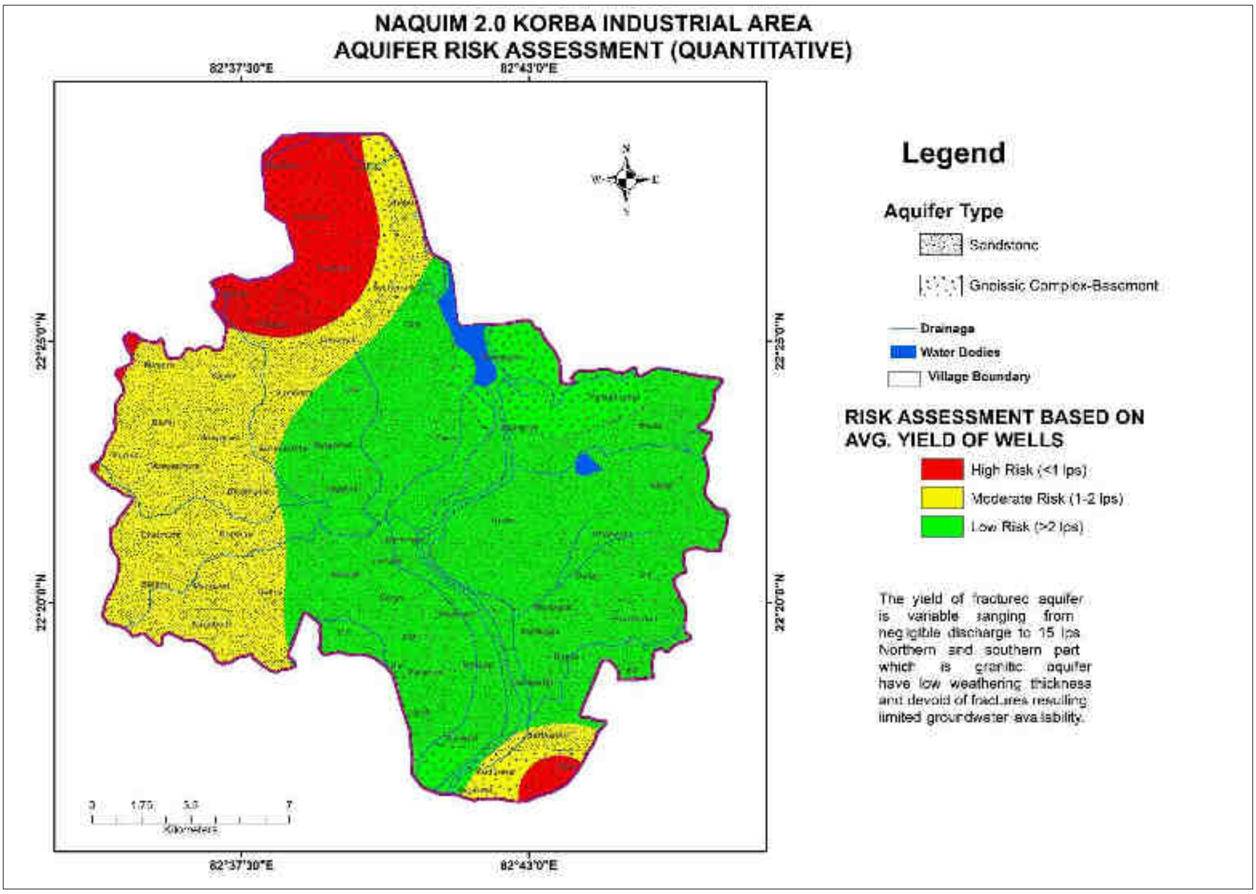


Figure 16 Groundwater (Quantitative) Risk Assessment Map

5.2 Aquifer Wise Water Level

5.2.1 Objective

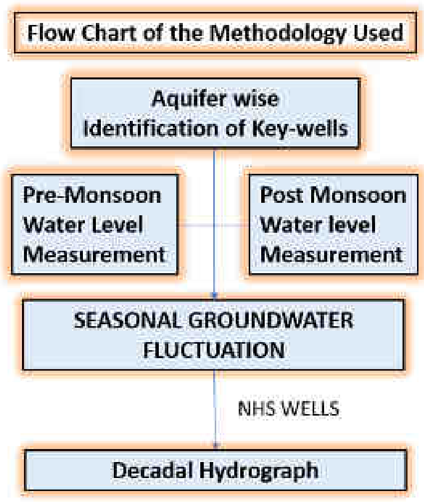
Groundwater level data is a critical component in understanding and managing groundwater resources, offering valuable information about the depth and variability of the water table in aquifers. Monitoring changes in groundwater levels over time provides insights into the health of aquifers, helping to make informed decisions about sustainable water use, especially in areas where groundwater is a primary source of freshwater.

One key aspect of groundwater level data is its role in assessing aquifer recharge and depletion. By observing fluctuations in groundwater levels, hydrologists can identify patterns related to natural recharge from precipitation and potential stressors leading to depletion, such as excessive pumping or prolonged droughts. This understanding is crucial for implementing effective groundwater management strategies to maintain aquifer sustainability.

Groundwater level data is also instrumental in delineating groundwater flow patterns. By analyzing variations in water table elevations across different locations, hydrogeologists can map the direction and rate of groundwater movement within an aquifer. This information aids in the development of conceptual models for the subsurface, contributing to more accurate predictions of groundwater behavior and facilitating sustainable water resource planning.

Furthermore, real-time groundwater level data is essential for managing water infrastructure and mitigating potential risks. Monitoring wells equipped with sensors provide continuous updates on groundwater levels, enabling rapid response to changing conditions. This is particularly valuable in preventing over-extraction, land subsidence, and other adverse impacts associated with improper groundwater management.

5.2.2 Material and Methods



5.2.3 Results and Discussion

5.2.3.1 Phreatic Aquifer/ Weathered Aquifer

Pre-monsoon and post-monsoon water-level measurements were carried to analyze the behavior of water level in the phreatic aquifer. A total of 51 dug well as monitoring stations were used to understand groundwater regime.

5.2.3.1.1 Pre-Monsoon Water Level

The pre-monsoon water level ranges from 0.1 to 9.8 mbgl having an average water level of 5.34 mbgl and standard deviation of 2.4 indicating a greater variation in groundwater level in the study area. Shallower water level (upto 5 mbgl) found in northern part of study area, however in southern part which also have greater influence of existing mines in study area have water level in range of 5 to 10 mbgl. Pre-monsoon water level map (Figure 18) has been prepared with the help of water level data of 51 dug wells monitored in May 2023.

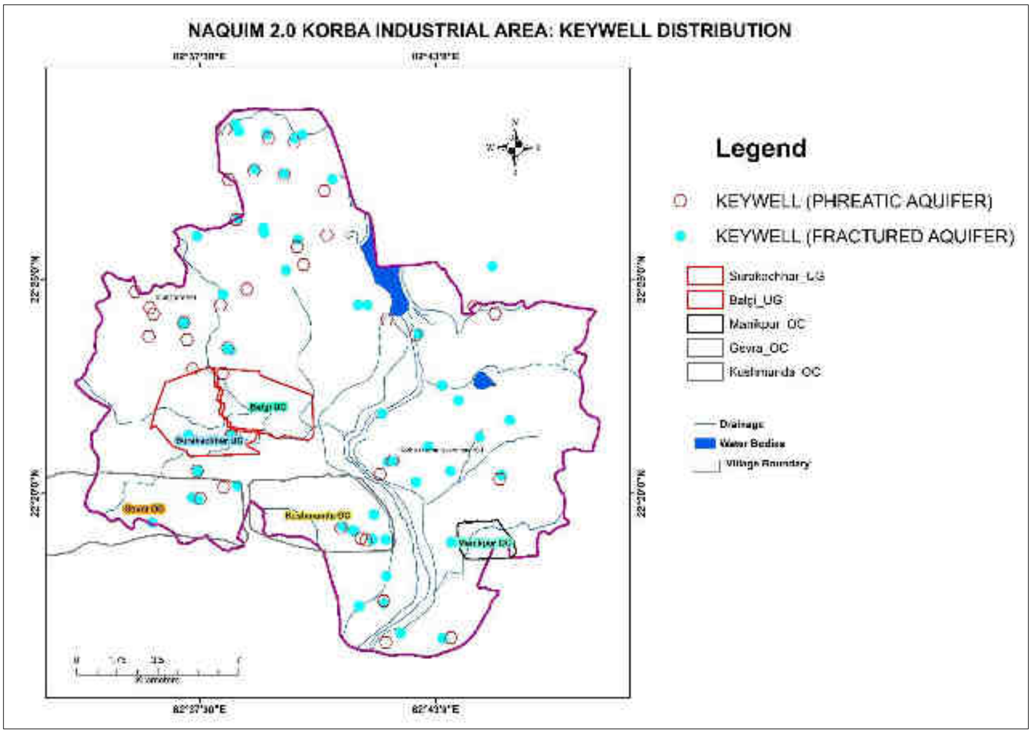


Figure 17 Water Level Monitoring Key Well Distribution Map

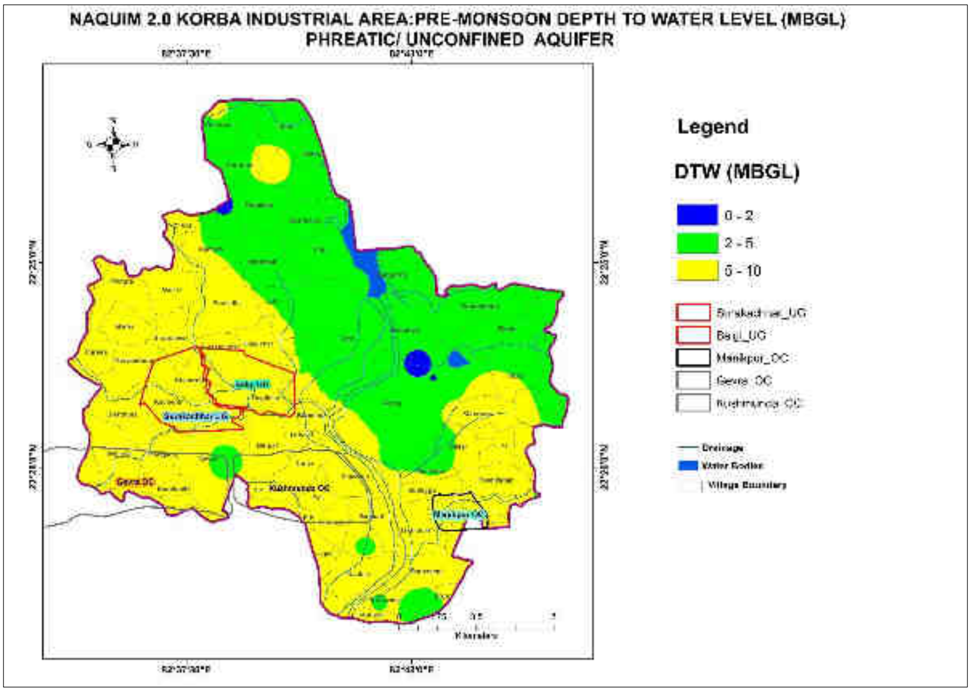


Figure 18 Pre-monsoon Water Level Map of Phreatic Aquifer

5.2.3.1.2 Post-Monsoon Water Level

The post-monsoon water level ranges from 1.05 to 9.7 mbgl having an average water level of 4.01 mbgl and standard deviation of 2.01 indicating a greater variation in groundwater level in the study area. The water level in maximum part of the area ranges from 2 to 5 mbgl with deeper water level ranging from 5 to 10 mbgl limiting to the core area of existing coal mines. The shallow water level shows similar pattern as the pre-monsoon area. Post-monsoon water level map (Figure 19) has been prepared with the help of water level data of 51 dug wells monitored in November 2023.

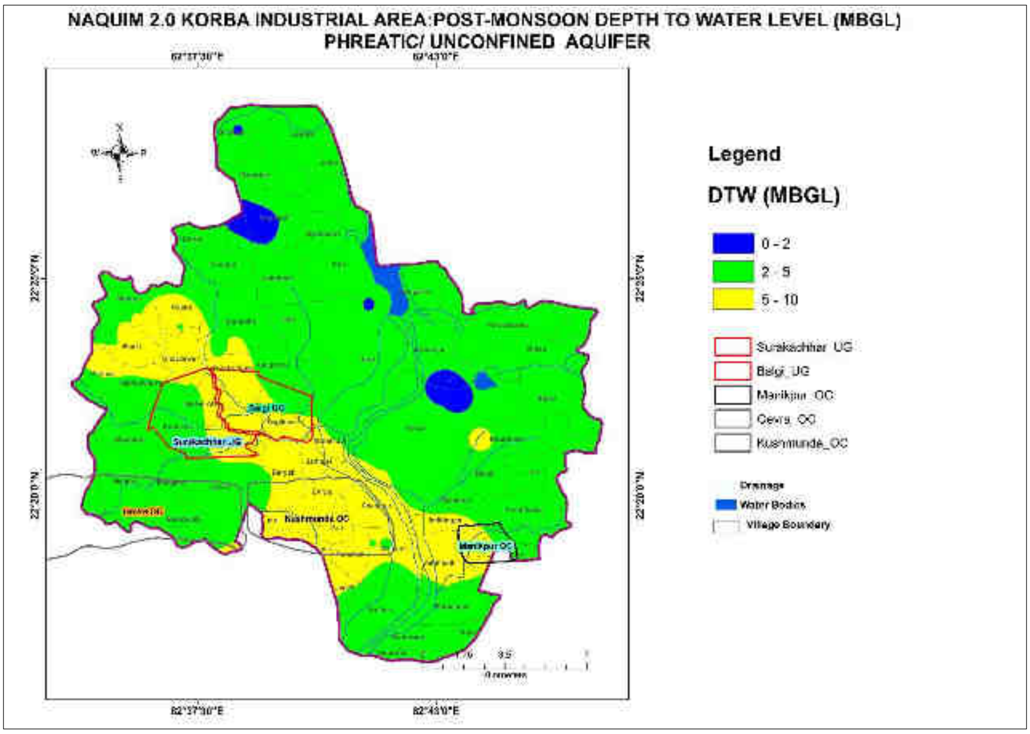


Figure 19 Post-monsoon Water Level Map of Phreatic Aquifer

5.2.3.1.3 Seasonal Ground Water Fluctuation

The seasonal groundwater fluctuation ranges from -0.62 meter to 4.88 meter. Average groundwater fluctuation is 1.32 meter. Negative water level fluctuation observed at few sporadic locations only and limited geographical extent. In more than 95 % of area shows positive fluctuation indicated recharge due to rainfall. Seasonal Water level fluctuation (Figure 20) has been prepared with the help of water level data of 51 dug wells monitored in May 2023 and November 2023.

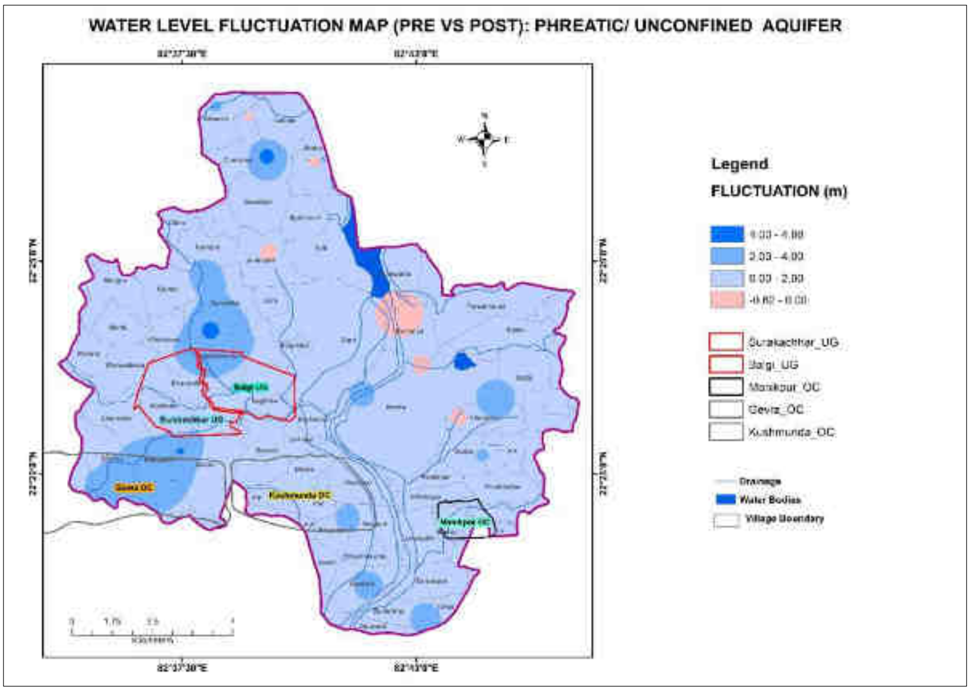


Figure 20 Seasonal Groundwater fluctuation Map of Aquifer-I

5.2.3.2 Fractured Aquifer/ Semiconfined Aquifer

Pre-monsoon and post-monsoon water-level measurements were carried to analyze the behavior of water level in the fractured aquifer/ Semiconfined Aquifer. A total of 31 handpump and borewells used as monitoring stations to understand groundwater regime of aquifer beneath weathered zone.

5.2.3.2.1 Pre-Monsoon Water Level

The pre-monsoon water level ranges from 3.46 to 24.34 mbgl having an average water level of 9.57 mbgl and standard deviation of 4.47 indicating a greater variation in groundwater level in the study area. The water level in northern half ranges from 5- 10 mbgl and in southern part ranges from 10-20 mbgl. Pre-Monsoon Water Level follows similar trend of phreatic aquifer. In vicinity of mining area water level is in the range of 10-20 mbgl. Pre-monsoon water level map (Figure 21) has been prepared with the help of water level data of 31 handpump and borewells monitored in May 2023.

5.3.2.2.2 Post-Monsoon Water Level

The post-monsoon water level ranges from 2.06 to 17.34 mbgl having an average water level of 7.25 mbgl and standard deviation of 3.50 indicating a greater variation in groundwater level in the study area. Most of the areas shows post monsoon water level in the range of 5 to 10 mbgl except in southern part underlain by granitic aquifer and in western part of study area which is upstream of underground coal mines. Post-monsoon water level map (Figure 22) has been prepared with the help of water level data of 31 dug wells monitored in November 2023.

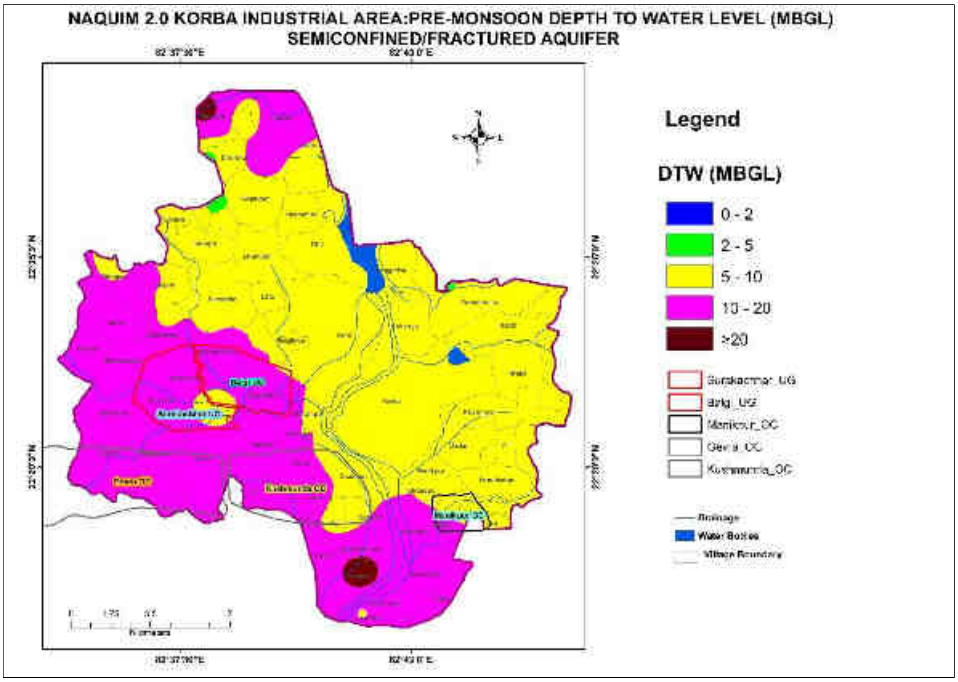


Figure 21 Pre-monsoon Water Level Map of Fractured Aquifer

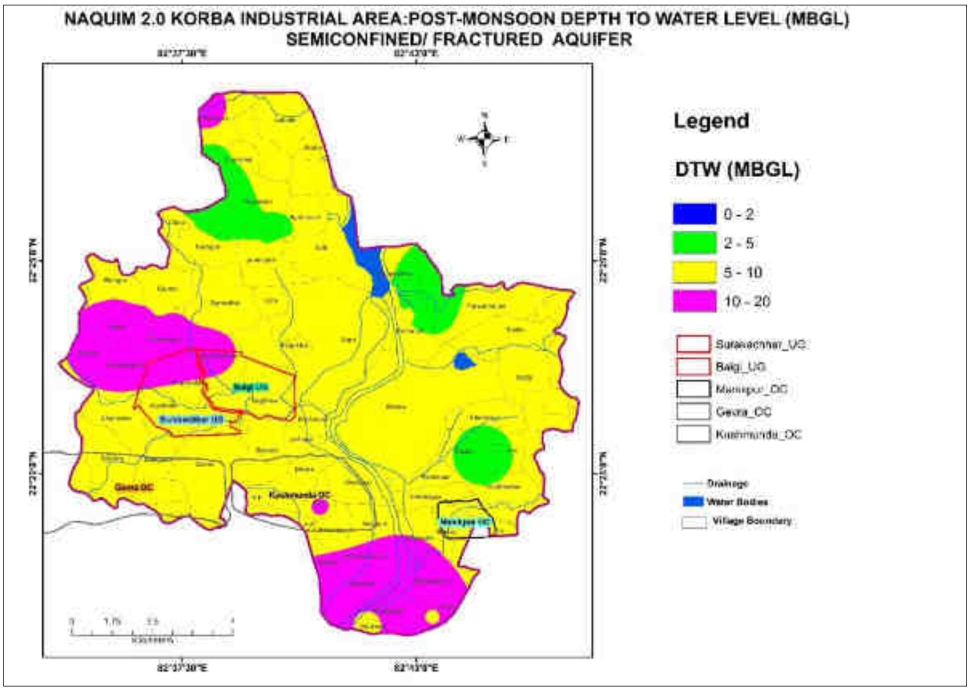


Figure 22 Post-monsoon Water Level Map Fractured Aquifer

5.3.2.2.3 Seasonal Ground Water Fluctuation

The seasonal groundwater fluctuation ranges from -3.3 meter to 9.8 meter, where study area shows rising except at Katainar village which is showing negative fluctuation. Fluctuation more than 04 meter observed in norther part underlain by granitic aquifer and in vicinity of coal mines. The mean fluctuation is 2.32 meter (rise) with standard deviation of 2.67 indicating a greater variation in groundwater fluctuation in the study area. Seasonal Water level fluctuation Map (Figure 23) has been prepared with the help of water level data of 31 dug wells monitored in May 2023 and November 2023.

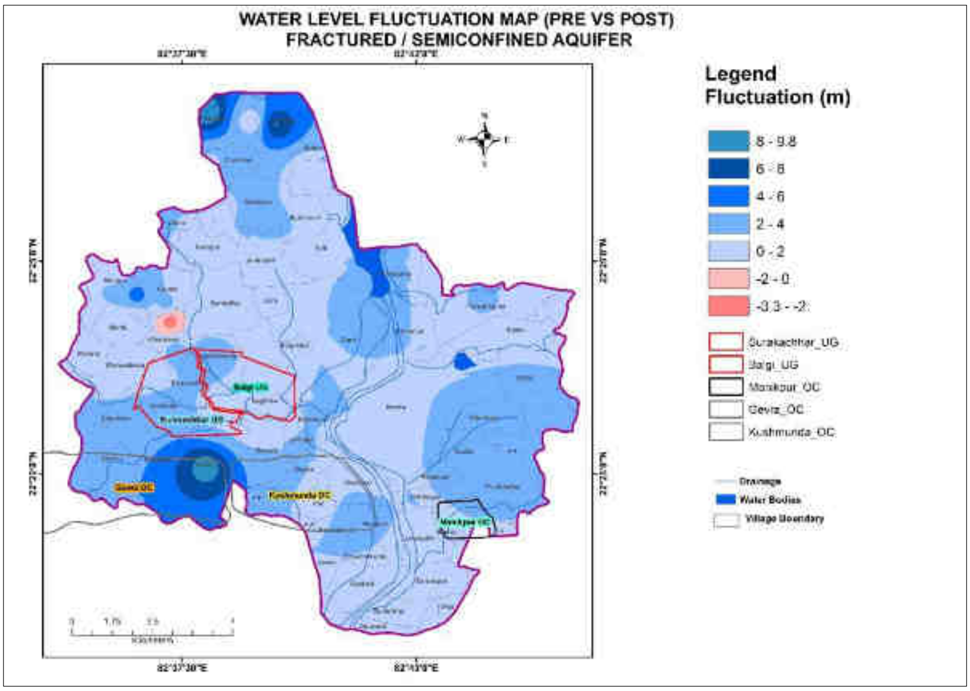


Figure 23 Seasonal Groundwater fluctuation Map of Fractured Aquifer

5.2.3.3 Decadal Trend

The decadal trend of NHNS monitoring wells was plotted to analyze the behavior of water level over the study area. The pre-monsoon water decadal water level trend map (Figure 24) showed rising trend in the study area however in post monsoon, western part of the study area shows falling trend along with few patches in eastern and southern part of study area as shown in Figure 25.

Hydrograph of 02 location namely Urga (Figure 26) and Gopalpur (Figure 27) NHNS monitoring station was analyzed and plotted shows neither rising nor falling trend in pre-monsoon as well as in post-monsoon seasons.

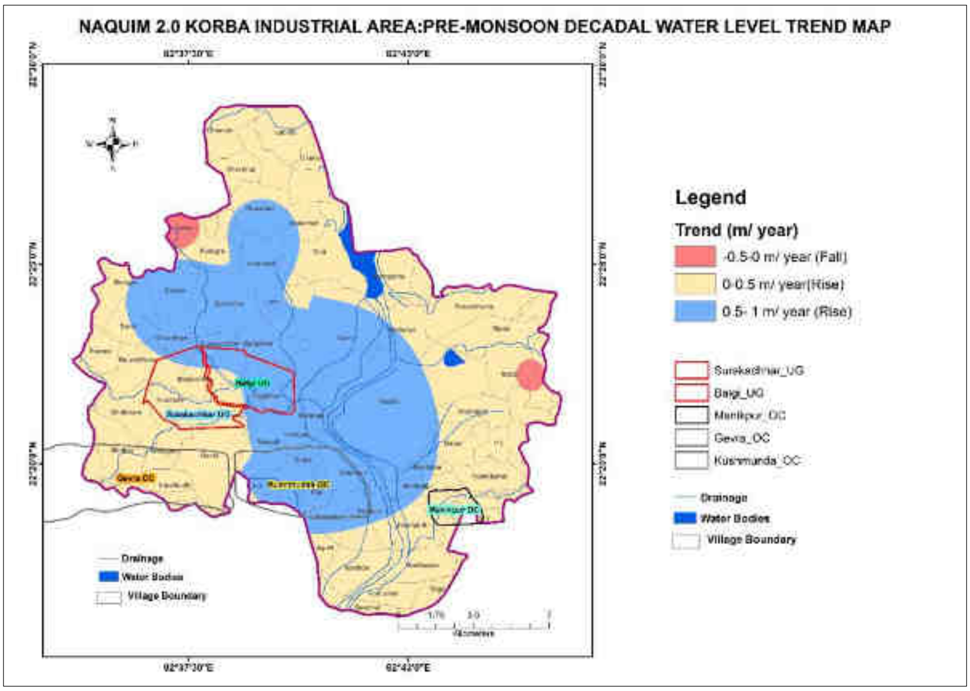


Figure 24 Pre-Monsoon Decadal Water Level Trend Map

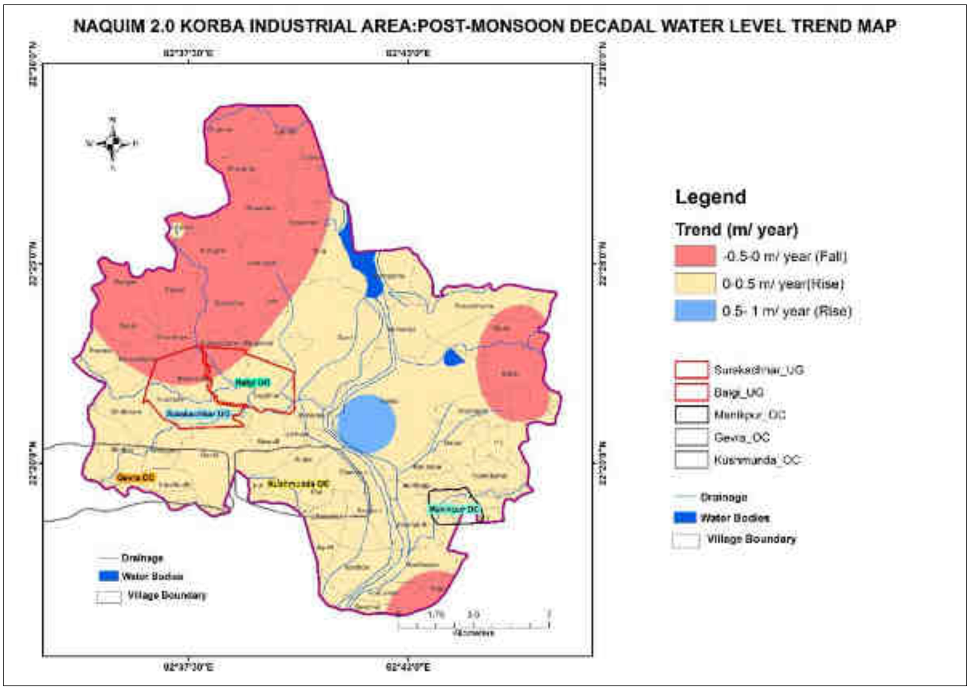


Figure 25 Post-Monsoon Decadal Water Level Trend Map

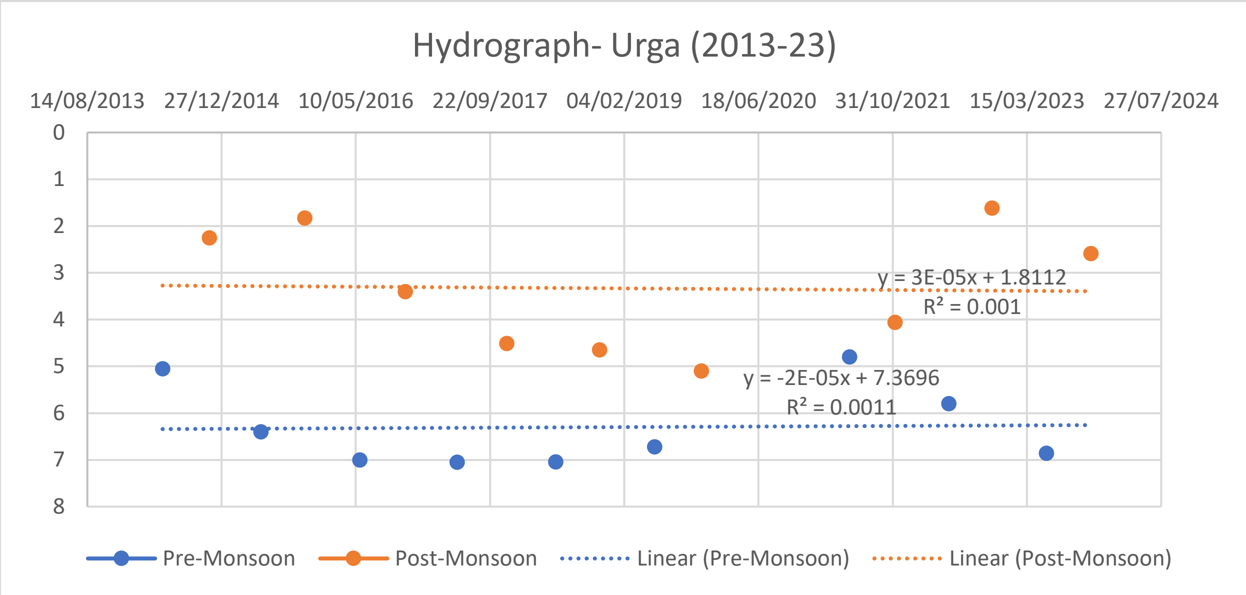


Figure 26 Hydrograph of Urga

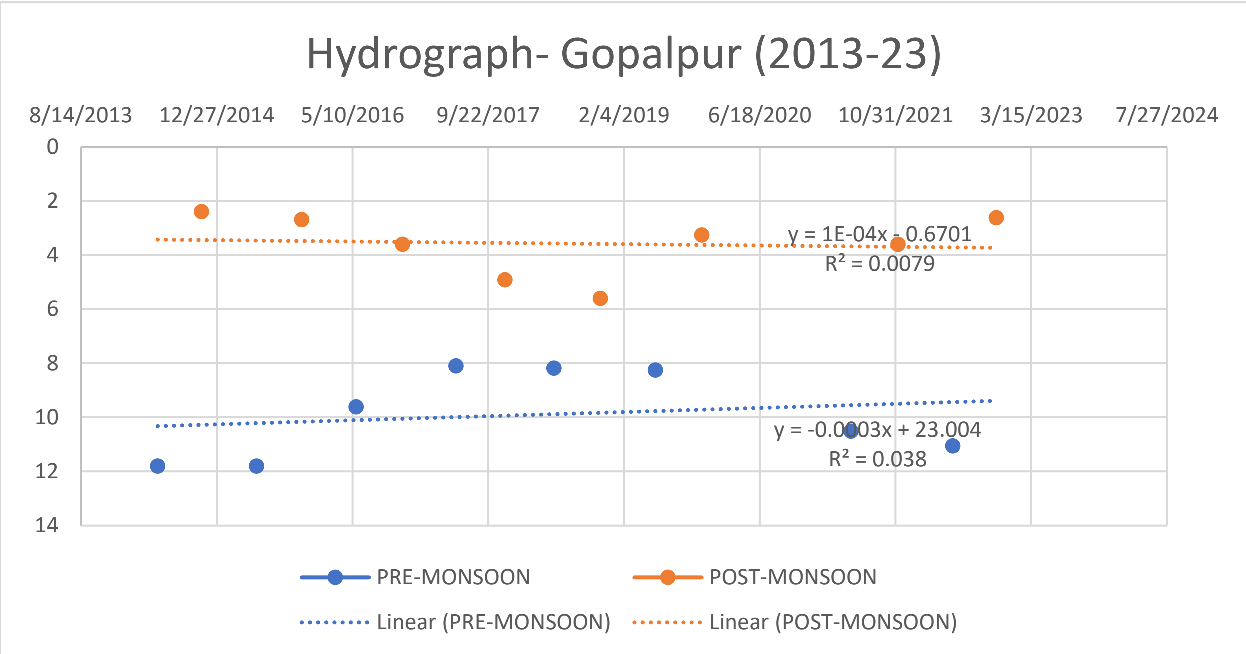


Figure 27 Hydrograph of Gopalpur

5.2.3.4 DWLR Daily Water level fluctuation

Day wise water level fluctuation from May-2023 to April 2024 has been shown by hydrograph of Korba- S and Korba- D (Figure 28) NHNS monitoring station which is located in study area. Minimum water level observed in Korba-S (Shallow Aquifer) is 0.64 mbgl which in September month indicate maximum possible recharge through rainfall. Minimum water level observed in Korba-D (Deeper Aquifer) is 7.01 mbgl which in August whereas deepest water level is observed in last week of June (13.94 mbgl).

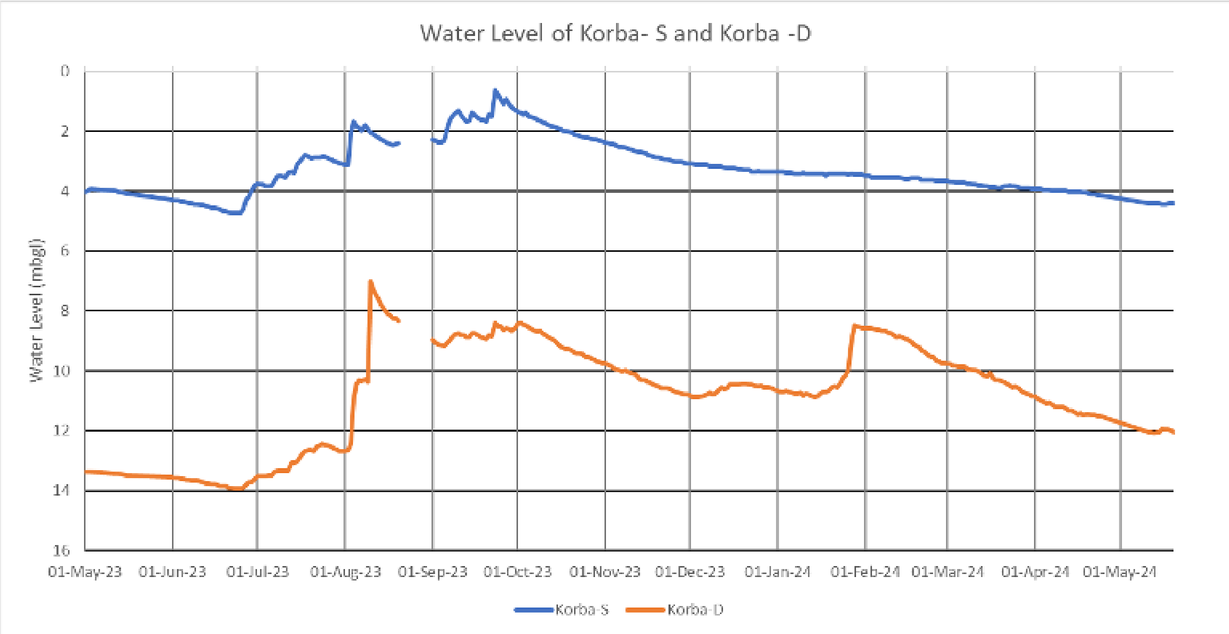


Figure 28 Hydrograph of Korba-S & Korba-D

5.2.3.5 Hydrogeological Map

From the hydrogeological map it is clear that groundwater flow is towards Hasdeo river which is flowing north to south and dividing study area into east and west part. In periphery of river underlain by sandstone aquifer there is higher discharge i.e. > 5 lps. Yield is largely controlled by lithology of the area. Area underlain by Granitic aquifer have low yield compared to sandstone aquifer system. Hydrogeological Map (Figure 29) has been prepared with the help of water level data, yield of exploratory wells, lithology encountered.

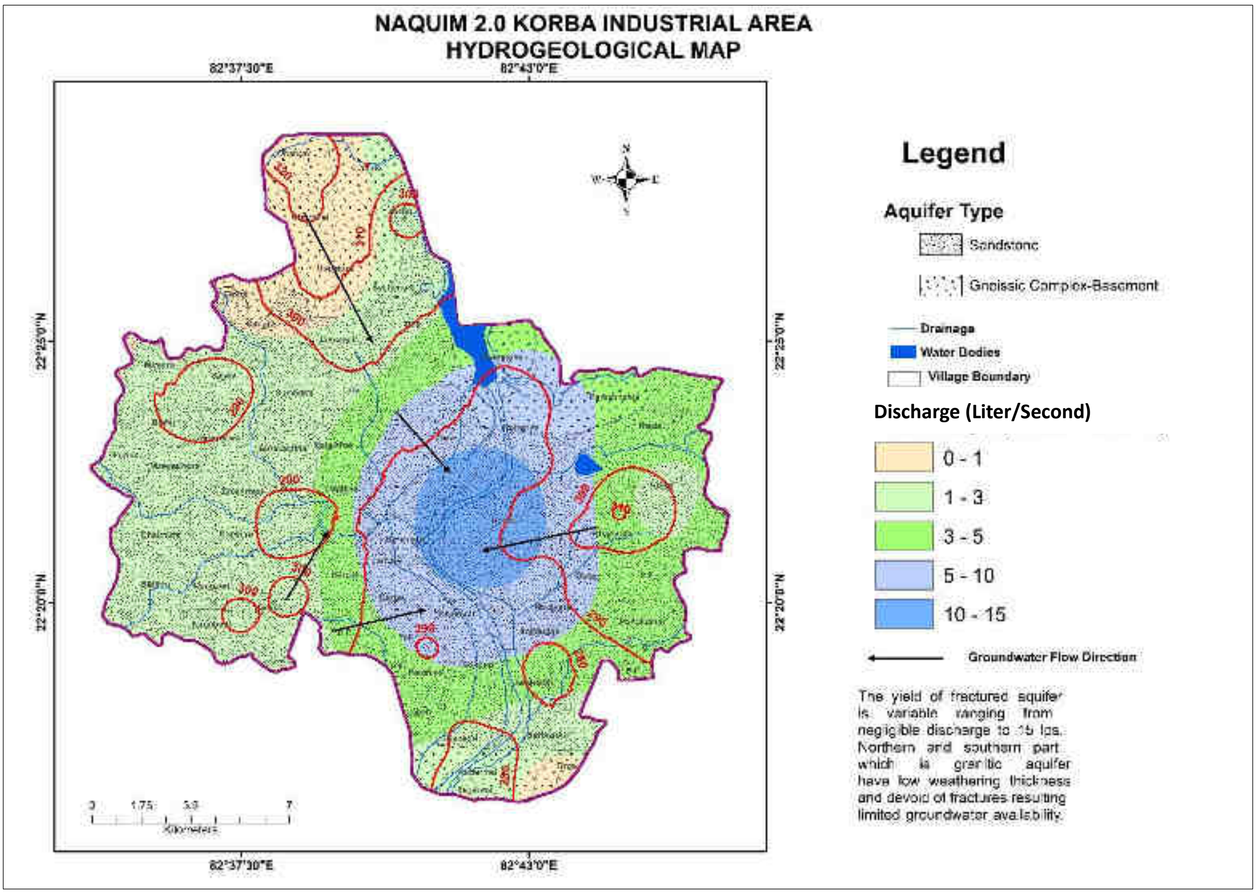


Figure 29 Hydrogeological Map

5.3 Recharge and Discharge area Delineation

Groundwater movement within a groundwater basin typically initiates from the recharge area and progresses towards the discharge area. The recharge area constitutes a vital segment of the watershed where groundwater diverges from the groundwater level. This region is characterized by a vertically downward flow of groundwater, signifying the direction in which water traverses through the geological formations.

In the recharge area, the water surface permeates through the topsoil to reach the groundwater level, marking a crucial process in the replenishment of groundwater resources. This infiltration mechanism plays a pivotal role in sustaining the aquifer by allowing water to seep through various layers of soil and rock, contributing to the overall health of the groundwater basin.

Furthermore, the characteristics of the recharge area encompass a deep phreatic water level, typically situated below the piezometric surface in normal conditions. This configuration highlights the depth at which the groundwater is present and emphasizes the significance of understanding the vertical distribution of water within the aquifer. The interplay between the phreatic water level and the piezometric surface provides valuable insights into the dynamics of groundwater flow in this region.

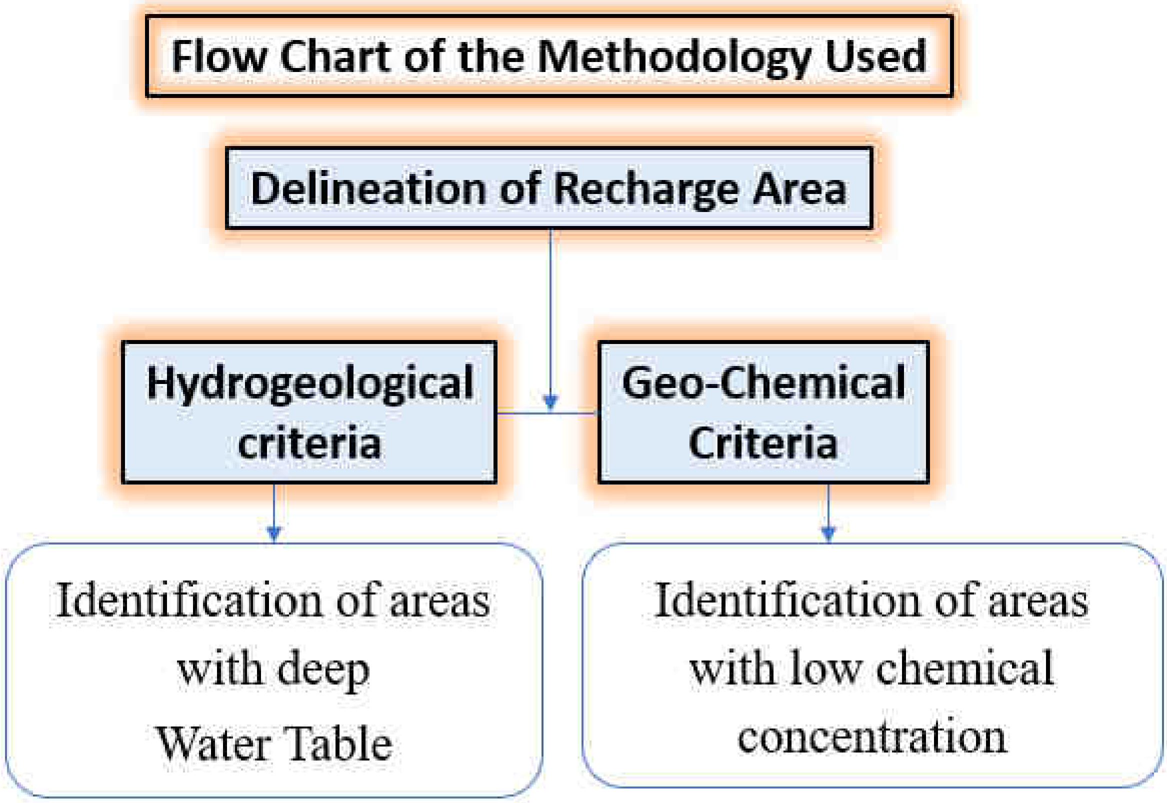
Another distinctive feature of the recharge area is the relatively low concentration of chemical constituents in the groundwater. This aspect is crucial for assessing the quality of the replenishing water and its potential impact on the overall groundwater composition. The lower chemical load in this area contributes to the maintenance of water quality as it percolates through the soil, preserving the integrity of the aquifer.

Lastly, the recharge area is characterized by groundwater with a younger age compared to other parts of the groundwater basin. The age of groundwater refers to the time elapsed since it entered the aquifer. In the recharge area, the relatively younger age of groundwater indicates a more recent influx, reflecting the ongoing process of replenishment and emphasizing the dynamic nature of groundwater flow within the basin.

5.3.1 Objective

Delineation of Recharge and Discharge area through multicriteria and statistical approach

5.3.2 Material and Methods



5.3.3 Results and Discussion

5.3.3.1 Hydrogeological Characteristics

From the topographic and water level map it is observed that there is strong lithological and anthropogenic control on the behavior of water level. The water level in both phreatic and deeper aquifer shows similar pattern with deeper water-level in southern portion and comparatively shallower water level in northern part of study area. This behavior is generally due to presence low aquifer thickness in the northern part where aquifer is granite.. However, the study area forms the upper portion of the water shed affirming to the general convention that the upper portion of a watershed forms the recharge area. This can also be verified through geochemical signatures.

5.3.3.2 Geochemical Characteristics

Chadha's plot (1999) was used to identify the groundwater provenance. In the diagram the difference in mill equivalent percentage between alkaline earths (Ca, Mg) and alkali metals (Na, K), expressed as percentage reacting values, is plotted on the X-axis. Similarly, the difference in mill equivalent percentage of weak acidic anions (CO_3, HCO_3) and strong acidic anions (SO_4, Cl) are plotted on the Y-axis. From the graph it is visible that in the pre-monsoon season the samples collected from the phreatic aquifer were scattered plotted in the diagram indicating various hydrogeological phenomena like recharge, ion exchange, reverse ion exchange and ionic dissolution actives. The de-watering by coal mine, industrial pollution by thermal power plant, acidic water discharge effect the local hydrogeological condition of the area. The local geological condition in the phreatic aquifer and anthropogenic activities leads to reverse ion exchange is a prime phenomenon in the post monsoon season while at few locations the recharge from meteoric water recorded in the study area.

In the pre-monsoon season the ground water moved from phreatic to fractured aquifer and its properties does not changed and exhibits the scattered plot. The plot shows recharge, ion exchange and revers ion exchange process due to the rapid change in hydrogeological condition due to the industrial and anthropogenic influence. In the post-monsoon season the most of the samples shows of revers ion exchange due the interaction of the recharge water with the local geology and the industrial influence.

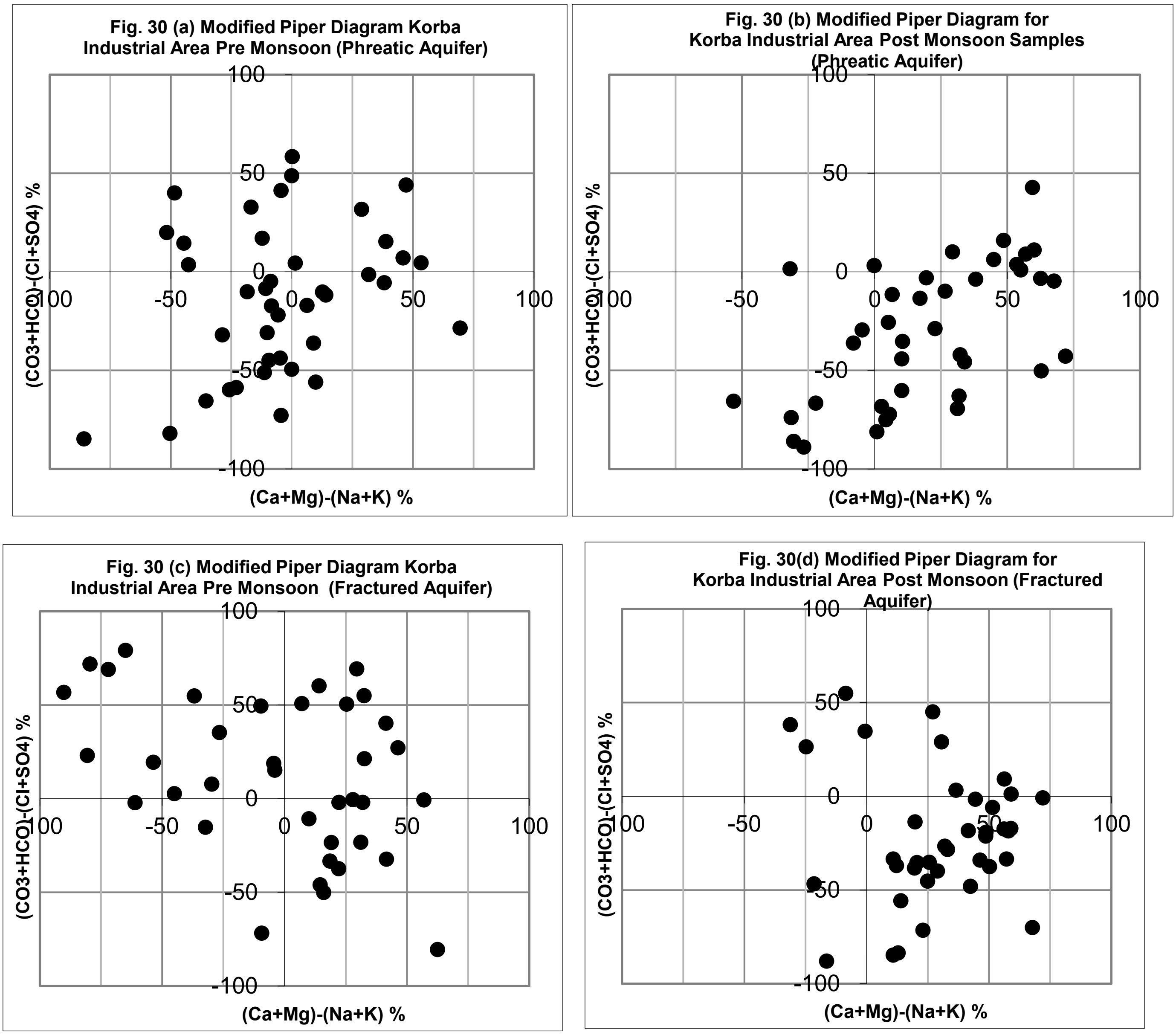


Figure 30 Geochemical Criteria for identification of recharge area using Chadha Plot

5.3.3.3 Recharge and Discharge Area

The watershed demarcated in figure 31 clearly indicates that the study area falls under confluence of their watershed namely Lower Hasdeo, Chornai and Ahiran. A Recharge area potential map was prepared by overlaying post monsoon water level of both first and second aquifer. The water-level was categorized into area with water-level less than 3 mbgl and below 3 mbgl. Other factors like existing fly ash deposits, geomorphology, drainage, lithology etc. also considered for demarcation of recharge area. 16 Micro-watershed (Table 12 & Figure 33) comprising of 141 Sq Km of Lower Hasdeo and Ahiran watershed identified for intervention.

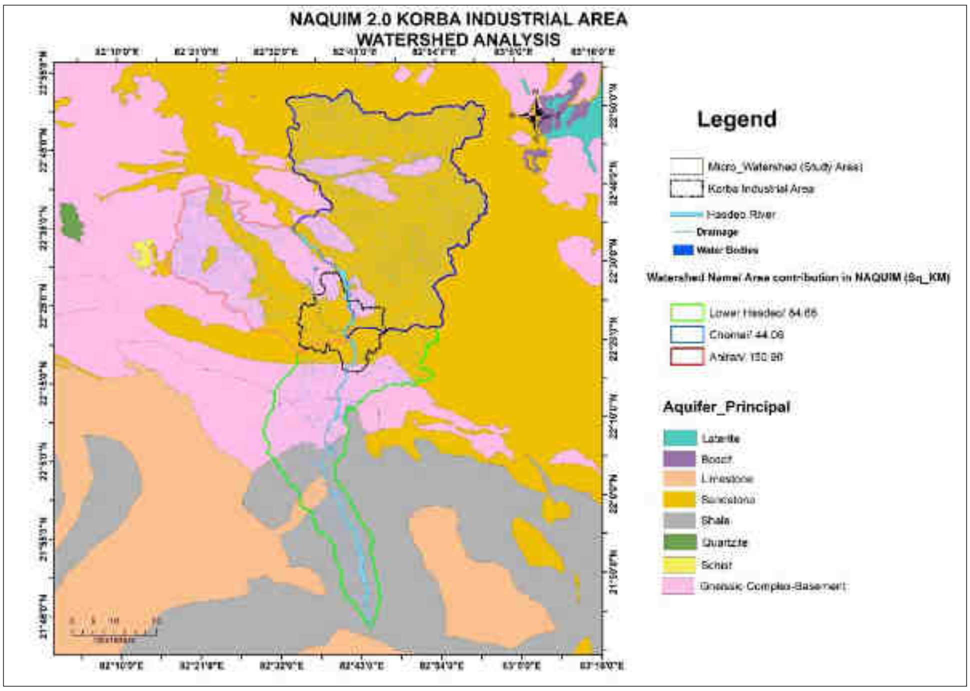


Figure 31 Watershed Map of the Study area

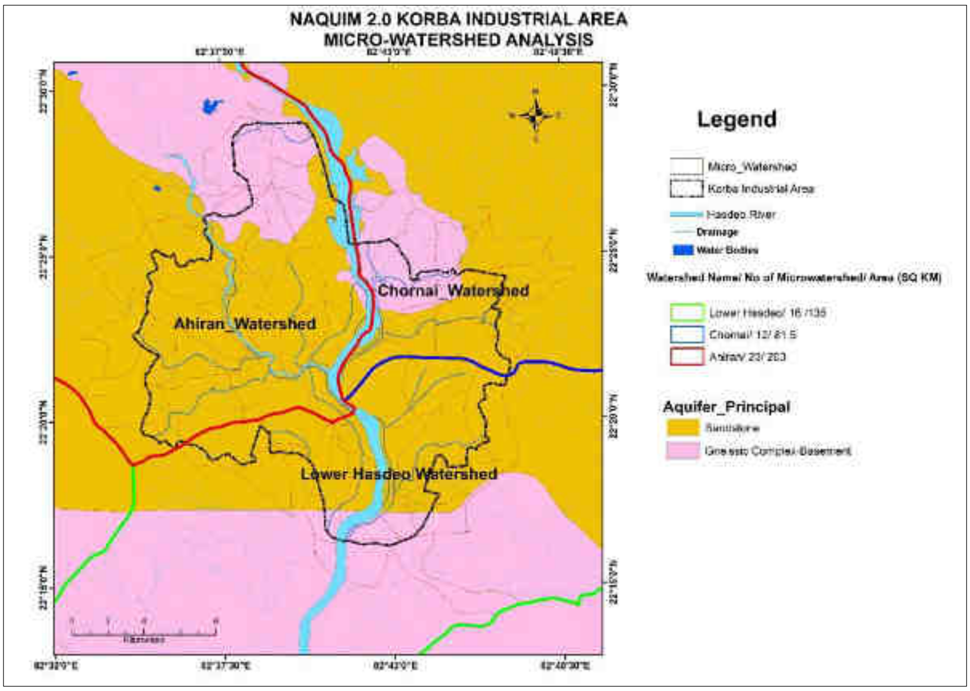


Figure 32 Micro Watershed Analysis of the Area

Table 12 Micro-watershed identified for Artificial Recharge

Sl No	MICRO_WS_CODE	BASIN	SUBCATCHMENT	WATERSHED	AREA_SQKM
1	4G2D2A3e	Mahanadi	Hasdo	Ahiran	11.81
2	4G2D2A3a	Mahanadi	Hasdo	Ahiran	8.71
3	4G2D2A2h	Mahanadi	Hasdo	Ahiran	11.43
4	4G2D2A2i	Mahanadi	Hasdo	Ahiran	8.42
5	4G2D2A2g	Mahanadi	Hasdo	Ahiran	9.00
6	4G2D2B1d	Mahanadi	Hasdo	Ahiran	8.86
7	4G2D2A1a	Mahanadi	Hasdo	Ahiran	9.62
8	4G2D2A2f	Mahanadi	Hasdo	Ahiran	5.13
9	4G2D2A2e	Mahanadi	Hasdo	Ahiran	9.60
10	4G2D2A2b	Mahanadi	Hasdo	Ahiran	8.42
11	4G2D2A2c	Mahanadi	Hasdo	Ahiran	9.49
12	4G2D1C5g	Mahanadi	Hasdo	Lower Hasdeo	8.66
13	4G2D1C3a	Mahanadi	Hasdo	Lower Hasdeo	6.20
14	4G2D1C5h	Mahanadi	Hasdo	Lower Hasdeo	9.14
15	4G2D1D5a	Mahanadi	Hasdo	Lower Hasdeo	10.79
16	4G2D1D5b	Mahanadi	Hasdo	Lower Hasdeo	5.54

Figure 33 Artificial Recharge Area Delineation Map

5.4 Groundwater Quality

Water quality assessment is crucial for ensuring the safety and sustainability of water sources across various sectors, including drinking water, irrigation, and industrial processes. In the context of drinking water, assessing water quality is essential to safeguard public health. Contaminants such as bacteria, viruses, heavy metals, and chemicals can pose serious health risks if present in drinking water. Regular monitoring and assessment help identify and address potential hazards, ensuring that water treatment facilities can effectively remove or mitigate these contaminants, thus providing safe and clean drinking water to communities.

In agriculture, water quality assessment is pivotal for irrigation purposes. Poor water quality can have detrimental effects on soil health and crop productivity. High levels of salts, sediments, or toxic substances in water can lead to soil degradation, affecting the fertility and structure of the land. By monitoring water quality, farmers can make informed decisions about irrigation practices, selecting appropriate water sources and optimizing resource utilization to enhance agricultural productivity while minimizing environmental impacts.

In industrial settings, water quality assessment is crucial for ensuring the efficiency and sustainability of manufacturing processes. Many industries rely on water for various purposes, including cooling, cleaning, and as a component in the production of goods. Poor water quality can lead to equipment corrosion, scaling, and fouling, impacting the overall efficiency of industrial operations. Regular water quality assessments enable industries to implement appropriate treatment measures, reduce environmental impact, and comply with regulations, ultimately contributing to sustainable and responsible industrial practices. Overall, water quality assessment plays a pivotal role in safeguarding human health, promoting agricultural productivity, and supporting sustainable industrial development.

5.4.1 Objective

The objective of the water quality analysis is to categorize area with poor water quality for drinking, irrigation and industrial purposes and found out the mechanism controlling the dissemination of the toxic elements.

5.4.2 Material and Methods

The methodology for assessing drinking water quality typically involves a comprehensive approach that considers a range of physical, chemical, and microbiological parameters. Water quality testing is conducted using standardized methods and guidelines established by regulatory bodies, such as the Bureau of India (BIS). Parameters assessed include pH levels, turbidity, dissolved oxygen, total dissolved solids, heavy metals, pesticides, and microbial contaminants. Samples are collected at various points in the water supply chain, from the source to the tap, to identify potential contamination sources and assess the effectiveness of water treatment processes. The collected data are then compared to established water quality standards and guidelines to determine compliance. Additionally, drinking water quality indexing often involves the development of a composite index that combines multiple parameters into a single numerical value, simplifying the communication of overall water quality and aiding in the identification of potential health risks. This approach ensures a systematic and thorough evaluation of drinking water quality, helping authorities and water management agencies make informed decisions to ensure the provision of safe and reliable drinking water to the public.

5.4.3 Results and Discussion

5.4.3.1 Type of water

Water type/ hydro chemical facies evaluations are extremely useful in providing a preliminary idea about the complex hydro chemical processes in the subsurface. Determination of hydro chemical facies was extensively used in the chemical assessment of groundwater and surface water for several years. This method is able to provide sufficient information on the chemical quality of water, particularly the origin.

Water facies is identified by using Piper trilinear diagram is a graphical representation of the hydrochemistry of water samples collected in and around Korba industrial cluster. The cations and anions are shown by separate ternary plots. The apexes of the cation plot are calcium, magnesium and sodium plus potassium cations. The apexes of the anion plot are sulphate, chloride and carbonate plus hydrogen carbonate anions. The two ternary plots are then projected onto a diamond. The diamond is a matrix transformation of a graph of the anions (sulphate + chloride/ total anions) and cations (sodium + potassium/total cations) (J.D. Hem). Piper trilinear graphical representation of dug well water and hand pumps water of Korba study area are shown in Figure-34 and 35.

In the pre-monsoon season, ground water is mostly mixed in nature. The geological condition, mining and industrial activity influence the ground water character. The dug well water is mostly mixed in nature however few of the samples are shows Ca-Mg-Cl-SO^4 type. The most of the borewell/ hand pump water is mixed in character and few of the water is $CaCO^3$ type shows recharge process. By the ion exchange some of the water samples shows $NaHCO^3$

character. In the post-monsoon season most of the samples shows Ca-Mg-Cl character may be due to the industrial and anthropogenic activity.

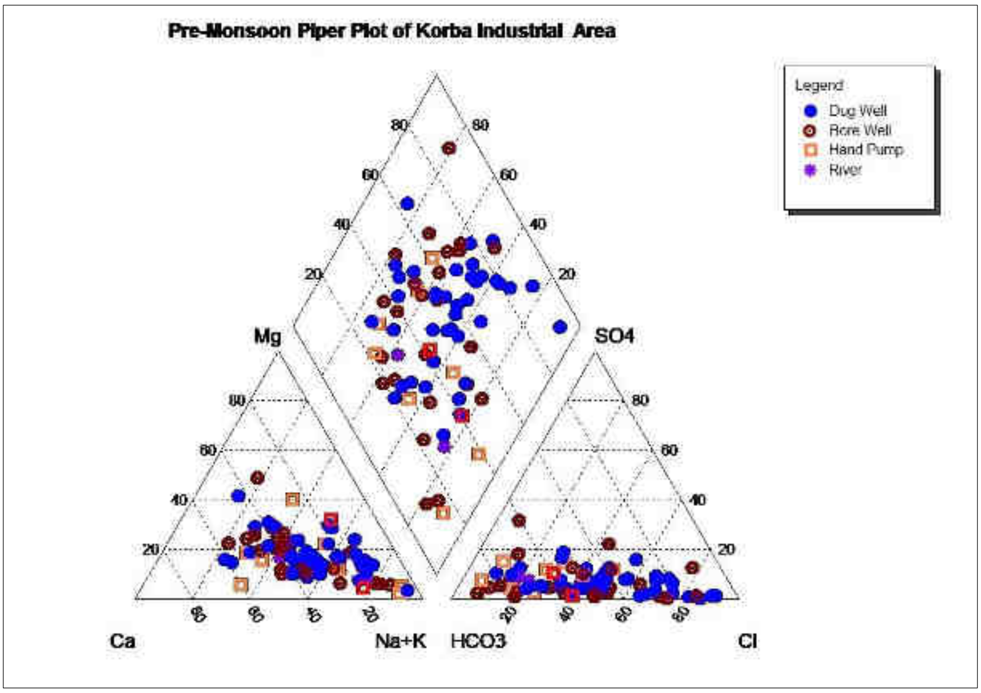


Figure 34 Piper trilinear diagram of Pre-Monsoon water samples of study area

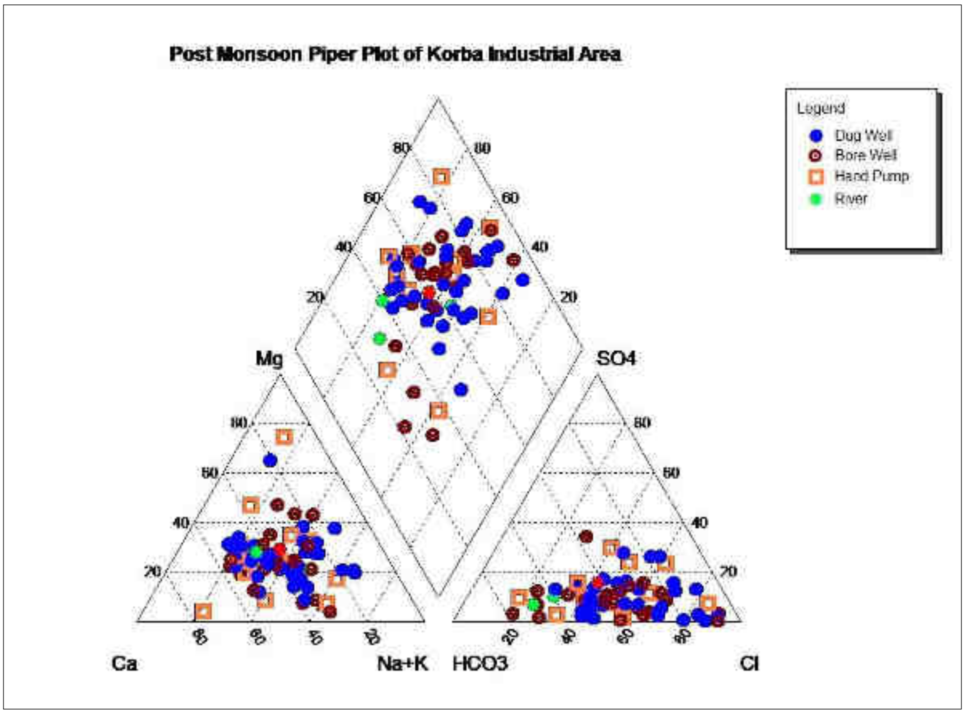


Figure 35Piper trilinear diagram of Post-Monsoon water samples of study area

5.4.3.2 Drinking Water Specification

pH

pH is the hydrogen ion activity of the solution, pH value indicate whether water is acidic, alkaline or neutral. The BIS recommended pH value is 6.5 – 8.5 for drinking purpose.

Pre-monsoon Season: In dug well (phreatic aquifer) water samples pH value varies in between 5.5-8.0 with the average value of 7.1. In handpump/ borewell water samples pH value is ranging from 5.9 - 8.1 with the average value of 7.1. In total at 11 locations (Annexure I) in study area pH found less than 6.5 which is not suitable for drinking purpose.

Post-monsoon Season: In dug well (phreatic aquifer) water samples pH value varies in between 5.3-7.95 with the average value of 6.8. In handpump/ borewell water samples pH value is ranging from 5.3 - 8.1 with the average value of 6.8. In total at 24 locations (Annexure II) in study area pH found less than 6.5 which is not suitable for drinking purpose.

The less than 6.5 pH value indicating the acidic character of the ground water. The mine water discharge affecting the pH character of the water.

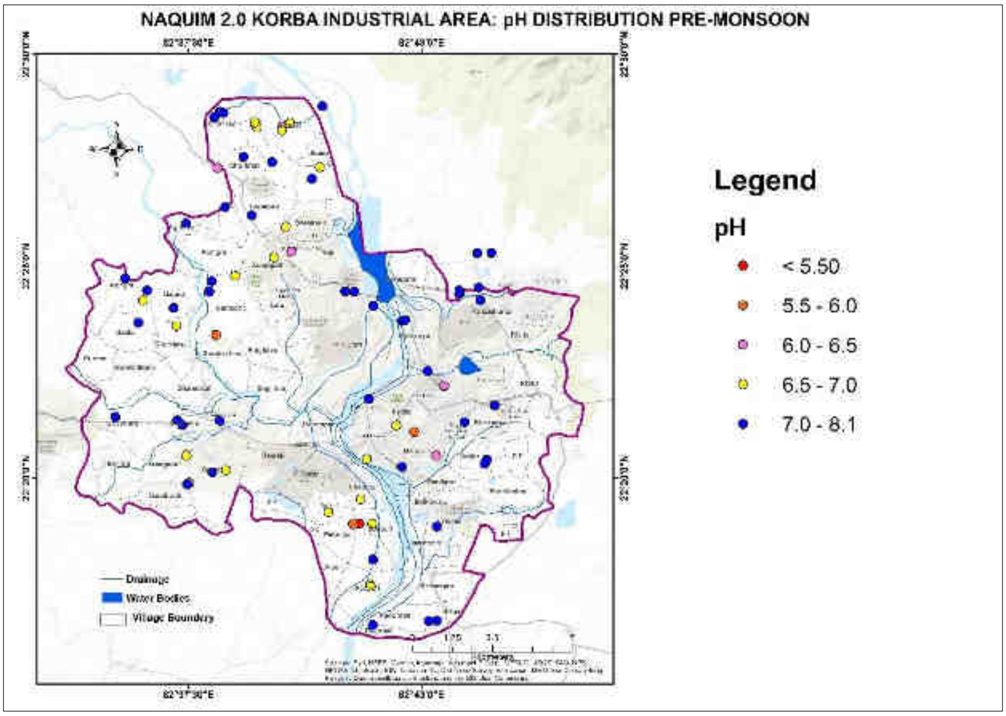


Figure 36 pH Distribution Map Pre-Monsoon

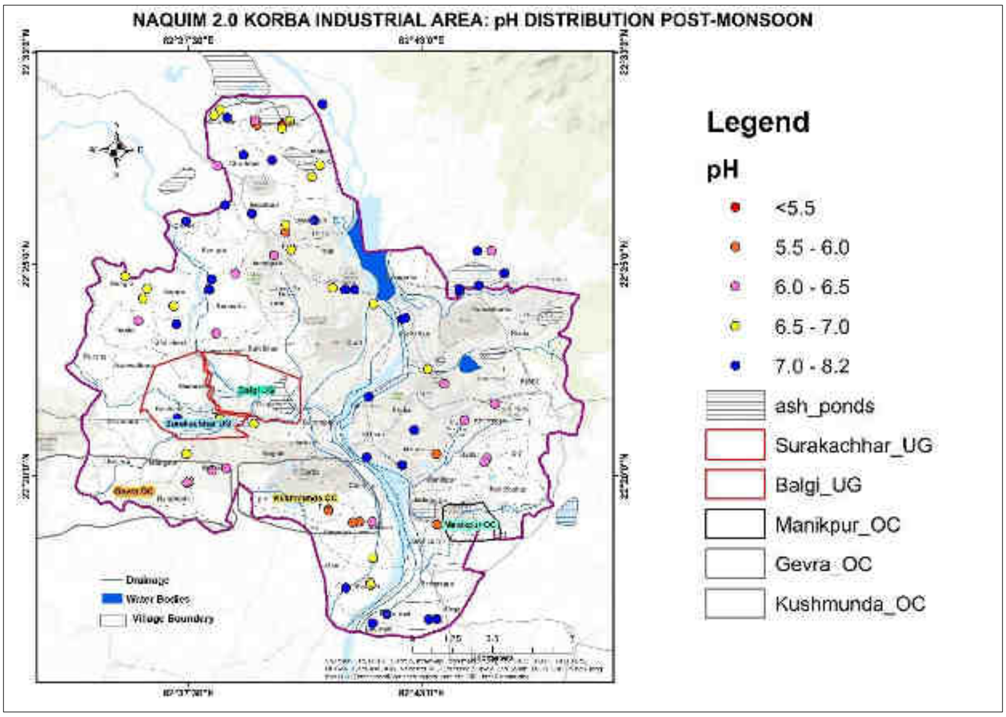


Figure 37 pH Distribution Map Post-Monsoon

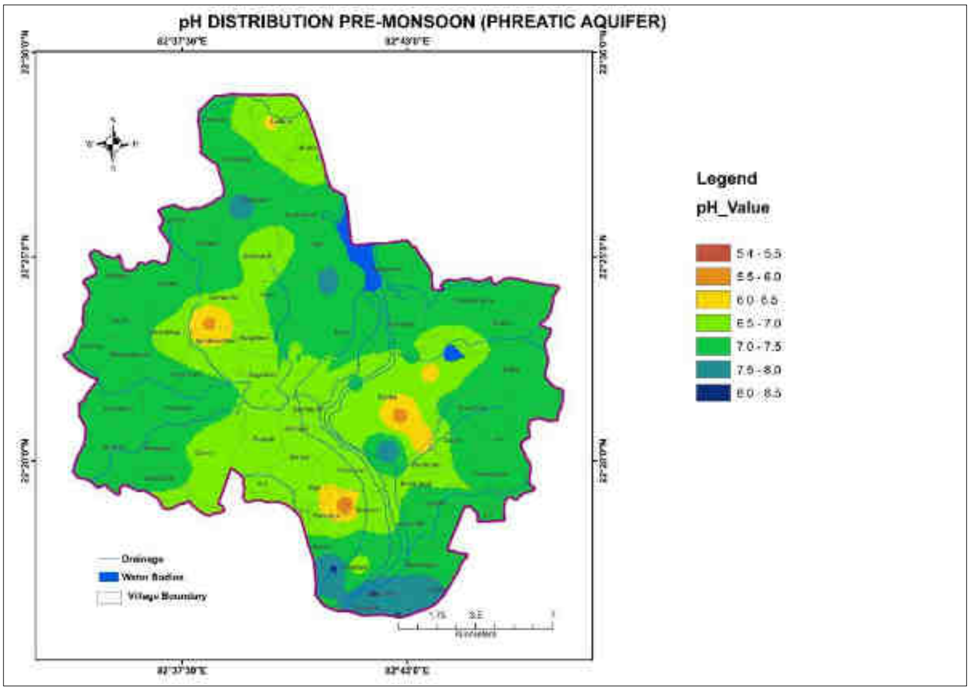


Figure 38 pH Contour Map Phreatic Aquifer (Pre-Monsoon)

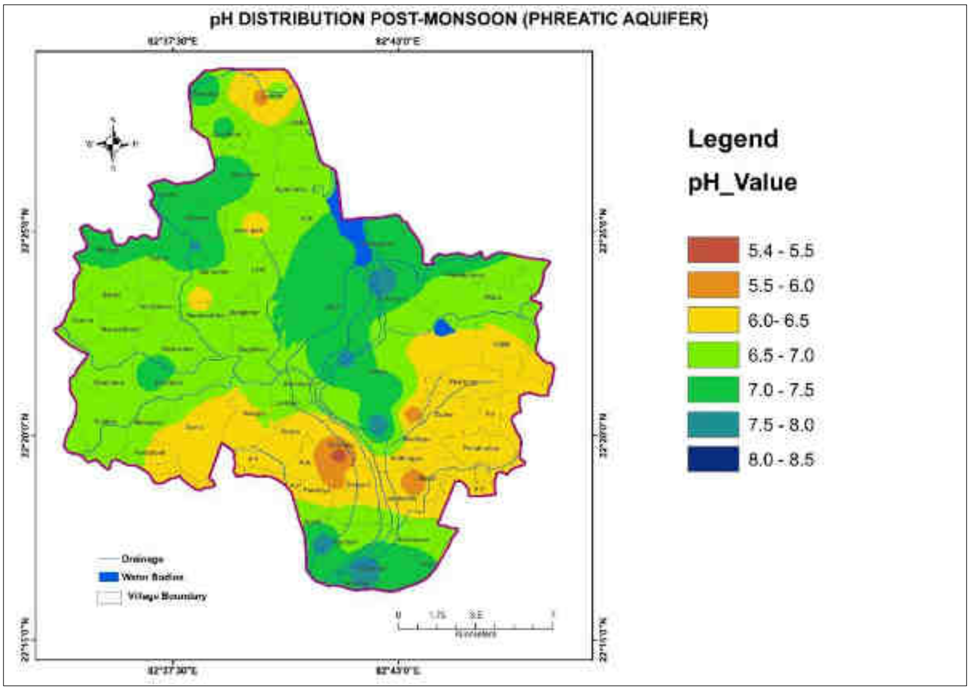


Figure 39 pH Contour Map Phreatic Aquifer (Post-Monsoon)

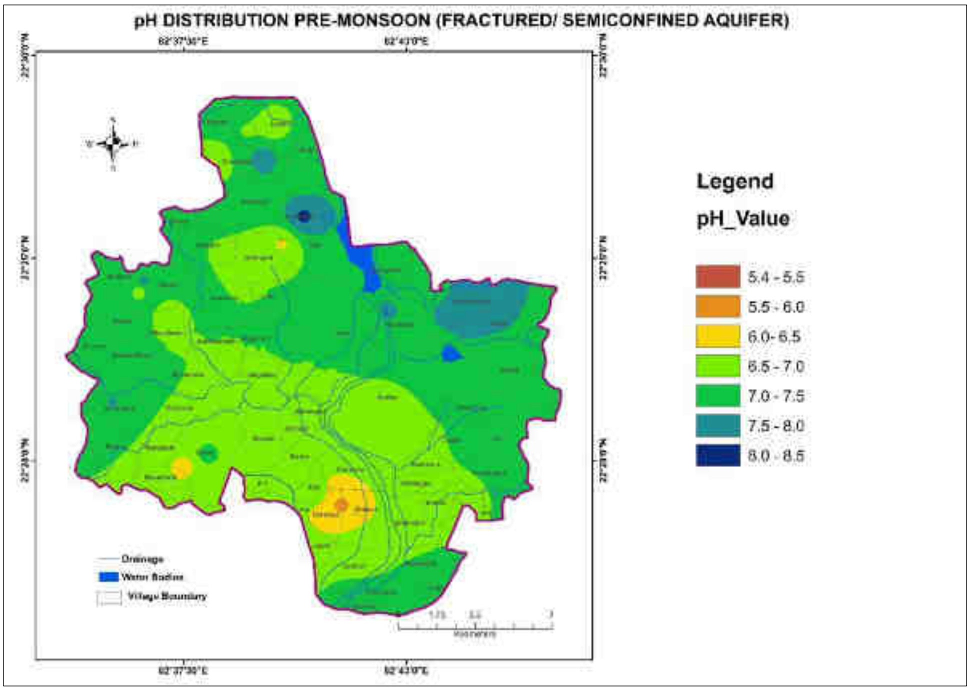


Figure 40 pH Contour Map Fractured Aquifer (Pre-Monsoon)

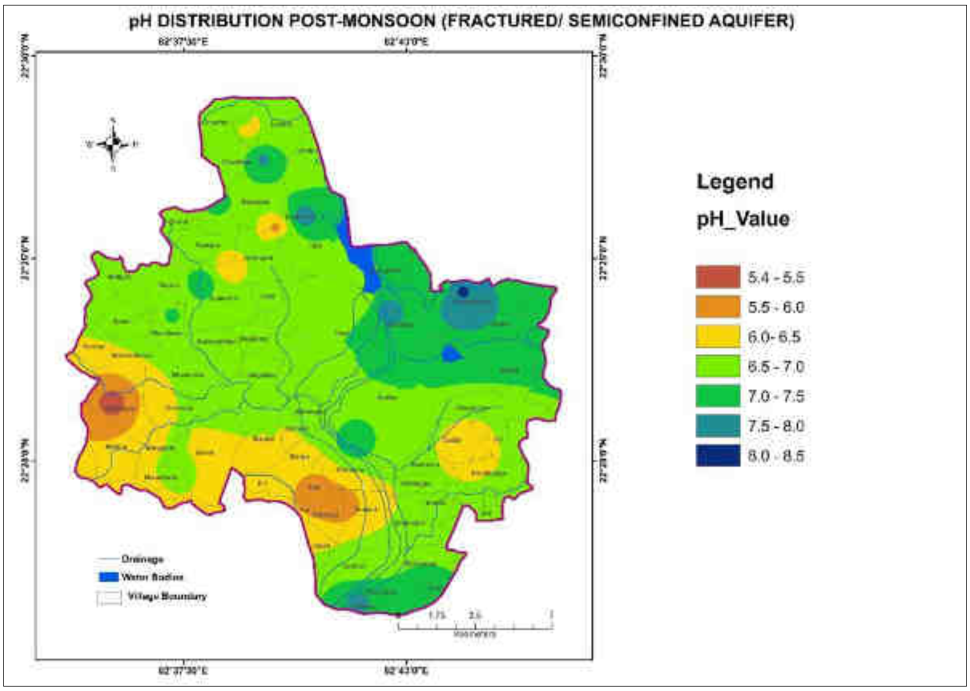


Figure 41 pH Contour Map Fractured Aquifer (Post-Monsoon)

Electrical conductivity (EC)

Electrical conductivity measures the ability of an aqueous solution to convey an electric current. More number of ions gives the high electrical conductivity whereas less number of ions gives low conductivity value.

Pre-monsoon Season: In dug well (phreatic aquifer) water samples EC value varies in between 135-1607 µS/cm with the average value of 570 µS/cm. In handpump/ borewell water samples EC value is ranging from 59 - 2430 µS/cm with the average value of 458 µS/cm. In total at 3 dugwell locations Sitamani, Kudurmal, and Balrampur along with 02 Handpump samples namely Parsabhata and Semripali in study area EC found more than 1200 µS/cm.

Post-monsoon Season: In dug well (phreatic aquifer) water samples EC value varies in between 106-1695 µS/cm with the average value of 518 µS/cm. In handpump/ borewell water samples EC value is ranging from 83 - 2230 µS/cm with the average value of 440 µS/cm. In total at 3 dugwell locations Sitamani, Kudurmal, and Semipali along with 01 Handpump samples namely Semripali (Annexure III) in study area EC found more than 1200 µS/cm.

Total hardness (TH)

Pre-monsoon Season: In dug well water samples total hardness value varies from 10 to 555 mg/l with average hardness 152 mg/l as CaCO3. In hand pump water samples the hardness varies in between 10 to 725 mg/l with average hardness 113 mg/l as CaCO3. At Semripali (Urga) high TH (725) observed in handpump samples.

Post-monsoon Season: In dug well water samples total hardness value varies from 30 to 750 mg/l with average hardness 165 mg/l as CaCO3. In hand pump water samples the hardness varies in between 20 to 1085 mg/l with average hardness 166 mg/l as CaCO3. At Semripali (Urga) high TH (1085) observed in both dug well and handpump samples.

The BIS acceptable and maximum permissible limit of total hardness in drinking water is 200 – 600 mg/l respectively. In study area surface water is soft and ground water is soft to moderately hard in nature.

Carbonate ion (CO_3^-) and Bicarbonate ion (HCO_3^-)

No carbonate alkalinity has been observed in ground water of Korba city.

Pre-monsoon Season: In case of dug well water samples the bicarbonate concentration is ranging between 12 to 555 mg/l with average concentration of 144.4 mg/l. In hand pump water samples the bicarbonate concentration varies from 6 to 445.3 mg/l with average concentration of 150.4 mg/l. High concentration of bicarbonate (>500 mg/l) is observed at Kudurmal dug well water samples.

Post-monsoon Season: In case of dug well water samples the bicarbonate concentration is ranging between 6 to 299 mg/l with average concentration of 65.7 mg/l. In hand pump water samples the bicarbonate concentration varies from 6 to 177 mg/l with average concentration of 63.5 mg/l.

The total alkalinity is calculated in mg/l as $CaCO_3$ by obtained concentration of carbonate and bicarbonate. In all the collected water samples the total alkalinity value is within the set range 200-600 mg/l by BIS for the drinking purposes.

Chloride (Cl^-)

The presence of chloride in natural water can be attributed to dissolution of salt deposit discharges of effluents from chemical industries.

Pre-monsoon Season: In dug well water samples the chloride concentration varies from 7 to 252 mg/l with average concentration of 94.4 mg/l. In hand pump water samples the chloride ion concentration is ranging between 3.6 to 337.3 mg/l with average concentration of 51.7 mg/l.

Post-monsoon Season: In dug well water samples the chloride concentration varies from 14.2 to 245 mg/l with average concentration of 63.1 mg/l. In hand pump water samples the chloride ion concentration is ranging between 14.2 to 394.1 mg/l with average concentration of 53.5 mg/l.

The chloride concentration is within limit in the study area, prescribed by BIS (250 - 1000 mg/l) for drinking purpose in all kinds of water.

Sulphate (SO_4^{2-})

Sulphate ions occur mostly in the evaporate sediments as anhydrite and as gypsum.

Pre-monsoon Season: In dug well water samples sulphate ion concentration is ranging between 0.2 to 77.1 mg/l with the average concentration 18.7 mg/l. In hand pump water samples the sulphate ion concentration varies from 0 to 107.2 mg/l with the average concentration 16.8 mg/l.

Post-monsoon Season: In dug well water samples sulphate ion concentration is ranging between 0 to 53.3 mg/l with the average concentration 12.9 mg/l. In hand pump water samples the sulphate ion concentration varies from 0 to 200 mg/l with the average concentration 15.6 mg/l.

The BIS acceptable and maximum permissible limit for drinking purposes is 200-400 mg/l respectively. In all the water samples sulphate concentration was found within the prescribed range at the study area.

Nitrate (NO_3^-)

Pre-monsoon Season: In dug well water samples nitrate ion concentration is ranging between 1.1 to 64 mg/l with the average concentration 27 mg/l. In hand pump water samples the nitrate ion concentration varies from 0 to 69.4 mg/l with the average concentration 17.6 mg/l. In total at 12 dugwell and 5 handpump locations (Annexure 02) and in study area nitrate ion concentration found more than 45 mg/l which is not suitable for drinking purpose.

Post-monsoon Season: In dug well water samples nitrate ion concentration is ranging between 0.6 to 61 mg/l with the average concentration 22.5 mg/l. In hand pump water samples the nitrate ion concentration varies from 0 to 56.1 mg/l with the average concentration 17.1

mg/l. In total at 7 dugwell and 4 handpump locations (Annexure 03) and in study area nitrate ion concentration found more than 45 mg/l which is not suitable for drinking purpose.

The BIS recommended concentration nitrate in drinking water is 45 mg/l more than this leads to blue baby syndrome (Drinking water standards of BIS 10500: 2012).

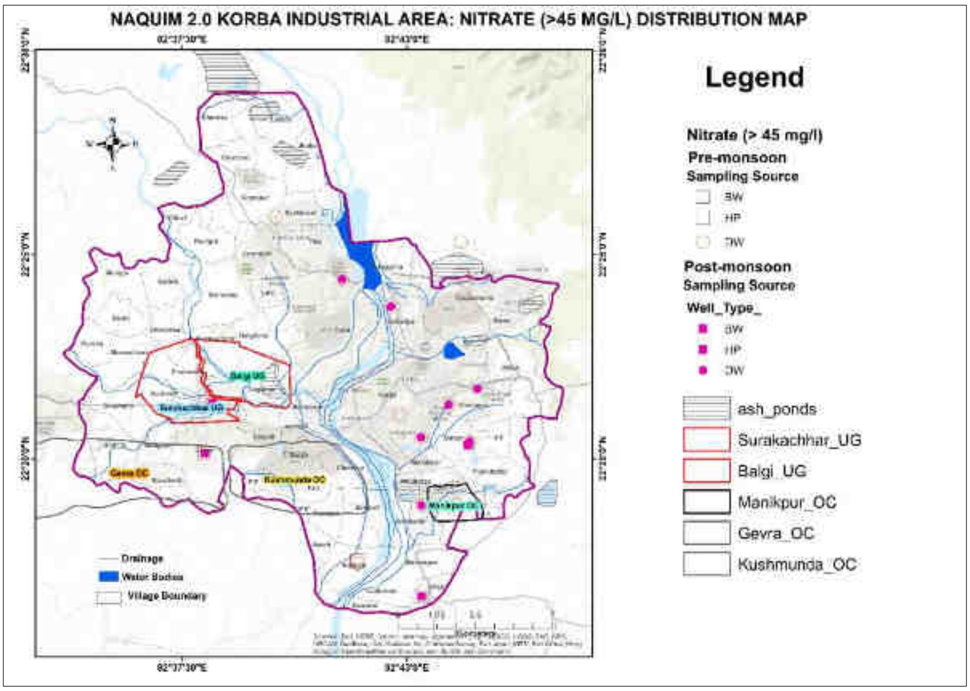


Figure 42 Nitrate Distribution in Study Area (>45 mg/l)

Fluoride (F^-)

Fluoride ions have dual significance in water supplies. High concentration of F^- ions causes fluorosis but at low concentration (less than 0.8mg/l) causes dental caries. Hence, it is essential to maintain the F^- ions concentration between 0.8 to 1.0 mg/l in drinking water (B.K. Handa).

In dug well water the fluoride concentration ranges upto 2.4 mg/l with an average concentration of 0.4 mg/l. In dug well water samples only at Kudurmal high fluoride content 2.4 mg/l is recorded and rest of the locations it is observed less than the desired limit of BIS. In hand pump water samples the fluoride concentration ranges upto 5.1 mg/l with an average concentration of 0.7 mg/l. High fluoride content in hand pump water is observed at Madwamahua, Dhanras, Nawagaon Kala and Premnagar with respective concentration 5.0, 3.0, 2.6 and 2.1 mg/l.

Sample from stream water collected at Parsabhata (1.27 mg/l) and Rogbahari (1.03 mg/l) village showing Flouride concentration is may be due to fly ash containing high fluoride and over flow of ash ponds goes into nearby surface water body.

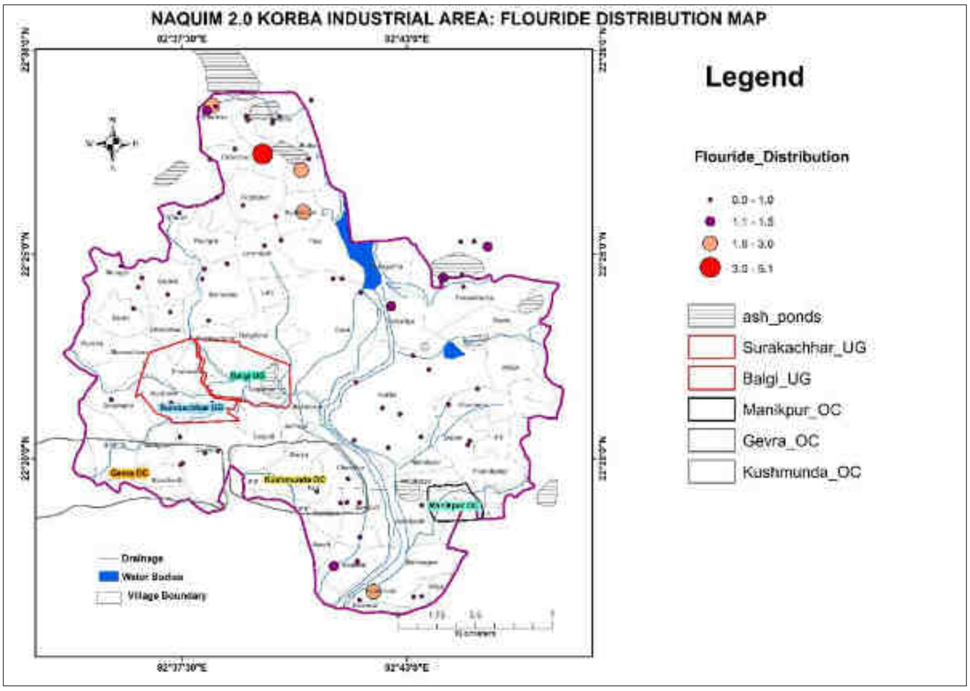


Figure 43 Fluoride Distribution Map

Silicate (SiO_2)

Pre-monsoon Season: In dug well water samples silicate concentration is ranging between 3.9 to 22.4 mg/l with the average concentration 11.0 mg/l. In hand pump water samples the silicate concentration varies from 4.3 to 33.2 mg/l with the average concentration 14.8 mg/l.

Post-monsoon Season: In dug well water samples silicate concentration is ranging between 0.1 and 20.1 mg/l with the average concentration of 8.9 mg/l. In hand pump water samples the silicate concentration varies from 3.2 and 24.4 mg/l with the average concentration of 9 mg/l.

Phosphate (PO_4^{3-})

Phosphorus occurs in natural water and waste water in the form of various types of phosphates. These types are commonly classified into orthophosphates and total phosphates. These may occur in the soluble form, in particles of detritus or in the bodies of aquatic organisms.

Sodium (Na^+)

Sodium is the most abundant of the alkali elements in the cosmos and the earth in term of both atomic abundance and weight percent.

Pre-monsoon Season: In dug well water samples sodium ion concentration is ranging between 7.2 to 211 mg/l with the average concentration 57 mg/l. In hand pump water samples the sodium ion concentration varies from 4.9 to 248 mg/l with the average concentration 49.2 mg/l.

Post-monsoon Season: In dug well water samples sodium ion concentration is ranging between 5.6 to 225 mg/l with the average concentration 27 mg/l. In hand pump water samples the sodium ion concentration varies from 5.2 to 118.2 mg/l with the average concentration 36.1 mg/l.

Potassium (K^+)

Pre-monsoon Season: In dug well water samples potassium ion concentration is ranging between 1.5 to 53.5 mg/l with the average concentration 15.5 mg/l. In hand pump water samples the potassium ion concentration varies from 1.1 to 46.8 mg/l with the average concentration 11.1 mg/l.

Post-monsoon Season: In dug well water samples potassium ion concentration is ranging between 0.3 to 105 mg/l with the average concentration 15.7 mg/l. In hand pump water samples the potassium ion concentration varies from 0.5 to 16 mg/l with the average concentration 4.8 mg/l.

Calcium (Ca^{2+})

The presence of calcium fifth among the element order of abundance in water supplies results from passage through or over deposits of limestone, dolomite, gypsum, and gypsiferous shale (D.K. Todd).

Pre-monsoon Season: In dug well water samples calcium ion concentration is ranging between 2 to 124 mg/l with the average concentration 37 mg/l. In hand pump water samples the calcium ion concentration varies from 2 to 112 mg/l with the average concentration 28 mg/l.

Post-monsoon Season: In dug well water samples calcium ion concentration is ranging between 6 to 92 mg/l with the average concentration 34.3 mg/l. In hand pump water samples the calcium ion concentration varies from 2 to 194 mg/l with the average concentration 36.9 mg/l.

Magnesium (Mg2 +)

In the solar system, magnesium is the 8th most abundant constituent. Igneous rock contains average of the 1.76% magnesium.

Pre-monsoon Season: In dug well water samples magnesium ion concentration is ranging between 1.2 to 63.6 mg/l with the average concentration 14.2 mg/l. In hand pump water samples the magnesium ion concentration varies from 1.2 to 106.8 mg/l with the average concentration 10.4 mg/l.

Post-monsoon Season: In dug well water samples magnesium ion concentration is ranging between 0 to 137.9 mg/l with the average concentration 19.3 mg/l. In hand pump water samples the magnesium ion concentration varies from 1.2 to 146.4 mg/l with the average concentration 18 mg/l.

Heavy Metals

Heavy metals viz. iron, manganese, copper, zinc, lead and chromium were analysed in ground water and surface water samples collected during pre-monsoon in and around the Korba industrial cluster areas. The concentration of heavy metal along with location was summarized in Annexure IV. The distributions of heavy metal along with their effect are discussed below.

Iron (Fe)

Abundance of iron is recorded in all the water samples collected from the study area and it is one of the major contaminant in ground water. In dug well water samples it varies from upto 0.24 mg/l with the average concentration 0.03 mg/l that is within the prescribed limit by BIS. In hand pump water samples the iron concentration is varies from 0.00 to 13.1 mg/l with the average concentration 1.12 mg/l. Iron observed at 06 locations (BW/HP) beyond the set limit of BIS 0.3 mg/l (Drinking water standards of BIS 10500: 2012). In Banki Mongra highest Iron concentration observed (13 PPM) in sample collected from borewell.

Manganese (Mn)

High manganese concentration observed at 03 location in dugwell samples namely Ayodhyapuri (0.4 mg/l), Manasnagar(0.4 mg/l), and Jamnipali (0.5 mg/l),. which is more than the BIS Drinking water standards (0.3 mg/l). In hand pump water samples the manganese concentration observed over the recommended limit of BIS at Banki Mongra(2.5 mg/l), Semri Pali (Urga) (0.5 mg/l), Padania(0.3 mg/l) and Dadar Khurd(0.3 mg/l).

Copper (Cu)

Copper are essential nutrients for human being. BIS recommended acceptable and permissible concentration is 0.05 to 1.5 mg/l respectively for drinking water. In both dug well and handpump water samples copper concentration is recorded within the acceptable range for drinking purpose.

Zinc (Zn)

BIS recommended the zinc concentration in drinking water is 5 to 15 mg/l respectively. In both dug well and handpump water samples zinc concentration is recorded within the acceptable range for drinking purpose.

Lead (Pb)

BIS recommended the lead concentration in drinking water is upto 0.01 mg/l. In both dug well and handpump water samples lead concentration is recorded within the acceptable range for drinking purpose.

Chromium (Cr)

BIS recommended the chromium concentration in drinking water is upto 0.05 mg/l. In both dug well and handpump water samples chromium concentration is recorded within the acceptable range for drinking purpose.

Other parameters like Selenium (Se), Cadmium (Cd), Mercury (Hg) and Arsenic (As) were also analysed for both dugwell and hand pump/ borewell samples and found well within the permissible limit as per drinking water standards of BIS 10500: 2012.

5.4.3.3 Classification of Irrigation Water

U.S. Salinity diagram

US salinity laboratory (USSL 1954) (N. Nielson et al) has developed a diagram for classification of irrigation waters into 16 classes with reference to Sodium Adsorption Ratio (SAR) as an index for Sodium Hazard (S) and electrical conductivity (EC in µS/cm) as an index of salinity hazard (C). US Salinity diagram of ground water samples of Korba is presented in Figure-44.

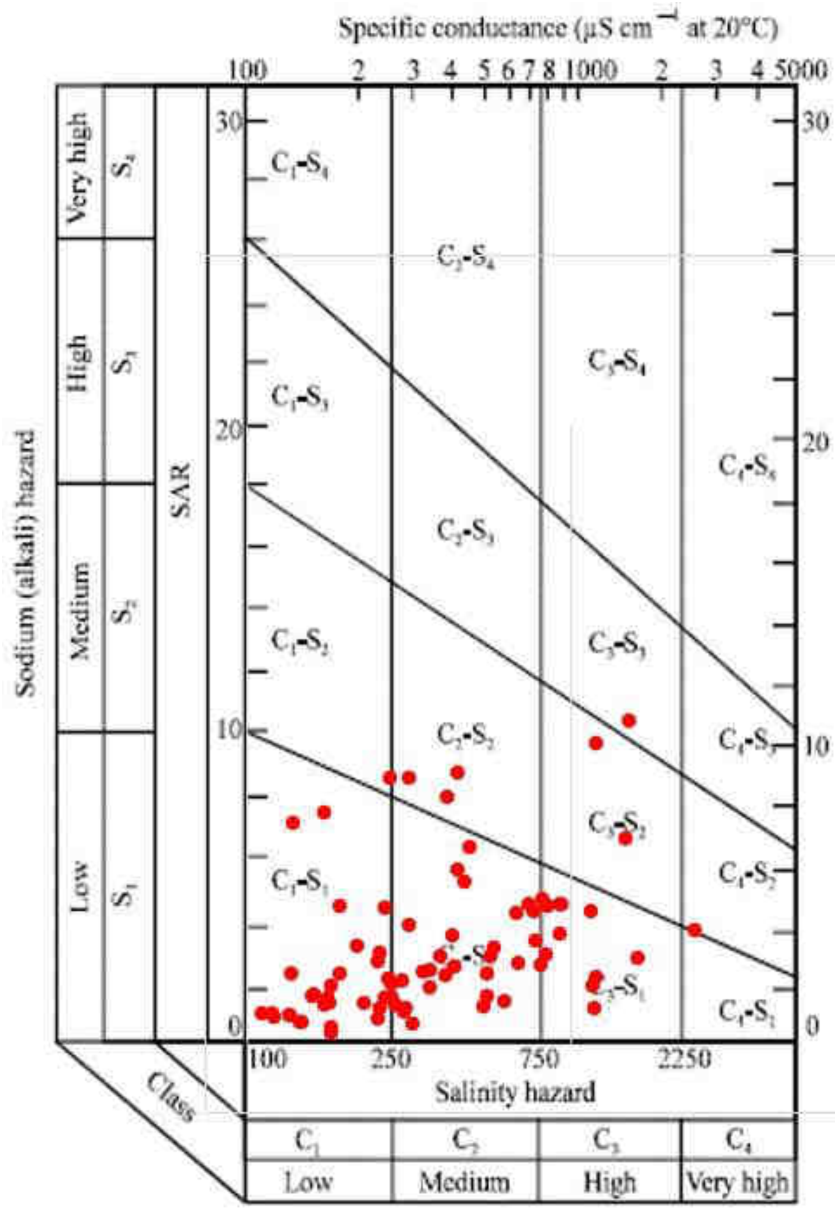


Figure 44 US Salinity diagram for Korba Industrial Area

The US Salinity diagram exhibited that the water of the most of the location is comes under C1S1 (Low salinity hazard and low sodium hazard) and C2S1 (Medium salinity hazard and low sodium hazard) category moreover excellent for the irrigation. Whereas water of few locations are fall under C3S1 (High salinity hazard and low sodium hazard) class and marginally suitable for irrigation purpose.

Wilcox diagram

Wilcox (1955) has proposed a (bivariate %Na versus EC in µS/cm) diagram with five category classification for irrigation water. The computed values of Sodium percentage versus electrical conductivity EC in water of Korba are plotted in the diagram which is given in Figure-45. The Wilcox diagram exhibited that, in most of the locations ground water come in excellent to good category and in few places fall in good to permissible category that shows the water of study area is suitable for the irrigation. At Nagin Bhatin and Urga villages, groundwater found unsuitable to doubtful category.

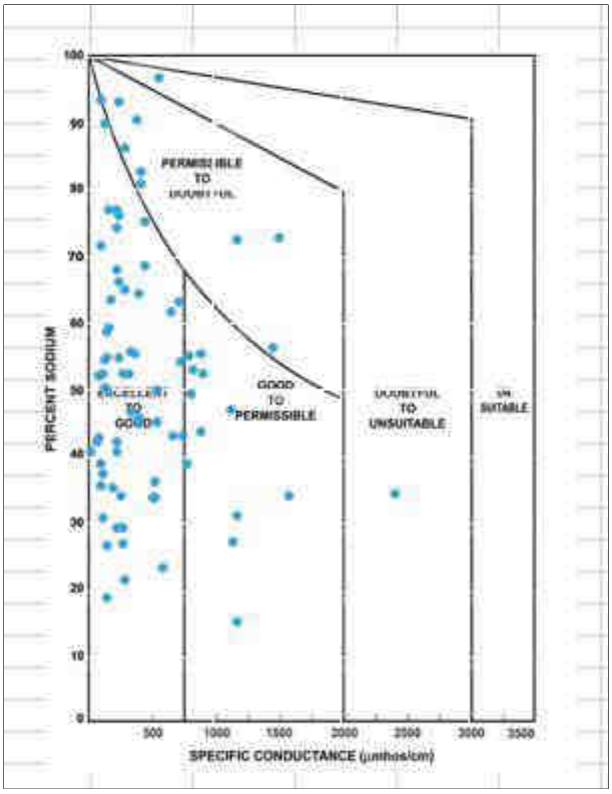


Figure 45 Wilcox diagram for Korba Industrial Area

5.4.3.4 Ground water suitability for irrigation purposes

Suitability of ground water for irrigation can be assessing by using the indices for salinity, chlorinity and sodicity. Apart from various indices such as soluble sodium percentage (SSP), sodium absorption ratio (SAR), residual sodium carbonate (RSC), percentage of sodium (%Na), Kelley ratio (KI), magnesium ratio (MR), and permeability index (PI) are computed (Annexure V) and summarized in Table 13. The quality criteria for irrigation water are evaluated on the basis of chemical characteristics indicative of their potential to create soil condition hazardous to crop growth and yields.

Table 13 Parameters for Ground water suitability for irrigation purposes

INDICES	S S P%	SAR	RSC	%Na	K I	Mg^{+2}	P I
MIN	12.61	0.25	-7.09	15.21	0.14	0.00	31.17
MAX	96.60	17.96	4.53	96.67	28.39	66.39	155.13
AVERAGE	47.69	2.37	-0.20	52.36	1.81	35.46	87.70
STD DEV	19.67	2.42	1.76	19.09	3.62	13.97	28.14

Sodium soluble percentage

Soluble sodium percentage (SSP) of the water is calculated by applying the equation given below, where the values are expressed in meq/l.

$$\mathbf{SSP = Na^{*}100/Ca + Mg + Na}$$

The sodium in water replaces Ca in the soil by base exchange process decreasing the soil permeability. Water with less than or equal to 50 SSP value is of good quality and more than 50 is not suitable for irrigation as permeability will be very low.

At the study area in dug well water samples the SSP varies from 17.4 to 90.6 and in hand pump water samples it is ranging in between 12.6 and 96.6. It indicates that the ground water of study area is suitable for irrigation purpose. At 30 locations were SSP > 50 in ground water is less suitable for irrigation purpose.

Sodium Adsorption Ratio (SAR)

SAR being a measure of alkali/sodium hazard to crops is an important parameter for assessing the suitability of the ground and surface water for irrigation purposes. Richard's (1954) has given following formula for calculation of SAR value, where all ions in meq/l.

$$\mathbf{SAR = [Na]/ \{[Mg] + [Ca]/2\}^{1/2}}$$

The suitability of the water for irrigation decreases with increasing SAR value. Specifically, the sodium reacts with soil, reducing its permeability. At study area in dug well water samples the SAR value varies from 0.4 to 6.9 and in hand pump water samples the SAR values is ranging in between 0.3 to 17.96. At Parsabhata Chowk hand pump samples recorded SAR 17.96. All other samples having SAR value < 10 is suitable for the irrigation purpose in respect to SAR value.

Residual Sodium Carbonate (RSC)

The sodium hazard to soil is also increased if the water contains high concentration of bicarbonate ions. The bicarbonate values are conveniently expressed in terms of Residual Sodium Carbonate. The excess sum of carbonate and bicarbonate content in ground water over the sum of calcium and magnesium content influences the suitability of water for irrigation purpose. This is expressed as Residual Sodium Carbonate (RSC) and calculated using the following formula. All ions are in meq/l.

$$\mathbf{RSC = (CO^{-}_3 + HCO^{-}_3) - (Ca^{++} + Mg^{++})}$$

At study area in dug well water samples the RSC value varies from -6.3 to 4.5 and in hand pump water samples it is ranging in between -7 to 3.8. Ground water of study area having Residual Sodium Carbonate (RSC) value < 1.25 and water is suitable for irrigation purposes.

Percent Sodium (%Na)

Irrigation water having high concentration of dissolved Na^{+} involves base exchange reactions with alkaline earths of the soil. These reactions reduce the permeability and cause poor internal drainage and air circulation in soil. Sodium content in natural water is expressed in terms of percent sodium (%Na) is calculated by using the following formula, all ions in meq/l.

$$\mathbf{Na\ \% = [Na] + [K] / \{[Na+[K]+[Mg]+[Ca]\} \times 100}$$

At the study area in dug well water samples %Na varies from 15.2 to 92.9 and in hand pump water samples it is ranging in between18.7 to 96.7. That shows ground water of study area is suitable for irrigation purpose (except at few locations where %Na value has > 50 is less suitable).

Kelley's Ratio

Kelley (P.S.V. Shankar et al) proposed a cation based formula to quantify the sodium problem in irrigation water. This formula known as Kelley's ratio is expressed as follows, all ions in meq/l.

$$\mathbf{Kelley\ Ratio = [Na] / \{[Mg] + [Ca]\}}$$

Water having Kelley's ratio greater than one is considered as unfit for irrigation purposes. The value of Kelley's ratio in dug well water and hand pump water were observed 0.2 to 9.6 and 0.1 to 28.4 respectively.

Magnesium Ratio (MR)

Magnesium Ratio (MR) is calculated by applying following equation in which the ions are expressed in meq/l.

$$MR = (Mg*100) / (Ca+ Mg)$$

MR value >50 is considered unsuitable for irrigation. The magnesium ratio in dug well water, hand pump water and surface water were observed 19.8 to 66.4 and 0.0 to 66.4 respectively.

Permeability Index (PI)

Doneen (1964) formulated an equation to determine the permeability index (PI) to study the suitability of water for irrigation as continuous application of water may affect soil permeability by precipitation of certain elements in the top soil thus reducing void space hindering water dynamics. The PI can be determined by applying following formula in which all the ions are in meq/l.

$$PI = ((Na+ (\sqrt{HCO_3}) / (Ca+ Mg+ Na))*100$$

Where, PI = 25%-75% - Class-II - suitable for irrigation

PI >75% -Class-I - unsuitable for irrigation

In dug well water samples are calculated PI value is in between 31.7 to 139 at the study area and in hand pump water samples the calculated PI value is ranging from 31 to151.

5.4.3.5 Ground water suitability for industrial purposes

Ground water quality needs to be assessed with reference to its usefulness for industrial purposes as some of the industries might consume ground water for various processes. Since the current study focused on water contamination in industrial clusters, the ground water is assessed with reference to evaluate its suitability for industrial purpose. The water in specific quality is a must to protect the necessary machinery from scaling or corrosion effects. Thus it is imperative to periodically monitor the water chemistry applying various equations using different indices of the analysed parameters. Industrial water quality of Korba are summarised in Table 13. Location wise CR, LSI and RSI has been calculated in Annexure VI.

Table 14 Industrial quality parameters in ground water of Korba industrial area

Parameter	CR <1 good >1 corrosive	LSI < -2 corrosive >2 non corrosive	RSI <6 scale forming >>8 corrosive
Min	0.10	-5.19	6.63
Max	9.98	1.24	16.30
Average	1.39	-1.85	10.79
SDV	1.78	1.24	2.02

Corrosivity Ratio (CR)

The Corrosivity ratio (CR) is calculated using the under mentioned formula in which the ions are in mg/l units.

CR = ((Cl/35.50 + 2(SO4/96)) / 2(HCO3 + CO3/100)

The CR value of water with less than or equal to 1 is considered good whereas more than 1 indicates corrosive nature and is not fit for passing through metal pipes (Ryner 1944; Raman 1985) and it is not suitable for industrial or domestic purposes.

High corrosivity ratio was observed in 33 locations while highest value has been observed in Nagin Bhatan-3 dug well.

Langelier Saturation Index (LSI)

LSI is a measure to study the suitability of water for industrial purposes with reference to these affects. LSI helps in predicting the calcium carbonate stability of water and its ability to precipitate or dissolve. Apart from damaging the instruments/machinery, the scaling or corrosion properties of ground water will also bodily damage the house hold pipelines, fixtures water heating vessels, and thus it is essential to study the calcium carbonate stability of water by determining LSI value which is calculated using following formula

LSI = pH – pHs

Based on the LSI value the following classification can be made (Carrier 1965)

2.0 : Scale forming but non-corrosive

0.5 : Slightly scale forming and corrosive

0.02 : Balanced but pitting - corrosion possible

-0.5 : Slightly corrosive but non-scale forming

-2.0 : Serious corrosion

The positive value of LSI indicates the over-saturation of water thus tendency of $CaCO_3$ deposition and a negative saturation has tendency for corrosion. The saturation index is used to evaluate the scale forming and scale dissolving tendencies of water. If the saturation index is zero (pH=pHs), the water is in equilibrium and there is no net tendency of either scaling or corroding.

The high > -2.0 negative value of LSI is recorded in dug well as well as in borewell water of Korba study area. The highest LSI value (-5.19) is recorded at Nagin Bhatan-3 dug well water sample. In 38 locations water has serious corrosive tendency and in rest of the locations water have slight corrosive but non scale forming.

Ryznar Stability Index (RSI)

The Ryznar stability Index (RSI) is another method of identifying dissolving or precipitation nature of $CaCO_3$ of the ground water (Roberge 1999). It can be assessed using the equation mentioned below.

$$\mathbf{RSI = 2(pHs) - (pHw)}$$

Where,

pHs is the pH at saturation in $CaCO_3$ and

pHw is the measured pH of water.

The RSI value of <6 indicates increasing tendency for scale forming with a decreasing index, where as a value of >7 suggests formation of no corrosion protective film. Water with RSI of >8 suggest tendency for corrosion (Kunwar Singh 2006).

The highest LSI value (16.3) is recorded at Nagin Bhatan-3 dug well water sample.

CHAPTER - 6

GROUND WATER RESOURCES

The quantitative estimation of various inputs to ground water resources and their temporal variation in space and time is imperative for a planned management and development of ground water resources. The resources in the surveyed area are computed on the basis of methodology recommended by the Ground Water Estimation Committee of Ministry of Water Resources, Govt. of India, 2015. The estimation of ground water resource in the surveyed area is taken as on March 2024.

6.1 Objective

Refinement of Parameters

Ground Water Resource Estimation of Korba Municipal Corporation

6.2 Material and Methods

The primary source of recharge of groundwater in study area is rainfall. Therefore, water table balance method has been used for estimating the resources. Rainfall recharge factor or Infiltration factor is a recharge parameter that indicates a quantum of water recharged to the groundwater system in relation to the rainfall. It is a function of rate of infiltration and ability of the system to accept the infiltrated water. The infiltration factor can be expressed as follows

IF = (Qi/Qa) X SY,
Where,
IF = Infiltration Factor
Qi = Quantum of water infiltrated over the test period in m
Qa = Quantum of water applied in m
SY = Specific Yield

Recharge of ground water involves several components and the rainfall being the major one. The other components are return irrigation flow from surface water and ground water. Rainfall infiltration factor for alluvial formations is taken as 20%. The Return Flow Factor for recharge from surface water irrigation has been taken as 15-25 % for non-paddy crops and 50-60 % for paddy crops. In case of ground water irrigation, the return flow factor has been taken as 15-25 % for non-paddy crops. Canal seepage factor, for lined and unlined canals, has been taken as per GEC' 2015 norms. The recharge from other sources i.e. ponds and lakes have also been estimated based on the spread area of the water bodies.

6.3 Results and Discussion

6.3.1 Soil Infiltration studies

Soil infiltration testing is a crucial component of hydrological studies, providing insights into water movement through the soil profile. One widely used method for conducting infiltration tests is the double ring infiltrometer technique. Soil infiltration tests with double ring infiltrometers provide valuable insights into soil-water interactions, infiltration dynamics, and hydraulic conductivity. Understanding soil infiltration helps in managing water resources effectively, especially in areas prone to drought or water scarcity. It helps in estimating groundwater recharge rates and designing efficient irrigation systems. Soil infiltration studies aid in predicting and mitigating floods by assessing how quickly the soil can absorb rainfall and reduce surface runoff. It plays a crucial role in erosion control. Higher infiltration rates reduce surface runoff, preventing soil erosion and sedimentation in rivers, lakes, and reservoirs. The data obtained from these tests contribute to watershed management, irrigation scheduling, soil conservation, and flood control efforts. By understanding the infiltration characteristics of soils, stakeholders can make informed decisions regarding land use planning, agricultural practices, and water resource management strategies.

Table 15 Soil Infiltration Rate for Korba Industrial Area

Sl no.	**Location**	**Lattitude**	**Longitude**	**Date of SIT**	**Average Infiltration Rate (cm/sec)**	**Average Infiltration Rate (cm/hr)**	**Test duration in min.**	**Soil type**
1	Dhanras	22.4791	82.6384	24-01-2024	0.001462	5.264781	60	Alfi red loamy soil
2	Balgi(pump house premise)	22.3840	82.6509	25-01-2024	0.013334	48.00283	60	Alfi red loamy soil
3	Gopalpur	22.4429	82.6487	26-01-2024	0.001642	5.912226	100	Alfi red loamy soil
4	Indira nagar Stadium(right side of auditorim)	22.3614	82.7004	15-02-2024	0.000721	2.596671	100	Compacted sandy soil
5	Indira nagar Stadium	22.3594	82.6998	15-02-2024	0.003836	13.80995	115	Lateritic soil
6	Daganiyakhar	22.3716	82.6507	14-02-2024	0.002092	7.532369	80	Compacted soil
7	Purenakhar	22.4750	82.6538	13-02-2024	0.000838	3.018039	90	Compact fly ash
8	Purenakhar	22.4743	82.6540	13-02-2024	0.007506	27.02093	80	Fly ash

6.3.2 Domestic Draft Refinement

Load factor on groundwater has been changed to 30 percent as currently in most of the part of study area drinking water supplies through Hasdeo river through several intake points and after primary filtration through water treatment plant.

6.3.3 Recalculated Groundwater Resources

Table 16 Groundwater Recharge of Korba Industrial Area

Assessment Unit Name	Recharge Worthy Area(Ha)	Recharge from Rainfall-Monsoon Season	Recharge from Other Sources-Monsoon Season	Recharge from Rainfall-Non-Monsoon Season	Recharge from Other Sources-Non-Monsoon Season	Total Annual Ground Water (Ham) Recharge	Total Natural Discharge (Ham)
Korba Industrial Area	27961	2979.66	251.77	45.61	350.94	3627.99	312.28

Table 17 Groundwater Resources of Korba Industrial Area

Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use (Ham)	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)
3315.70	721.86	1606.00	202.00	2529.86	551.60	436.24	76.30

Overall stage of groundwater extraction comes to 76.3 % which falls under semi-critical categorization.

CHAPTER - 7

GROUNDWATER MANAGEMENT

Groundwater management encompasses various strategies aimed at ensuring sustainable utilization of this vital resource. Two primary approaches to groundwater management are demand-side management and supply-side management, each addressing different aspects of groundwater use and conservation.

Demand-side management focuses on reducing the demand for groundwater by implementing measures to increase efficiency, promote conservation, and manage consumption. This approach often involves implementing water-saving technologies, promoting water-efficient practices in agriculture, industry, and urban areas, and raising awareness about the importance of water conservation. By reducing the overall demand for groundwater, demand-side management helps to alleviate pressure on groundwater resources, mitigate the risk of overexploitation, and ensure long-term sustainability.

Supply-side management, on the other hand, involves strategies aimed at increasing the availability of groundwater resources to meet existing and future demand. This approach includes measures such as artificial recharge, rainwater harvesting, groundwater banking, and conjunctive use of surface water and groundwater. By enhancing the recharge of aquifers and optimizing the utilization of available groundwater resources, supply-side management aims to maintain adequate groundwater levels, improve water security, and meet the diverse needs of society.

7.1 Issues

The issues identified in the study area are as follows:

1. Aquifer covering northern part of study area covering Dhanras, Lotlota and Goplapur villages and in southern part Kudurmal, Deurmal, Urga and Barbaspur villages are comes under high risk areas in terms of groundwater availability.
2. Water level in and around the periphery of mining area shows deeper water level in both pre and post monsoon season in comparison to areas with no mining activities. Deeper water level also observed in areas underlain by granitic aquifer i.e. Dhanras, Lotlota, Kudurmal, Urga, Deurmal.
3. pH value less than 6.5 found mainly in vicinity of mining areas, overburden dump and fly-ash deposits
4. Nitrate ion concentration found more than 45 mg/l in urban settlements because of no

proper sewage network and absence of STP.

5. Flouride concentration in groundwater (>1.5 mg/l) found in Kudurmal, Madwamahua, Dhanras, Nawagaon Kala and Premnagar villages which are underlain by granitic aquifer system.
6. Iron concentration (>0.3 mg/l) found mainly underlain by sandstone aquifer system.

7.2 Supply side Management

7.2.1 Runoff Calculation

The Soil Conservation Service (SCS) Curve Number (CN) method is a widely used empirical approach for estimating direct runoff from rainfall events in watersheds. Developed by the United States Department of Agriculture's Natural Resources Conservation Service, this method considers the influence of soil, land use, and antecedent moisture conditions on runoff generation. The CN method assigns a curve number to each land cover type and soil condition, representing the watershed's hydrologic characteristics. These curve numbers range from 0 to 100, with lower values indicating high infiltration and lower runoff potential, while higher values correspond to reduced infiltration and increased runoff. By integrating factors such as soil permeability, land cover, and rainfall intensity, the CN method provides a simple yet effective means of estimating direct runoff volume, making it valuable for hydrological modeling, land use planning, and water resource management. Despite its simplicity and widespread application, the CN method requires careful consideration of local conditions and calibration to ensure accurate runoff predictions.

Table 18 Year-Wise Runoff Calculation for Korba Industrial Area

Year	Total precipitation (mm)	Total runoff (mm)
2019	1478	221
2020	1707	287
2021	1446	180
2022	1387	187

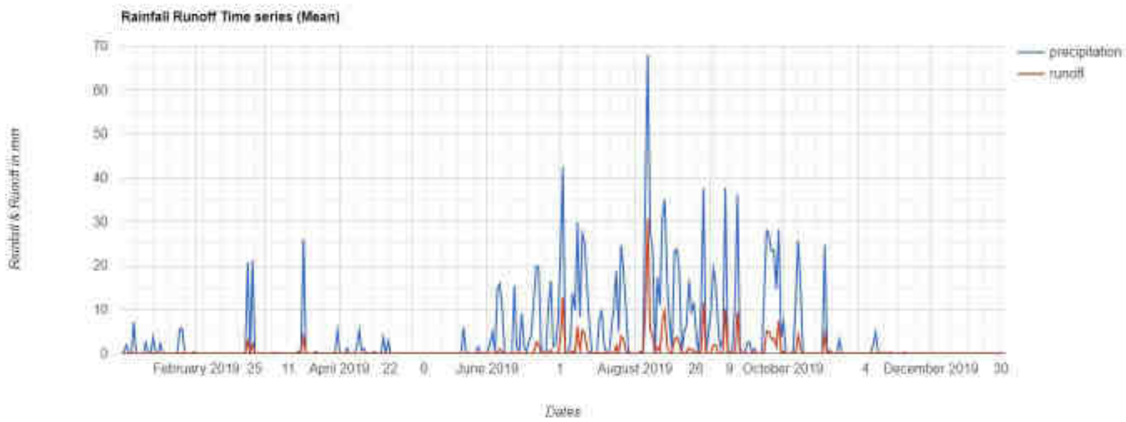


Figure 46 Rainfall vs Runoff Curve for Year 2019

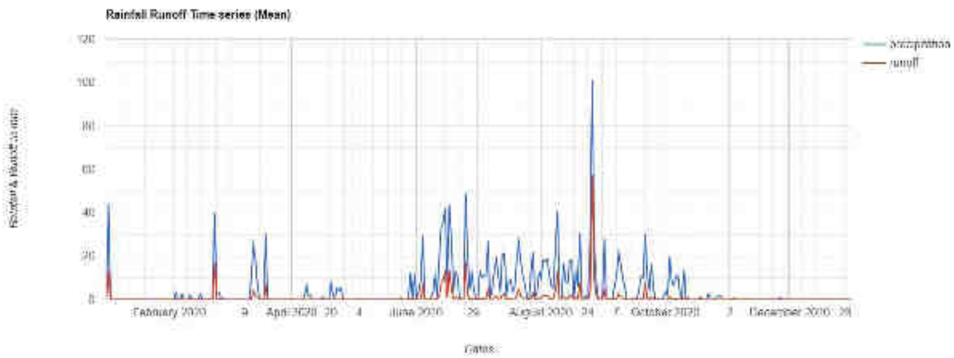


Figure 47 Rainfall vs Runoff Curve for Year 2020

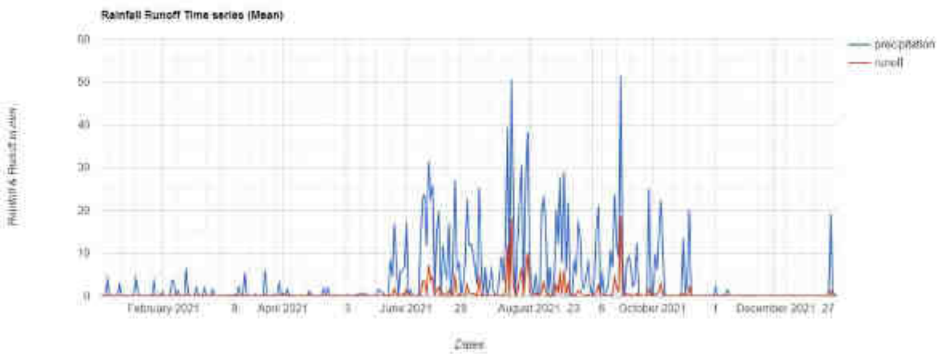


Figure 48 Rainfall vs Runoff Curve for Year 2021

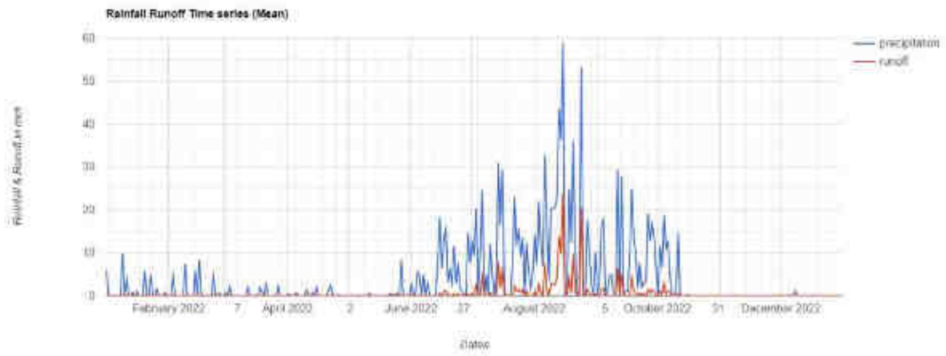


Figure 49 Rainfall vs Runoff Curve for Year 2022

7.2.2 Suitable structures for Water Conservation Measures

A detailed analysis of the overall hydrogeology, water consumption, and recession analysis reveals that Korba Municipal Corporation is part of 03 watersheds. The baseflow of water from the upper catchment to the middle and lower catchment is very fast. In northern part of the study area underlain by Granitic rocks have very low yield because of low weathering thickness and limited fracture occurrence. 16 Micro-watershed comprising of 141 Sq Km of Lower Hasdeo and Ahiran watershed identified for intervention.

From the detailed hydrogeological investigation, it is gathered that managed aquifer recharge is the prime requisite for tackling this scenario. Objectives regarding groundwater availability and quality concern have to be achieved through different artificial recharge measures. Source sustainability issues of Dhanras and nearby villages can be improved by creation of ponds attached with injection well. Number of proposed recharge structure is shown in Table-19 along with tentative cost estimate in Table 20. Cost of constructing recharge structure will further be reduced by using existing infrastructure of defunct bore well and existing pond. Tentative location of recharge structure is also shown figure 50 and details provided in Annexure XII. Design of pond with recharge bore well/ tube well is shown in figure 51 for reference.

Korba Industrial Area, which is a region with significant industrial activity, source water quality is paramount for artificial recharge. Before recharging, source water must be assessed for contaminants like heavy metals and pollutants, as these can degrade groundwater quality. Adherence to CGWA and MOEF guidelines is essential to ensure the sustainability of groundwater resources in Korba.

Table 19 Number of Proposed Recharge Structures

Structure Type	Pond with Recharge Bore Well Recharge capacity (0.1 mcm)	Nalas Bunding/ Cement Plug/ Check Dam Recharge capacity (0.03 mcm)	Gravity head /Dug well/ Tube well/ Recharge shaft Recharge capacity (0.008 mcm)	Gully Plugs Gabion Structures Recharge Capacity (0.007 mcm)
Required numbers	27	45	102	78
Total Recharge capacity	2.7	1.35	0.816	0.546

Table 20 Cost of Proposed Recharge Structures

Recharge Structure	Pond with Recharge Tube Well @ Rs 5 lakh/ structure	Nalas bunding cement plug/ check dam @ Rs 3 lakh/ structure	Gravity head /Dug well/ tube well/ recharge shaft @ Rs 2 lakh/ structure	Gully plugs Gabion structures @ Rs.50000/ structure
Cost (Rs Lakh)	135	135	204	39
Total Estimated Cost: Rupees 5 Crore 13 lakh Only				

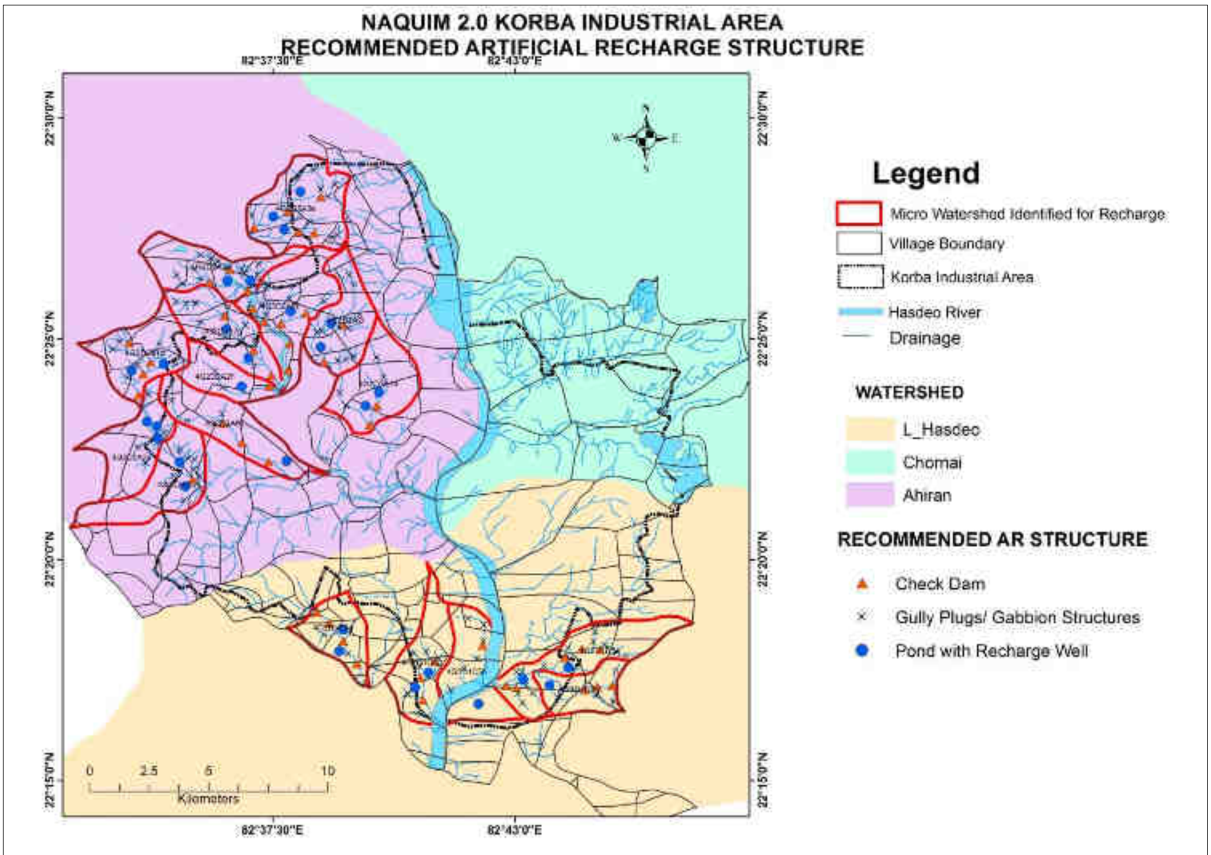


Figure 50 Tentative Location of Recommended Artificial Recharge Structure

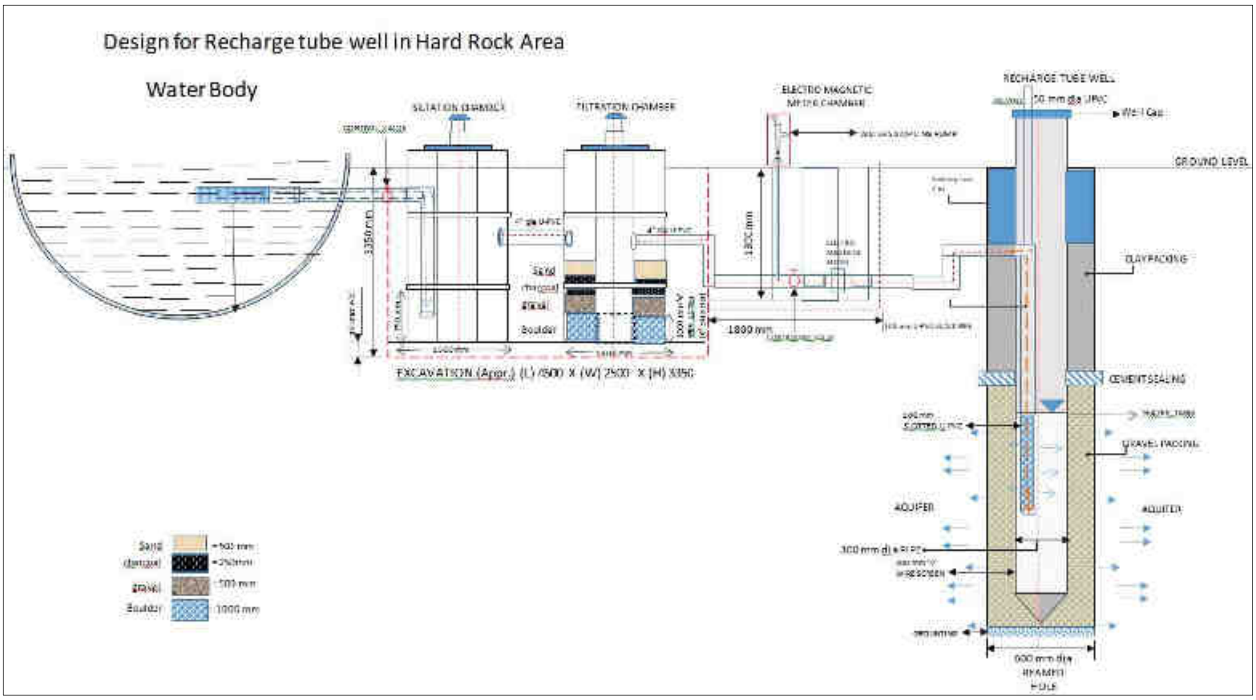


Figure 51 Pond with Recharge bore well structure (Source-Atal Bhujal Yojna)

7.3 Demand side Management

1. Separate drainage network for storm water connecting to natural streams.
2. Sewage treatment plant with connected concrete networks of sewage water collection with recycling and reuse concept.
3. Installation of appropriate filtration unit in quality affected area or alternate water supply.
4. People awareness about effective use of water and focus on recycle and reuse.

7.4 Mine Seepage Management Plan

7.4.1 Introduction

The Korba industrial area, located in Chhattisgarh, India, is a major coal mining hub. Coal mining activities often lead to mine seepage, which can significantly impact the environment and local communities. This plan outlines a comprehensive approach to manage mine seepage in the Korba industrial area, focusing on prevention, control, and remediation measures. The Ministry of Environment, Forest and Climate Change (MoEF&CC), Central Ground Water Authority (CGWA) and Chhattisgarh Environment Conservation Board (CECB) guidelines may be taken into consideration for the management of acid mine drainage (AMD in the Korba industrial area.

7.4.2 Understanding Mine Seepage

Mine seepage occurs when water infiltrates underground mines and accumulates, eventually finding its way to the surface. This seepage can carry pollutants such as heavy metals, acid mine drainage (AMD), and other contaminants, posing risks to water bodies, soil, and ecosystems.

7.4.3 Key Components of the Mine Seepage Management Plan

1. **Baseline Assessment:**
   - Conduct a detailed hydrogeological study to identify potential seepage sources and pathways.
   - Assess the quality of groundwater and surface water in the area.
   - Inventory existing mine infrastructure and drainage systems.
2. **Prevention and Control Measures:**
   - **Surface Water Diversion:**
     - Construct effective surface water diversion systems to prevent rainwater from entering mine pits.
     - Maintain and upgrade existing drainage channels and culverts.
   - **Groundwater Control:**
     - Implement dewatering systems to lower the water table within the mine.
     - Use pumping systems and drainage galleries to extract water from underground workings.
     - Install watertight seals and barriers to prevent water infiltration.
   - **Best Practices in Mining:**
     - Adhere to strict mining regulations and environmental standards.
     - Minimize disturbance to the natural hydrological balance.
     - Implement proper mine closure and rehabilitation plans.
3. **Treatment and Remediation:**
   - **Water Treatment:**
     - Employ appropriate water treatment technologies to remove pollutants from mine seepage.
     - Consider chemical treatment, biological treatment, or a combination of methods.
     - Implement a regular monitoring program to assess the effectiveness of treatment.
   - **Remediation of Contaminated Sites:**
     - Identify and prioritize contaminated sites for remediation.
     - Use techniques such as soil washing, bioremediation, or phytoremediation to clean up contaminated soil and water.

    - Monitor the remediation process to ensure long-term effectiveness.

4. **Monitoring and Surveillance:**
    - Establish a comprehensive monitoring network to track water quality parameters, groundwater levels, and flow rates.
    - Conduct regular inspections of mine infrastructure and drainage systems.
    - Implement an early warning system to detect potential seepage problems.
5. **Community Engagement and Awareness:**
    - Involve local communities in the planning and implementation of the management plan.
    - Educate the public about the potential risks of mine seepage and the importance of water conservation.
    - Establish a grievance redressal mechanism to address community concerns.

7.4.4 Effective Use of Mine Seepage Water in Different Activities

Mine seepage water, if treated appropriately, can be a valuable resource for various purposes. Here are some effective ways to utilize it:

1. **Industrial Use:**
    - Process Water: After treatment, it can be used as process water in industries like mining, power plants, and manufacturing.
    - Cooling Water: It can be used for cooling equipment and machinery, reducing the demand for fresh water.
    - Dust Suppression: Spraying treated mine water can help suppress dust in mining operations and on roads.

2. **Agricultural Use:**
    - Irrigation: Treated mine water can be used for irrigating crops, especially in areas with water scarcity. However, careful monitoring of water quality is essential to avoid soil salinization.
    - Livestock: It can be used for watering livestock, provided it meets certain quality standards.

3. **Domestic Use:**
    - Non-Potable Water: After appropriate treatment, it can be used for non-potable purposes like flushing toilets, cleaning, and gardening.
    - Potable Water: In some cases, with advanced treatment, it may be suitable for drinking water, but this requires rigorous testing and compliance with strict water quality standards.

4. **Environmental Use:**

    - Recharging Groundwater: Treated mine water can be used to recharge depleted groundwater aquifers.

- Habitat Restoration: It can be used to restore wetlands and other aquatic ecosystems.

7.4.5 Key Considerations for Effective Use:

- **Water Quality Assessment:** Conduct thorough water quality analysis to determine the level of treatment required.
- **Treatment Technologies:** Select appropriate treatment technologies based on the specific contaminants present in the water.
- **Infrastructure Development:** Invest in infrastructure for water collection, treatment, and distribution.
- **Regulatory Compliance:** Adhere to local, state, and federal regulations regarding water quality and discharge standards.
- **Community Engagement:** Involve local communities in the planning and implementation of water reuse projects.

By adopting sustainable water management practices and utilizing mine seepage water effectively, mining operations can minimize their environmental impact and contribute to water conservation efforts.

Effective mine seepage management is crucial for protecting the environment and public health in the Korba industrial area. By implementing a comprehensive plan that combines prevention, control, and remediation measures, it is possible to mitigate the negative impacts of mine seepage and ensure sustainable mining practices.

CHAPTER – 8

CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

1. The Korba Industrial Area spans both banks of the Hasdeo River within Korba district. Predominantly overlapping with the Korba Municipality area, covering an area of 280 sq km. According to 2011 census total population recorded as 3,65,253 having 48% female population with average literacy of 83.5%.
2. Geomorphologically, Korba city and its surroundings is a complex interplay of natural processes and human activities. Mining sites, fly ash deposits, riverine landforms, and anthropogenic modifications collectively define the landscape, reflecting the dynamic interaction between geology, hydrology, and human intervention. Coal mining lease area of SECL encompasses about 61 sq km and fly ash deposits have area of 12 sq km. In general, elevation ranges from 366 – 194 meter above mean sea level and slope is towards south.
3. Geologically the area comprises of two distinct geological formations i.e. i) Chhota Nagpur Gneissic Complex of Archean to Proterozoic age contributes about 15% and consists of granite gneiss and granitoids, containing enclaves of metasedimentary and meta-igneous suites comprising schists, quartzites, amphibolites and dolomitic marbles. ii) The Gondwana Super Group contributes about 85% and is represented by Talchir, Karaharbhari, Barakar and Kamthi formations consist of Sandstone, Shale and Coal seam.
4. Land Use/ Land Cover analysis shows water bodies occupy a minimal percentage, accounting for 3.35% of the area. Trees and forest cover constitute 7.72 %, crop land contributes about 24%. Builtup land, which includes infrastructure and urban developments, occupies 27.63% of the area, indicating the presence of settlements and human activities. Range land, comprising 35.43% of the landscape. In comparison to 1985, LULC data crop-land has been reduces significantly by 21% because of mining expansion, industrial growth along with urban development.
5. There are two major aquifer system viz. Granite Aquifer system and Sandstone Aquifer system. Both the aquifer system have the shallow aquifer and deeper aquifer which occurs in phreatic and Semiconfined condition respectively.
6. Drilling by combination rig is preferred in sandstone aquifer where well construction is required depending upon the water zone and formation encountered. Drilling by DTH rig is preferred in granite aquifer system.

7. Sandstone Aquifer System has average thickness of the weathered portion in the area is around 21 m. In general, the discharge varies from 1 lps to 9.8 lps with an average yield of 4.5 lps. Transmissivity range observed is 3.74 to 115.28 sq meter/day with average of 21.86 sqm /day.
8. Granite Aquifer System has average thickness of the weathered portion in the area is around 10.5 m. In general, the discharge varies from negligible to 1 lps. Transmissivity range observed is upto 7.38 sq meter/day.
9. Central part of the either side of the river have high yield potential, water may be supplied through these areas as alternate source.
10. Aquifer covering northern part of study area covering Dhanras, Lotlota and Goplapur villages and in southern part Kudurmal, Deurmal, Urga and Barbaspur villages are comes under high risk areas in terms of groundwater availability.
11. Water level in and around the periphery of mining area shows deeper water level in both pre and post monsoon season in comparison to areas with no mining activities. Deeper water level also observed in areas underlain by granitic aquifer i.e. Dhanras, Lotlota, Kudurmal, Urga, Deurmal.
12. Regional ground water flow is towards Hasdeo river. Study area falls under confluence of there watershed namely Lower Hasdeo, Chornai and Ahiran.
13. pH value less than 6.5 found mainly in vicinity of mining areas, overburden dump and fly-ash deposits. Low pH distribution area increased in post-monsoon season comparing to pre-monsoon season.
14. Nitrate ion concentration found more than 45 mg/l in 12 dugwell and 5 handump because of no proper sewage network and absence of STP.
15. Flouride concentration in groundwater (>1.5 mg/l) found in Kudurmal, Madwamahua, Dhanras, Nawagaon Kala and Premnagar villages which are underlain by granitic aquifer system.
16. Iron concentration (>0.3 mg/l) found at 06 locations mainly underlain by sandstone aquifer system.
17. Ground Water Resource Assessment carried out for Korba Industrial area, the stage of ground water extraction is 76.3% in Semi-Critical Category. The irrigation draft makes up 29 %, domestic draft makes up 8% and Industrial draft makes 63 % of the total draft, which is mainly dewatering from mines.

8.2 RECOMMENDATIONS

Following recommendations are proposed for Korba Industrial area.

A. Urban area:

5. Restoration of decaying lakes water bodies, and through desiltation, catchment treatment, storing treated wastewaters and harvested rainwater, prohibiting mining in river beds, and discharge of untreated waste waters.
6. Separate drainage network for storm water preferably in front of house/establishment connecting to natural streams.
7. Sewage treatment plant with connected concrete networks of sewage water collection with recycling and reuse concept.
8. Protection of groundwater by law and artificial recharge combined with Demand and Supply measures.
9. Roof Top Rainwater Harvesting to be enforced vigorously.
10. Rainwater harvesting and recycling of treated wastewaters to make substantial freshwater available for urban area.
11. Eco-restoration model needed to be implemented in urban area for improving its hydrology, ecology and environment.
12. Modern management tools like Groundwater Modeling, monitoring, auditing and budgeting of water bodies, ward wise microlevel surveys to prepare water atlases, telemetry monitoring of rainfall and weather forecasts over the city, and digital modelling for generation of hydrological scenarios needed to ensure successful water management.
13. Monitoring of water quality of surface and ground water and enforce adherence to prescribed standards.
14. Water economy to be practiced in all activities including domestic chores.
15. People's participation is essential in all water management programs from planning, implementation to maintenance and monitoring.
16. Mass awareness about conservation and protection of water to be generated through media campaigns, seminars etc.
17. A data base for all water related information has to be created on website for free access to the public. A common platform may be created where data, skill, knowledge, technology may be shared by all stakeholders and public.

B. Mining Area

Based on MoJS Guidelines dated 24.09.2020 published in the Gazette of India vide Notification number S.O. 3289 (E) or its Amendment Notification dated 29.03.2023 published in the Gazette of India vide Notification number S.O. 1509 (E)

1. All the mining industries to ensure that water available from de-watering operations is properly treated and should be gainfully utilized for supply for irrigation, dust suppression, mining process, recharge in downstream and for maintaining e-flows in the river system.
2. Construction of observation well(s) (piezometers) along the periphery in the premises, for monthly ground water level monitoring, Depth and aquifer zone tapped in the piezometer shall be commensurate with aquifer used for irrigation/drinking water in the buffer area.
3. In addition, the proponent shall monitor ground water levels by establishing observation wells (piezometers) in the core and buffer zones as specified in the No Objection Certificate.
4. In case of coal and other base metal mining the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.
5. In addition to this, all mining units shall also monitor the water quality of mine seepage and mine discharge through NABL accredited/ Govt. approved laboratories and the same shall be submitted at the time of self-compliance.

It has been observed in field that fresh water from dewatering is mixing with contaminated water, which need to be avoided. Further water quality need to be monitored for all the streams in vicinity of mining area by concerned department. DWLR as well as flow meter with telemetry system ensured to be functional for all the installed instrument.

C. Thermal Power Plants:

1. Guidelines for disposal/utilization of fly ash for reclamation of Low Lying Areas and in stowing of Abandoned mines/Quarries issued by Central Pollution Control Board March, 2019 should be followed.
2. Monitoring agencies/ authority shall monitor water quality of streams in vicinity of fly ash disposal sites as defined by CPCB in both pre--monsoon and post-monsoon seasons.
3. CGWB shall monitor water quality in vicinity of fly ash disposal sites in both pre-monsoon and post-monsoon seasons.
4. Area underlain by granitic aquifer may be preferred over sandstone aquifer system with

hydrogeological study shall only be taken for fly ash disposal site. CGWB preferably shall be consulted before establishing any new site for fly ash disposal.

5. It has been observed in fields that seepage water from fly ash deposits are mixing into natural streams, which need to be avoided.
6. Excess water coming from fly ash disposal site are need to be re-used for agriculture, storage tank and further distributary channel may be planned for effective utilization of water resources and to avoid contamination with the help of agriculture and water resources department.

All projects using groundwater shall take NOC from CGWA as per the Consolidated Guidelines to regulate and control ground water extraction in India (24-Sep-2020 with Amendment Notification dated 29.03.2023)

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ANNEXURE I Water Level Monitoring Sheet for Korba Industrial A

Sl No	Village	Well Type/ Source	Lat	Long	PRE_WL (MBGL)	POST_WL (MBGL	Fluctuation
1	Dhanras	DW	22.47696	82.63877	6.5	4.37	2.13
2	Dhanras	DW	22.47427	82.6402	3.26	1.34	1.92
3	Chorbhati	DW	22.45965	82.64655	3.57	2.24	1.33
4	purenakhar	DW	22.47318	82.65109	3.2	3.4	-0.2
5	Lotlota	DW	22.47152	82.66185	2.55	2.35	0.2
6	Lotlota	DW	22.47285	82.66483	3.7	2.65	1.05
7	Madwa Mahua	DW	22.45792	82.65802	9.2	4.32	4.88
8	Nawagaon jhabu	DW	22.45561	82.67663	3.8	3.9	-0.1
9	Rogbahari	DW	22.42177	82.73862	6.38	3.38	3
10	Kanberi Basti	DW	22.29057	82.69664	7.3	4.3	3
11	Khair Bhawan	DW	22.30121	82.69754	4	3.65	0.35
12	BADERIMUDA	DW	22.44017	82.63997	1	1.06	-0.06
13	GOPALPUR	DW	22.43657	82.64984	2.8	1.05	1.75
14	AYODHYPURI	DW	22.43204	82.66321	3	2.6	0.4
15	IRRIGATION COLONY	DW	22.40668	82.68654	2.4	2.28	0.12
16	SITAMANI	DW	22.33774	82.70905	4.1	3.1	1
17	BHILAI	DW	22.31428	82.72267	8	6.93	1.07
18	SEMIPALI	DW	22.27698	82.71941	4.3	2.15	2.15
19	KUDURMAL	DW	22.27909	82.70306	4.9	3.32	1.58
20	BALRAMPUR	DW	22.28942	82.68694	5.05	4.06	0.99
21	SONPURI	DW	22.31536	82.69724	5.3	4.7	0.6
22	SONPURI-2	DW	22.31543	82.69221	7.76	4.8	2.96
23	PADANIA-3	DW	22.31897	82.68441	8.7	7.8	0.9
24	PALI(PADANIA	DW	22.32058	82.68052	8.9	8.9	0
25	PADANIA-4	DW	22.31852	82.68536	8.7	7.41	1.29
26	JATRAJ	DW	22.32507	82.69269	9.7	9.7	0
27	MUDAPAR	DW	22.35145	82.71377	4.2	3.28	0.92
28	PODIBHAR	DW	22.35532	82.73367	5.7	6.05	-0.35
29	DADAR KHURD	DW	22.3405	82.74227	5.7	3.6	2.1
30	KASHINAGAR	DW	22.36182	82.74539	6.1	3.05	3.05
31	KRSHNANAGAR	DW	22.34206	82.72244	2.7	2.68	0.02
32	PATHARIA PARA(WARD-17	DW	22.36956	82.72557	1.95	1.25	0.7
33	MANASNAGAR MOHALA(BHESKHATAL	DW	22.37535	82.71904	1.15	1.4	-0.25
34	KOHODIA(CHARPARA	DW	22.39545	82.71022	4.3	4.92	-0.62
35	DARRI	DW	22.40667	82.6902	2.1	1.87	0.23
36	JAMNIPALI	DW	22.42016	82.65855	2.8	3.05	-0.25
37	DUMARMUDA	DW	22.43351	82.62397	4.5	4.91	-0.41
38	DUMARMUDA-2	DW	22.43351	82.62397	7.1	4	3.1
39	SEMIPALI	DW	22.4107	82.63406	5.6	2.96	2.64
40	NAGIN BHATAN	DW	22.38902	82.63713	9.5	5.7	3.8
41	NAGIN BHATAN-3	DW	22.38954	82.63583	8.9	4.5	4.4
42	GAJRA	DW	22.39902	82.61876	5.65	3.95	1.7
43	GAJRA-3	DW	22.40024	82.61913	7.8	7.7	0.1
44	GEWRAGHAT	DW	22.36442	82.69591	4.45	2.05	2.4
45	VIJAYANAGAR BASTI	DW	22.35394	86.50667	4.8	4.1	0.7
46	KENCHUA MODE	DW	22.35593	82.63726	9.8	7.6	2.2
47	KUCHENA	DW	22.35604	82.62062	5.7	4.24	1.46

Sl No	Village	Well Type/ Source	Lat	Long	PRE_WL (MBGL)	POST_WL (MBGL	Fluctuation
48	KUCHENA-2	DW	22.35417	82.62259	5.5	4.31	1.19
49	MANGAON	DW	22.34207	82.62436	8.45	4.36	4.09
50	NARIBODH-2	DW	22.33081	82.6244	6.5	4.75	1.75
51	GEVERA(BARPALI	DW	22.33641	82.6397	3.2	2.7	0.5
52	Dhanras	HP	22.47517	82.63512	24.34	14.51	9.83
53	Chorbhati	BW	22.45893	82.64621	9.01	5.13	3.88
54	purenakhar	HP	22.4714	82.65186	5.88	5.71	0.17
55	Lotlota	BW	22.47007	82.66177	14.84	6.76	8.08
56	Nawagaon Kala	BW	22.451	82.67351	8.6	8.53	0.07
57	Banki Mongra Indra Nagar Banki Mongra	HP	22.41183	82.60001	9	7.35	1.65
58	Banki Mongra Azad Chowk Banki Mongra	BW	22.40318	82.60714	11.84	6.84	5
59	Banki Mongra 2 No.	BW	22.39446	82.60527	17.68	17.34	0.34
60	Parsabhata	HP	22.40592	82.73167	4.26	3.04	1.22
61	Parsabhata chowk	HP	22.40333	82.73975	9.06	6.85	2.21
62	Semri pali (Urga)	HP	22.27715	82.72264	10.4	9.95	0.45
63	Kudurmal	BW	22.27549	82.69738	9.8	9	0.8
64	PANDRIPANI	BW	22.45537	82.6363	3.46	2.06	1.4
65	BADERIMUDA	hp	22.43987	82.6393	4.14	2.53	1.61
66	PREMNAGAR JELGAWN	HP	22.42235	82.66537	5.94	5.36	0.58
67	PREMNAGAR	BW	22.43383	82.67446	6.24	5.19	1.05
68	AYODHYPURI	HP	22.42929	82.66301	7.56	4.5	3.06
69	PADANIA	BW	22.31512	82.68966	8.2	5.66	2.54
70	PADNIA-2	BW	22.31603	82.68766	7.6	5.54	2.06
71	PALI(PADANIA	HP	22.31987	82.67999	12.3	10.9	1.4
72	DADAR KHURD	BW	22.33894	82.74144	6.64	3.95	2.69
73	DARRI-2	HP	22.401	82.69776	7.9	5.03	2.87
74	SUMEDHA	BW	22.40659	82.63315	7.45	6.16	1.29
75	BALGI	BW	22.38009	82.63404	14.69	11.93	2.76
76	KATAINAR	BW	22.3931	82.62019	8.64	12	-3.36
77	GAJRA-2	BW	22.39974	82.61882	9.02	6.37	2.65
78	GHORDEVA WARD-64	BW	22.3817	82.62227	14.03	11.58	2.45
79	VIJAYANAGAR SEWCL COLONY	BW	22.35394	82.50667	5.95	5.68	0.27
80	KENCHUA MODE	BW	22.35593	82.63726	6.99	5.4	1.59
81	NEWRA	BW	22.33567	82.63431	15.69	6.6	9.09
82	K.N. COLLEGE	BW	22.34076	82.69507	6.5	5	1.5

ANNEXURE II Pre-Monsoon Groundwater Quality Data for Korba Industrial Area

Sl. No.	Block	Village	Latitude	Longitude	Well Type	pH	EC	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	F	NO3	Sio2	PO4	TDS
							µS/cm	mg/l												
1	Katghora	Dhanras	22.4774	82.6373	HP	7.4	319	16	4.8	47.88	4.81	0	103.7	35.5	21.81	3	0.34	24.8	0	213.73
2	Katghora	Dhanras	22.4752	82.6351	HP	7.1	174.5	2	1.2	38.2	2.96	0	79.3	3.55	5.4	1.2	24.30	20.7	0	116.915
3	Katghora	Dhanras	22.4770	82.6388	DW	7.4	1168	84	33.6	56.23	5.3	0	317.2	102.95	77.06	0.45	32.79	18.5	0	782.56
4	Katghora	purenakhar	22.4726	82.6510	HP	7.3	194	8	1.2	36.16	3.11	0	73.2	21.3	10.04	1	0.51	26.5	0	129.98
5	Katghora	Chorbhati	22.4596	82.6465	DW	7.3	182	12	3.6	20.5	14.4	0	85.4	21.3	5.13	0.66	1.72	6.9	0	121.94
6	Katghora	purenakhar	22.4714	82.6519	HP	6.67	417	6	1.2	58	46.8	0	140.3	35.5	20.96	0.13	17.08	9.3	0	279.39
7	Katghora	purenakhar	22.4732	82.6511	DW	6.7	161	16	2.4	18.53	7.5	0	85.4	10.65	8.75	0.14	5.65	10.6	0	107.87
8	Katghora	Lotlota	22.4715	82.6618	DW	6.23	138	4	2.4	16.48	10.59	0	42.7	14.2	12.01	0.1	1.13	6.9	0	92.46
9	Katghora	Lotlota	22.4701	82.6618	BW	6.77	220	12	3.6	34.31	2.18	0	85.4	10.65	17.72	0.95	10.62	24.3	0	147.4
10	Katghora	Lotlota	22.4796	82.6777	River	7.14	112	10	2.4	9.26	4.16	0	54.9	10.65	4.48	0.46	0.21	6.7	0	75.04
11	Katghora	Lotlota	22.4728	82.6648	DW	6.97	254	10	2.4	25.45	35.15	0	97.6	14.2	13.67	0.26	10.62	10	0	170.18
12	Katghora	Madwa Mahua	22.4576	82.6578	BW	7.85	446	12	3.6	95.32	2.88	0	262.3	14.2	4.8	5.01	0.00	22.5	0	298.82
13	Katghora	Nawagaon jhabu	22.4556	82.6766	DW	6.95	181	12	3.6	14.45	10.32	0	91.5	7.1	9.29	0.14	4.33	11	0	121.27
14	Katghora	Nawagaon Kala	22.4510	82.6735	BW	7.26	319	6	2.4	69.54	1.57	0	183	14.2	7.32	2.06	0.00	26.3	0	213.73
15	Katghora	Banki Mongra Indra N	22.4118	82.6000	HP	7.04	255	28	6	12.96	8.59	0	109.8	24.85	3.24	0.27	16.55	19.2	0	170.85
16	Katghora	Banki Mongra Azad Cl	22.4032	82.6071	BW	6.85	447	12	3.6	60.85	41.65	0	128.1	74.55	4.48	0.91	5.13	6.7	0	299.49
17	Katghora	Banki Mongra SECL Ba	22.3573	82.5961	BW	7.51	537	42	19.2	27	27.2	0	189.1	14.2	77.24	0.25	13.88	10.3	0	359.79
18	Katghora	Banki Mongra 2 No.	22.3945	82.6053	BW	7.03	148	12	4.8	8.11	9.35	0	54.9	7.1	4.64	0.23	21.85	14.3	0	99.16
19	Katghora	Banki Mongra	22.4070	82.6087	HP	7.63	552	66	3.6	33	15.55	0	256.2	35.5	10.45	0.73	20.67	9.2	0	369.84
20	Korba	Parsabhata	22.4059	82.7317	HP	7.25	822	40	22.8	105.64	4.22	0	396.5	31.95	62.23	0.62	3.92	27.1	0	550.74
21	Korba	Parsabhata Dondro Ri	22.4070	82.7314	River	7.96	268	8	2.4	38.8217	11.9	0	115.9	17.75	11.41	1.27	1.44	9.8	0	179.56
22	Korba	Parsabhata chowk	22.4033	82.7398	HP	7.89	596	4		130.5963	5.2	0	244	35.5	4.93	0.97	61.92	12.2	0	399.32
23	Korba	Parsabhata	22.4083	82.7392	BW	7.74	1519	44	25.2	247.6	19.25	0	390.4	159.75	75.5	0.78	63.55	20.2	0	1017.73
24	Korba	Rogbahari	22.4218	82.7441	BW	7.6	366	34	4.8	30.452	19.25	0	170.8	28.4	5.42	0.22	3.55	33.15	0	245.22
25	Korba	Rogbahari	22.4218	82.7386	DW	7.77	1197	78	38.4	65.4	12.3	0	256.2	127.8	52.25	0.72	63.99	17.1	0	801.99
26	Korba	Rogbahari	22.4198	82.7496	River	7.82	139	2	0	25.8428	10.55	0	36.6	21.3	9.29	1.03	0.55	9.6	0	93.13
27	Korba	Semri pali (Urga)	22.2771	82.7226	HP	7.25	2430	112	106.8	159.4	24.1	0	445.3	337.25	107.17	0.87	69.38	20.5	0	1628.1
28	Korba	Kudurmal	22.2755	82.6974	BW	7.38	691	48	14.4	56.38	9.68	0	335.5	35.5	17.55	0.7	0.62	14.8	0	462.97
29	Katghora	Kanberi	22.2915	82.6965	BW	6.85	280	8	6	15.82193	41.35	0	48.8	35.5	4.13	0.2	49.57	14.1	0	187.6
30	Katghora	Kanberi Basti	22.2906	82.6966	DW	6.75	281	6	4.8	18.65	53.45	0	73.2	24.85	4.77	0.17	46.07	12	0	188.27
31	korba	PANDRIPANI	22.4554	82.6363	BW	6.45	309	28	9.6	19.39	2.28	0	61	46.15	31.25	0.01	1.74	11.66	0	207.03
32	korba	BADERIMUDA	22.4399	82.6393	hp	7.28	230	26	3.6	19.33	1.12	0	134.2	14.2	0	0.01	0.00	15.32	0	154.1
33	korba	GOPALPUR	22.4366	82.6498	DW	7.73	146.8	16	3.6	8.54	4.33	0	54.9	21.3	2.85	0.55	1.80	3.92	0	98.356
34	korba	PREMNAGAR JELGAW	22.4224	82.6654	HP	6.45	59.1	6	1.2	5.1	2.03	0	12.2	14.2	0	0	2.06	10.05	0	39.597
35	korba	PREMNAGAR	22.4338	82.6745	BW	8.1	472	24	3.6	73.86	1.24	0	237.9	39.05	1.88	2.6	0.00	16.19	0	316.24
36	korba	AYODHYPURI	22.4320	82.6632	DW	7	413	24	10.8	36.56	4.83	0	42.7	85.2	3.42	0	56.48	21.1	0	276.71
37	korba	NAGAIKHOR	22.4073	82.8170	BW	6.5	183	12	10.8	4.94	5.03	0	6.1	28.4	6.15	0	40.16	7.74	0	122.61
38	korba	KOHADIA	22.3951	82.7090	BW	7.52	307	32	9.6	18.08	3.48	0	122	35.5	6.9	0	1.60	4.3	0	205.69
39	korba	IRRIGATION COLONY	22.4067	82.6865	DW	7.78	1158	82	21.6	118.39	1.5	0	305	213	50.34	0.4	9.50	10.68	0	775.86
40	korba	SITAMANI	22.3377	82.7090	DW	7.96	1607	124	58.8	104.65	45.55	0	457.5	230.75	58	0.57	4.83	18.96	0	1076.69
41	korba	BHILAI	22.3143	82.7227	DW	7.22	431	10	12	49.35	21.1	0	67.1	74.55	1.63	0	61.00	10.89	0	288.77
42	korba	SEMIPALI	22.2770	82.7194	DW	7.81	1192	110	63.6	43.07	2.09	0	274.5	252.05	47.4	0.18	7.77	22.41	0	798.64
43	korba	KUDURMAL	22.2791	82.7031	DW	8.02	1477	68	42	199.4	3.3	0	555.1	188.15	54.56	2.4	6.82	19.25	0	989.59
44	korba	BALRAMPUR	22.2894	82.6869	DW	8.04	1204	32	24	211	5.65	0	494.1	205.9	11.27	1.17	5.53	13.56	0	806.68
45	korba	SONPURI	22.3154	82.6972	DW	6.73	578	38	14.4	62.3	14.65	0	91.5	142	20.49	0	6.94	16.28	0	387.26
46	korba	SONPURI-2	22.3154	82.6922	DW	5.49	159	6	6	15.96	7	0	18.3	21.3	8.02	0	36.84	8.28	0	106.53
47	korba	PADANIA	22.3151	82.6897	BW	5.91	121	10	3.6	8.75	8.33	0	18.3	28.4	0.47	0	20.90	12.88	0	81.07
48	korba	PALI(PADANIA	22.3199	82.6800	HP	6.6	120	4	4.8	8.83	10.19	0	42.7	17.75	0.71	0	0.08	7.42	0	80.4
49	korba	JATRAJ	22.3251	82.6927	DW	6.66	178	12	3.6	16.1	14.95	0	24.4	35.5	2.39	0	29.84	12.65	0	119.26
50	korba	MUDAPAR	22.3515	82.7138	DW	5.77	685	30	14.4	79.65	31.9	0	67.1	134.9	20.56	0.01	59.88	7.26	0	458.95

Sl. No.	Block	Village	Latitude	Longitude	Well Type	pH	EC	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	F	NO3	Sio2	PO4	TDS
51	korba	PODIBHAR	22.3553	82.7337	DW	7.24	738	32	15.6	88.25	40.95	0	73.2	156.2	17.89	0.08	60.46	5.51	0	494.46
52	korba	DADAR KHURD	22.3405	82.7423	DW	7.44	302	20	7.2	29.95	17.15	0	18.3	67.45	0.2	0.05	58.69	12.36	0	202.34
53	korba	DADAR KHURD	22.3389	82.7414	BW	7.01	327	40	9.6	12.05	9.41	0	97.6	56.8	1.04	0.15	42.36	11.72	0	219.09
54	korba	KASHINAGAR	22.3618	82.7454	DW	7.11	258	8	6	31.65	19.4	0	24.4	67.45	1.04	0.05	40.48	12.8	0	172.86
55	korba	KRSHNANAGAR	22.3421	82.7224	DW	6.16	368	24	6	35.8	22.25	0	42.7	67.45	12.52	0.07	45.32	5.1	0	246.56
56	korba	PATHARIA PARA(WAR	22.3696	82.7256	DW	6.31	398	32	4.8	45.55	19.35	0	109.8	71	6.25	0.16	17.31	12.32	0	266.66
57	korba	MANASNAGAR MOHA	22.3753	82.7190	DW	7.08	766	58	9.6	94.9	9.2	0	189.1	127.8	37.88	0.7	21.36	12.17	0	513.22
58	korba	KOHODIA(CHARPARA	22.3954	82.7102	DW	7.47	853	60	18	108.48	11.82	0	201.3	145.55	50.21	1.2	52.90	11.56	0	571.51
59	korba	DARRI	22.4067	82.6902	DW	7.2	838	68	10.8	68.85	45.95	0	244	113.6	21.75	0.26	62.73	6.3	0	561.46
60	korba	DARRI-2	22.4010	82.6978	HP	7.32	552	62	12	51.97	1.75	0	164.7	78.1	25.31	0.25	29.58	18.51	0	369.84
61	korba	JAMNIPALI	22.4202	82.6585	DW	6.55	437	38	10.8	47.19	10.91	0	85.4	102.95	3.81	0.15	39.20	11.54	0	292.79
62	korba	SEMIPALI(HARSINGHP	22.4128	82.6434	BW	6.54	135	12	3.6	10.09	5.16	0	24.4	28.4	3.72	0.1	10.98	8.69	0	90.45
63	korba	DUMARMUDA	22.4335	82.6240	DW	7.49	350	24	4.8	33.35	11.43	0	140.3	28.4	7.4	0.71	7.22	8.1	0	234.5
64	korba	SEMIPALI	22.4107	82.6341	DW	7.45	624	84	13.2	35.78	1.89	0	219.6	106.5	13.35	0.38	3.12	13.26	0	418.08
65	korba	SUMEDHA	22.4066	82.6331	BW	7.51	939	66	13.2	108.44	2.78	0	341.6	127.8	10.89	0.48	0.84	9.22	0	629.13
66	korba	NAGIN BHATAN-3	22.3895	82.6358	DW	5.93	277	2	1.2	44.05	26.8	0	12.2	85.2	1.64	0.05	25.53	9.22	0	185.59
67	korba	KATAINAR	22.3931	82.6202	BW	6.81	569	50	8.4	57.45	4.56	0	158.6	110.05	5.9	0.43	0.20	6.71	0	381.23
68	korba	GAJRA-3	22.4002	82.6191	DW	7.17	779	62	24	86.03	3.08	0	237.9	156.2	25.73	0.37	8.39	7.34	0	521.93
69	korba	GEWRAGHAT	22.3644	82.6959	DW	7.02	924	58	19.2	109.25	29.15	0	176.9	170.4	32.94	0.23	60.93	7.93	0	619.08
70	korba	VIJAYANAGAR SEWCL	22.3539	82.7067	BW	6.85	267	22	7.2	22.22	7.12	0	61	46.15	14.97	0.12	7.70	5.38	0	178.89
71	korba	KENCHUA MODE	22.3559	82.6373	DW	7.09	922	68	28.8	98.33	7.44	0	244	149.1	33.79	0.36	55.98	9.71	0	617.74
72	korba	KUCHENA	22.3560	82.6206	DW	7.3	173	6	6	12.95	14.95	0	48.8	28.4	3.91	0.67	15.51	4.3	0	115.91
73	korba	KUCHENA-2	22.3542	82.6226	DW	7.41	193	12	2.4	23.3	5.62	0	54.9	35.5	4.89	0.9	3.29	4.17	0	129.31
74	korba	MANGAON	22.3421	82.6241	BW	6.9	288	28	7.2	20.55	5.23	0	73.2	42.6	2.37	0.23	28.80	10.11	0	192.96
75	korba	NARAIBODH	22.3313	82.6252	BW	6.32	257	20	7.2	16.3	17.4	0	30.5	53.25	0.07	0.07	30.98	13.8	0	172.19
76	korba	NARIBODH-2	22.3308	82.6244	DW	7.05	183	24	3.6	7.24	8.69	0	73.2	14.2	3.15	0.18	21.84	13.95	0	122.61
77	korba	NEWRA	22.3357	82.6343	BW	7.1	274	20	3.6	27.65	14.15	0	18.3	63.9	1.05	0.06	50.35	13.18	0	183.58
78	korba	GEVERA(BARPALI	22.3364	82.6397	DW	6.51	486	14	6	79.79	5.32	0	24.4	142	2.42	0.1	18.17	5.69	0	325.62
79	korba	K.N. COLLEGE	22.3408	82.6951	BW	6.8	808	62	28.8	69	18.8	0	262.3	127.8	42	0.43	0.44	8.78	0	541.36
80	Katghora	Khair Bhawan	22.3012	82.6975	DW	7.19	135	12	3.6	9.86	2.61	0	54.9	14.2	3.15	0.16	7.59	9.71	0	90.45

ANNEXURE III Post-Monsoon Groundwater Quality Data for Korba Industrial Area

Sl No	Block	Village	Lat	Long	Source	pH	EC	Ca	Mg	Na	K	HCO3	Cl	SO4	F	NO3	Sio2	TDS
							µS/cm	mg/l										
1	Katghora	Dhanras	22.47736	82.63733	HP	6.98	359	38	3.66	32.8	2.2	42.7	31.95	31.95	0.68	2.85	14.96	240.53
2	Katghora	Dhanras	22.47517	82.63512	HP	6.63	178	8	3.66	24.24	1.2	18.3	24.85	5.96	0	18.51	0.12	119.26
3	Katghora	Dhanras	22.47427	82.6402	DW	7.28	1034	74	18.3	70	105	140.3	113.6	48.76	0	19.57	14.96	692.78
4	Katghora	purenakhar	22.4726	82.651	HP	6.83	202	18	65.88	22.8	1.5	42.7	17.75	10.13	0	2.5	17.48	135.34
5	Katghora	Chorbhati	22.45965	82.64655	DW	7.1	259	22	7.32	17	16	48.8	24.85	7.14	0	11.2	3.35	173.53
6	Katghora	purenakhar	22.4714	82.65186	HP	5.95	158	12	8.54	14.2	5.1	122	17.75	12.32	0	2.72	8.27	105.86
7	Katghora	purenakhar	22.47318	82.65109	DW	6.28	224	22	4.88	14.3	4.7	18.3	17.75	14.6	0	20.71	4.36	150.08
8	Katghora	Lotlota	22.47152	82.66185	DW	5.5	288	26	8.54	17.5	10.8	18.3	31.95	20.24	0	31.18	3.16	192.96
9	Katghora	Lotlota	22.47007	82.66177	BW	6.67	283	34	4.88	25	1.2	67.1	14.2	9.82	0.09	5.87	15.53	189.61
10	Katghora	Lotlota	22.47956	82.67766	River	7.02	129	18	4.88	6.6	2.1	36.6	10.65	4.77	0	0.76	3.34	86.43
11	Katghora	Lotlota	22.47285	82.66483	DW	6.87	253	28	8.54	9	13.2	48.8	14.2	8.62	0	15.69	3.34	169.51
12	Katghora	Madwa Mahua	22.45756	82.65783	BW	7.64	468	42	4.88	65.3	5.09	122	17.75	3.88	1.31	1.24	13.95	313.56
13	Katghora	Nawagaon jhabu	22.45561	82.67663	DW	6.6	207	24	7.32	8.77	5.56	42.7	17.75	8.92	0	6.89	4.36	138.69
14	Katghora	Nawagaon Kala	22.451	82.67351	BW	6.91	312	22	9.76	43.88	0.74	79.3	17.75	6.22	0.09	0	13.57	209.04
15	Katghora	Banki Mongra Indra	22.41183	82.60001	HP	6.65	264	40	1.22	10.41	4.18	42.7	35.5	0.78	0	20.4	12.47	176.88
16	Katghora	Banki Mongra Azad (	22.40318	82.60714	BW	6.86	413	46	9.76	23.58	4.47	48.8	53.25	5.92	0	20.44	8.61	276.71
17	Katghora	Banki Mongra SECL B	22.35733	82.5961	BW	5.33	265	16	2.44	24.5	12.8	6.1	53.25	2.38	0	37.85	7.49	177.55
18	Katghora	Banki Mongra 2 No.	22.39446	82.60527	BW	6.5	231	28	6.1	14.06	4.74	48.8	24.85	5.96	0	3.45	5.25	154.77
19	Katghora	Banki Mongra	22.40702	82.60867	HP	6.61	590	46	17.08	43	14	61	63.9	40.65	0	26.22	2.95	395.3
20	Korba	Parsabhata	22.40592	82.73167	HP	7.25	127	16	6.1	6.56	1.97	30.5	14.2	4.18	0	0.58	2.95	85.09
21	Korba	Parsabhata Dondro R	22.40699	82.73142	River	7.22	154	12	4.88	17.28	3.77	24.4	21.3	3.83	0	3.98	4.37	103.18
22	Korba	Parsabhata chowk	22.40333	82.73975	HP	8.17	597	44	6.1	102.14	1.57	134.2	42.6	3.83	0	1.88	5.74	399.99
23	Korba	Parsabhata	22.40828	82.73921	BW	7.54	917	94	34.16	79.55	1.45	176.9	85.2	24	0.0029	19.4	10.61	614.39
24	Korba	Rogbahari	22.42184	82.74412	BW	6.37	379	34	10.98	37.57	3.19	24.4	46.15	7.73	0	42.82	20.08	253.93
25	Korba	Rogbahari	22.42177	82.73862	DW	7.62	1141	86	12.2	92.6	86	128.1	120.7	51.03	0	42.48	9.33	764.47
26	Korba	Rogbahari	22.41313	82.74927	River	7.44	87	10	4.88	9.88	2.51	18.3	10.65	5.32	0	1.48	4.37	58.29
27	Korba	Semri pali (Urga)	22.27715	82.72264	HP	7.22	2230	194	146.4	91.76	7.54	164.7	394.05	200	0	47.3	12.35	1494.1
28	Korba	Kudurmal	22.27549	82.69738	BW	7.6	674	88	20.74	37.12	3.76	134.2	49.7	20.45	0	4.8	7.58	451.58
29	Katghora	Kanberi	22.29155	82.69647	BW	6.68	293	24	9.76	16	16	30.5	39.05	2.92	0	39.49	7.58	196.31
30	Katghora	Kanberi Basti	22.29057	82.69664	DW	6.72	350	26	10.98	10	27.15	30.5	35.5	10.75	0	38.99	7.58	234.5
31	Katghora	Khair Bhawan	22.30121	82.69754	DW	6.58	146.5	20	4.88	8.72	1.78	36.6	17.75	2.67	0	5.78	6.26	98.155
32	Korba	PANDRIPANI	22.45537	82.6363	BW	6.48	241	26	7.32	21.68	1.56	30.5	14.2	22.2	0	0	9.1	161.47
33	Korba	BADERIMUDA	22.43987	82.6393	hp	7.14	141	20	6.1	7.98	2.96	24.4	17.75	3.23	0	0.79	2.93	94.47
34	Korba	GOPALPUR	22.43657	82.64984	DW	7.35	642	78	28.06	27.41	0.45	109.8	56.8	17.91	0	29.35	18.13	430.14
35	Korba	PREMNAGAR JELGAW	22.42235	82.66537	HP	6.86	223	28	8.54	14.22	2.21	48.8	31.95	0	0	0.14	4.83	149.41
36	Korba	PREMNAGAR	22.43383	82.67446	BW	7.85	459	34	2.44	82.93	0.9	115.9	28.4	2.24	0.7	0	11.05	307.53
37	Korba	AYODHYPURI	22.42929	82.66301	HP	5.87	494	24	19.52	45.89	6.64	18.3	110.05	12.24	0	42.47	5.54	330.98
38	Korba	AYODHYPURI	22.43204	82.66321	DW	6.92	251	36	0	22.46	0.33	54.9	24.85	1.61	0	12.87	24.41	168.17
39	Korba	NAGAIKHOR	22.40733	82.6817	BW	6.57	294	20	20.74	18.01	5.88	42.7	31.95	6.26	0	19.68	4.83	196.98
40	Korba	KOHADIA	22.39513	82.70898	BW	7.67	1149	78	32.94	118.23	1.15	152.5	152.65	53.9	0	9.9	5.78	769.83
41	Korba	IRRIGATION COLONY	22.40668	82.68654	DW	7.15	333	30	10.98	22.07	4.65	54.9	28.4	8.13	0	1.01		223.11
42	Korba	SITAMANI	22.33774	82.70905	DW	7.95	1695	92	91.5	142	57.3	183	152.65	53.34	0	6.46		1135.65
43	Korba	BHILAI	22.31428	82.72267	DW	5.8	511	14	12.2	63	18.2	12.2	92.3	2.74	0	57.4		342.37
44	Korba	SEMIPALI	22.27698	82.71941	DW	7.35	1501	74	137.86	55.47	1.72	164.7	244.95	15.96	0	7.11		1005.67

Sl No	Block	Village	Lat	Long	Source	pH	EC	Ca	Mg	Na	K	HCO3	Cl	SO4	F	NO3	Sio2	TDS
45	Korba	KUDURMAL	22.27909	82.70306	DW	7.87	1626	50	89.06	225	3.4	298.9	156.2	22.61	0.52	7.85		1089.42
46	Korba	BALRAMPUR	22.28942	82.68694	DW	7.77	1114	36	29.28	185	4.35	225.7	124.25	3.84	0	1.17		746.38
47	Korba	SONPURI	22.31536	82.69724	DW	6.23	557	50	17.08	40	12.15	36.6	81.65	48.67	0	11.5		373.19
48	Korba	SONPURI-2	22.31543	82.69221	DW	5.7	159	12	3.66	15.1	5.85	6.1	21.3	0.88	0	41.56		106.53
49	Korba	PADANIA	22.31512	82.68966	BW	5.75	97	4	4.88	5.21	5.86	6.1	21.3	0	0	17.65		64.99
50	Korba	PALI(PADANIA	22.31987	82.67999	HP	5.74	83	2	3.66	7.13	0.49	12.2	14.2	0	0	12		55.61
51	Korba	JATRAJ	22.32507	82.69269	DW	5.3	278	16	1.22	27	15	6.1	60.35	0	0	43.03		186.26
52	Korba	MUDAPAR	22.35145	82.71377	DW	7.5	125	16	6.1	6.85	2.35	30.5	14.2	0.79	0	0.59		83.75
53	Korba	PODIBHAR	22.35532	82.73367	DW	6.15	798	36	25.62	70	31.35	24.4	117.15	26.03	0	61.41		534.66
54	Korba	DADAR KHURD	22.3405	82.74227	DW	6.11	346	16	10.98	26	17	12.2	49.7	0.05	0	57.55		231.82
55	Korba	DADAR KHURD	22.33894	82.74144	BW	6.3	348	42	9.76	13.09	8.7	42.7	49.7	0	0	48.17		233.16
56	Korba	KASHINAGAR	22.36182	82.74539	DW	6.23	458	18	12.2	62.3	10.97	24.4	60.35	13.92	0	52.23		306.86
57	Korba	KRSHNANAGAR	22.34206	82.72244	DW	5.77	424	30	8.54	34	24	18.3	46.15	13.96	0	56.98		284.08
58	Korba	PATHARIA PARA(WAI	22.36956	82.72557	DW	6.21	410	24	14.64	36	15	48.8	53.25	8.06	0	9.88		274.7
59	Korba	MANASNAGAR MOH/	22.37535	82.71904	DW	6.71	530	44	9.76	57.5	8.2	73.2	63.9	10.77	0	11.97		355.1
60	Korba	KOHODIA(CHARPARA	22.39545	82.71022	DW	7.7	858	44	39.04	102.43	11.4	128.1	71	30.86	0	46.69		574.86
61	Korba	DARRI	22.40667	82.6902	DW	7.09	787	44	32.94	60	34	115.9	74.55	18.37	0	49.64		527.29
62	Korba	DARRI-2	22.401	82.69776	HP	6.61	388	38	15.86	24.64	1.39	54.9	35.5	18.46	0	17.17		259.96
63	Korba	JAMNIPALI	22.42016	82.65855	DW	6.25	347	24	9.76	34.43	5.34	30.5	71	0.43	0	22.83		232.49
64	Korba	SEMIPALI(HARSINGHI	22.41282	82.64336	BW	6.15	134	8	3.66	9.83	4	12.2	21.3	4.87	0	9.65		89.78
65	Korba	DUMARMUDA	22.43351	82.62397	DW	7.27	387	44	6.1	24	20.5	79.3	49.7	8.66	0	2.36		259.29
66	Korba	SEMIPALI	22.4107	82.63406	DW	7.54	408	46	15.86	16.93	3.7	67.1	35.5	8.36	0	3.22		273.36
67	Korba	SUMEDHA	22.40659	82.63315	BW	7.27	1037	38	57.34	100.79	1.89	176.9	117.15	24.69	0	1.42		694.79
68	Korba	NAGIN BHATAN-3	22.38954	82.63583	DW	6.38	281	6	7.32	32	13.3	18.3	71	0	0	33.69		188.27
69	Korba	KATAINAR	22.3931	82.62019	BW	7.06	516	46	15.86	46.84	3.92	67.1	78.1	4.51	0	1.44		345.72
70	Korba	GAJRA-3	22.40024	82.61913	DW	6.96	592	60	25.62	26.07	1.37	61	99.4	10.47	0	18.43		396.64
71	Korba	GEWRAGHAT	22.36442	82.69591	DW	7.6	126	18	4.88	6.31	1.95	30.5	14.2	0	0	0.59		84.42
72	Korba	VIJAYANAGAR SEWCL	22.35394	82.65067	BW	6.6	257	24	10.98	16.3	5.57	24.4	31.95	11.41	0	11.26		172.19
73	Korba	KENCHUA MODE	22.35593	82.63726	BW	6.68	884	46	51.24	71.89	6.08	109.8	92.3	29.5	0	56.11		592.28
74	Korba	KUCHENA	22.35604	82.62062	DW	7.34	139	16	4.88	8.36	3.66	30.5	14.2	1.93	0	1.82		93.13
75	Korba	KUCHENA-2	22.35417	82.62259	DW	6.75	106	8	2.44	9.59	2.85	12.2	17.75	0.73	0	2.2		71.02
76	Korba	MANGAON	22.34211	82.62409	BW	6.53	280	26	10.98	14.77	3.48	30.5	39.05	0	0	31.52		187.6
77	Korba	NARAIBODH	22.33134	82.62524	BW	6.69	181	22	6.1	5.68	6.56	30.5	24.85	0.29	0	25.43		121.27
78	Korba	NARIBODH-2	22.33081	82.6244	DW	6.42	183	22	6.1	5.59	6.41	61	14.2	0	0	26.22		122.61
79	Korba	NEWRA	22.33567	82.63431	BW	6.18	394	18	13.42	30	12	12.2	85.2	0.29	0	50.59		263.98
80	Korba	GEVERA(BARPALI	22.33641	82.6397	DW	6.14	346	6	6.1	58.29	3.5	30.5	85.2	0	0	8.76		231.82
81	Korba	K.N. COLLEGE	22.34076	82.69507	BW	7.26	628	50	29.28	39.72	11.76	67.1	46.15	14.01	0	11.23		420.76
82	Korba	kudurmal hasdeo rive	22.27893	82.69193	river	7.4	180	16	6.1	9.29	3.47	85.4	17.75	6.56	0	3.51		120.6

ANNEXURE IV Groundwater Quality Data (Heavy Metals) for Korba Industrial Area

Sl No	District	Block	Village	Latitude	Longitude	Well Type	27 Al [He]	52 Cr [He]	55 Mn [He]	56 Fe [He]	63 Cu [He]	66 Zn [He]	75 As [He]	78 Se [He]	111 Cd [He]	202 Hg [He]	206 [Pb] [He]	238 U [He]
							Conc. [ppb]	Conc. [ppb]	Conc. [ppb]	Conc. [ppm]	Conc. [ppb]	Conc. [ppm]	Conc. [ppb]	Conc. [ppb]	Conc. [ppb]	Conc. [ppb]	Conc. [ppb]	Conc. [ppb]
							200ppb	50 ppb	100 - 300 ppb	1.0 ppm	50 - 150 ppb	5 - 15 ppm	10 ppb	10 ppb	3 ppb	1 ppb	10 ppb	30 ppb
1	Korba	Katghora	Dhanras	22.47736	82.63733	HP	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00775	0.00000	0.00410
2	Korba	Katghora	Dhanras	22.47517	82.63512	HP	0.00000	0.00000	30.49732	0.61736	19.39536	0.12826	0.70949	0.73720	0.00000	0.00540	0.00000	2.99309
3	Korba	Katghora	Dhanras	22.47696	82.63877	DW	0.00000	0.00000	56.14530	0.00000	0.05015	0.00000	3.78499	3.54364	0.00000	0.00598	0.00000	2.76192
4	Korba	Katghora	purenakhar	22.4726	82.651	HP	0.00000	0.00000	35.28841	0.00000	0.00000	0.09043	2.37475	0.00000	0.00000	0.00000	0.00000	0.71470
5	Korba	Katghora	Chorbhati	22.45965	82.64655	DW	0.00000	0.00000	0.62035	0.00000	0.00000	0.00000	0.63819	0.49377	0.00000	0.00000	0.00000	0.09654
6	Korba	Katghora	purenakhar	22.4714	82.65186	HP	0.00000	0.00000	144.11158	9.89920	0.00000	0.39617	0.01122	0.00000	0.00000	0.00036	0.00000	0.07451
7	Korba	Katghora	purenakhar	22.47318	82.65109	DW	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05198	0.00000	0.00000	0.00096	0.00000	0.02566
8	Korba	Katghora	Lotlota	22.47152	82.66185	DW	0.00000	0.00000	39.60703	0.00000	0.00000	0.00000	0.00992	0.06725	0.00000	0.00000	0.00000	0.24872
9	Korba	Katghora	Lotlota	22.47007	82.66177	BW	0.00000	0.00000	19.46810	0.00000	0.00000	0.29093	0.79266	0.85339	0.00000	0.00000	0.00000	5.02784
10	Korba	Katghora	Lotlota	22.47956	82.67766	River	0.00000	0.00000	35.62769	0.00000	0.00000	0.00000	0.53946	0.01939	0.00000	0.00000	0.00000	0.02221
11	Korba	Katghora	Lotlota	22.47285	82.66483	DW	0.00000	0.00000	1.49911	0.00000	0.00000	0.01794	0.06500	0.25754	0.00000	0.00000	0.00000	0.03001
12	Korba	Katghora	Madwa Mahua	22.45756	82.65783	BW	0.00000	0.00000	43.13138	0.00000	0.00000	0.00000	5.28202	0.01011	0.00000	0.00074	0.00000	3.37745
13	Korba	Katghora	Nawagaon jhabu	22.45561	82.67663	DW	0.00000	0.00000	16.84474	0.24116	5.20571	0.14114	0.04500	0.18099	0.00000	0.00000	0.00000	0.06890
14	Korba	Katghora	Nawagaon Kala	22.451	82.67351	BW	0.00000	0.00000	38.41342	9.85017	0.00000	1.74112	0.38301	0.03630	0.00000	0.00000	0.00000	0.85840
15	Korba	Katghora	Banki Mongra	22.41183	82.60001	HP	0.00000	0.00000	44.21227	2.81348	0.95164	0.45150	0.00000	0.03953	0.00000	0.00000	0.00000	0.09797
16	Korba	Katghora	Banki Mongra Azad Chowk	22.40318	82.60714	BW	0.00000	0.00000	210.90081	13.05437	49.13052	0.47631	0.50872	0.08014	0.03243	0.00699	0.00000	0.01021
17	Korba	Katghora	Banki Mongra SECL Banki Mongra	22.35733	82.5961	BW	0.00000	0.00000	2509.63549	0.22867	0.00000	0.00000	0.02939	0.00000	0.00000	0.00000	0.00000	0.08835
18	Korba	Katghora	Banki Mongra 2 No.	22.39446	82.60527	BW	0.00000	0.00000	51.84385	0.00000	0.00000	0.00000	0.00000	0.38415	0.00000	0.00000	0.00000	0.00790
19	Korba	Katghora	Banki Mongra	22.40702	82.60867	HP	0.00000	0.00000	11.47861	0.61514	0.00000	0.15167	0.00471	0.00000	0.00000	0.00000	0.00000	3.37467
20	Korba	Korba	Parsabhata	22.40592	82.73167	HP	0.00000	0.00000	181.05743	0.32170	0.00000	0.01460	0.21912	1.51683	0.00000	0.00000	0.00000	10.96657
21	Korba	Korba	Parsabhata Dondro River	22.40699	82.73142	River	0.00000	0.00000	49.06821	0.00000	0.54819	0.00000	3.95974	1.24115	0.00000	0.08716	0.00000	0.36579
22	Korba	Korba	Parsabhata chowk	22.40333	82.73975	HP	0.00000	0.00000	15.87124	0.00000	0.00000	0.00000	0.12488	0.24009	0.00000	0.00000	0.00000	0.50505
23	Korba	Korba	Parsabhata	22.40828	82.73921	BW	0.00000	0.00000	6.85439	0.03684	17.06588	0.05373	0.19336	0.00000	0.00000	0.00000	2.11385	26.24713
24	Korba	Korba	Rogbahari	22.42184	82.74412	BW	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.46738	0.45911	0.00000	0.00000	0.00000	0.71164
25	Korba	Korba	Rogbahari	22.42177	82.73862	DW	0.00000	0.00000	0.00000	0.00000	1.11444	0.01189	1.42908	5.98537	0.00000	0.00000	0.00000	0.52719
26	Korba	Korba	Rogbahari	22.4198	82.74959	River	170.75878	0.00000	84.90611	0.08666	0.00000	0.00000	3.46158	0.95350	0.00000	0.16435	0.00000	0.11422
27	Korba	Korba	Semri pali (Urga)	22.27715	82.72264	HP	0.00000	0.00000	541.46315	1.84513	3.22818	0.28485	0.08484	1.98791	0.00000	0.01711	0.00000	34.92621
28	Korba	Korba	Kudurmal	22.27549	82.69738	BW	0.00000	0.00000	84.41381	0.00000	0.00000	0.00000	0.00000	0.03428	0.00000	0.00000	0.00000	37.43256
29	Korba	Katghora	Kanberi	22.29155	82.69647	BW	0.00000	0.00000	80.30723	1.62364	3.39151	0.04974	0.00000	0.00216	0.00000	0.00000	0.00000	0.72808
30	Korba	Katghora	Kanberi Basti	22.29057	82.69664	DW	0.00000	0.00000	0.00000	0.00000	0.00000	0.09021	0.03647	0.02649	0.00000	0.00000	0.00000	0.02986
31	korba	korba	PANDRIPANI	22.45537	82.6363	BW	7.87154	1.27540	39.96229	0.02761	0.45707	0.05657	0.58306	1.16720	0.05559	0.20502	0.51119	0.17028
32	korba	korba	BADERIMUDA	22.43987	82.6393	hp	6.55541	0.91454	174.27937	0.02493	0.84728	0.00610	0.06876	0.34624	0.02887	0.22119	0.33781	0.07644
33	korba	korba	GOPALPUR	22.43657	82.64984	DW	27.70262	1.12442	5.04629	0.01178	3.30792	0.00292	0.53402	0.89711	0.05984	0.23149	0.07003	0.00831
34	korba	korba	PREMNAGAR JELGAWN	22.42235	82.66537	HP	7.94788	1.27019	77.68104	0.02977	0.65866	0.04416	0.03810	0.33019	0.02830	0.20325	0.16715	0.00268
35	korba	korba	PREMNAGAR	22.43383	82.67446	BW	5.48838	1.23562	5.74961	0.07731	0.16197	0.01035	0.96654	0.28838	0.04062	0.28955	0.12380	4.65798
36	korba	korba	AYODHYPURI	22.43204	82.66321	DW	8.75633	1.30245	358.93494	0.03186	0.55785	0.15827	0.03058	0.37216	0.15791	0.20481	0.31723	0.03179
37	korba	korba	NAGAIKHOR	22.40733	82.81703	BW	7.50282	1.37663	126.73405	0.01531	0.73494	3.30112	0.03804	0.45111	1.65923	0.28483	0.19855	0.03286
38	korba	korba	KOHADIA	22.39513	82.70898	BW	11.60958	1.72611	11.48221	0.01507	3.11636	0.05865	0.18639	0.36506	0.06580	0.24553	0.13886	0.22301
39	korba	korba	IRRIGATION COLONY	22.40668	82.68654	DW	7.64172	1.26006	0.41096	0.01463	0.39965	0.00670	0.27394	0.64188	0.01486	0.22115	0.12751	199.98681
40	korba	korba	SITAMANI	22.33774	82.70905	DW	9.92752	1.45288	0.37456	0.01444	0.81973	0.00325	0.37967	0.59632	0.01893	0.22483	0.16094	9.08713
41	korba	korba	BHILAI	22.31428	82.72267	DW	10.41891	1.41597	294.90266	0.02271	1.32168	0.15747	0.09492	0.44713	0.36394	0.20862	0.37241	0.03880
42	korba	korba	SEMIPALI	22.27698	82.71941	DW	8.18933	1.11091	4.28491	0.00750	0.53923	0.00666	0.25825	0.37971	0.05698	0.22887	0.07709	27.95442
43	korba	korba	KUDURMAL	22.27909	82.70306	DW	10.85840	1.63527	0.53585	0.02823	8.01699	0.00820	2.28865	0.41254	0.03909	0.23527	1.86041	2.46339
44	korba	korba	BALRAMPUR	22.28942	82.68694	DW	8.68102	1.30231	1.31157	0.05313	3.42465	0.02069	2.34548	0.50737	0.26709	0.22746	0.22868	1.70488
45	korba	korba	SONPURI	22.31536	82.69724	DW	6.44744	1.44810	2.22649	0.01070	0.68201	0.01555	0.86616	0.29058	0.19908	0.20981	0.06495	0.05939
46	korba	korba	SONPURI-2	22.31543	82.69221	DW	10.96927	1.11185	40.24174	0.01090	0.39017	0.02086	0.02811	0.22431	0.05161	0.20097	1.24770	0.02094
47	korba	korba	PADANIA	22.31512	82.68966	BW	6.82595	1.21906	309.68932	0.03113	1.70056	0.43314	0.02040	0.27332	0.20837	0.19962	0.47895	0.01747
48	korba	korba	PALI(PADANIA	22.31987	82.67999	HP	6.36920	1.43591	175.36955	0.01314	5.98779	1.62182	0.03608	0.27730	0.04836	0.19904	0.10962	0.00490

Sl No	District	Block	Village	Latitude	Longitude	Well Type	27 Al [He]	52 Cr [He]	55 Mn [He]	56 Fe [He]	63 Cu [He]	66 Zn [He]	75 As [He]	78 Se [He]	111 Cd [He]	202 Hg [He]	206 [Pb] [He]	238 U [He]
49	korba	korba	JATRAJ	22.32507	82.69269	DW	9.40435	1.36054	7.33722	0.03051	0.73611	0.12855	0.12944	0.24237	0.16633	0.20024	0.18639	0.01396
50	korba	korba	MUDAPAR	22.35145	82.71377	DW	7.43174	1.11796	1.04517	0.01295	0.45454	0.02555	0.13992	0.25216	0.04605	0.19681	0.10114	0.00868
51	korba	korba	PODIBHAR	22.35532	82.73367	DW	8.61179	1.34103	142.13244	0.02606	2.10166	1.32175	0.04325	0.28219	0.07119	0.19930	0.48012	0.00454
52	korba	korba	DADAR KHURD	22.3405	82.74227	DW	7.37112	1.16323	4.68929	0.01277	0.70812	0.10435	0.12355	0.25564	0.05012	0.19665	0.09387	0.01226
53	korba	korba	DADAR KHURD	22.33894	82.74144	BW	7.43534	1.31822	307.11300	0.01108	0.82822	0.03362	0.19286	0.42654	0.32983	0.20395	0.07840	0.01419
54	korba	korba	KASHINAGAR	22.36182	82.74539	DW	13.33422	1.85212	56.95086	0.01225	0.36702	0.01215	0.14772	1.44221	0.07190	0.19857	0.17634	0.05880
55	korba	korba	KRSHNANAGAR	22.34206	82.72244	DW	8.62817	1.34122	22.11791	0.01465	0.57604	0.04599	0.04034	0.60447	0.08314	0.19869	0.20119	0.02198
56	korba	korba	PATHARIA PARA(WARD-17)	22.36956	82.72557	DW	8.01061	1.66933	4.30485	0.01334	1.09685	0.01876	0.03102	0.80647	0.03627	0.19911	0.27988	0.11479
57	korba	korba	MANASNAGAR MOHALA(BHESKHAT AL	22.37535	82.71904	DW	9.64110	1.28133	415.84640	0.01400	0.32830	0.09697	0.05378	0.21638	0.27033	0.19989	0.14367	0.01460
58	korba	korba	KOHODIA(CHARPARA)	22.39545	82.71022	DW	11.09215	1.23202	45.67293	0.02821	0.44466	0.01947	0.07930	0.53087	0.11563	0.19993	0.19928	0.01335
59	korba	korba	DARRI	22.40667	82.6902	DW	14.78869	1.23015	116.11898	0.02102	0.36866	0.04604	0.10959	0.36436	0.07253	0.19918	0.34066	0.00975
60	korba	korba	DARRI-2	22.401	82.69776	HP	9.06850	1.55656	2.84351	0.02056	0.39175	0.00779	0.22868	0.62675	0.02683	0.20229	0.17259	0.17230
61	korba	korba	JAMNIPALI	22.42016	82.65855	DW	6.60998	1.15178	530.54710	0.02404	1.27629	0.36959	0.89766	0.59358	0.26205	0.20486	0.14028	0.14071
62	korba	korba	SEMIPALI(HARSINGH PUR)	22.41282	82.64336	BW	11.09266	2.38779	37.21249	0.03589	0.44609	0.03359	0.02991	1.64169	0.30681	0.20480	0.13673	0.03730
63	korba	korba	DUMARMUDA	22.43351	82.62397	DW	18.38687	2.01699	1.12389	0.04466	1.92258	0.01502	1.42440	0.68679	0.32402	0.23122	0.22055	1.69840
64	korba	korba	SEMIPALI	22.4107	82.63406	DW	8.54053	1.35453	1.46486	0.04324	0.94548	0.01422	0.39945	0.25958	0.22986	0.20215	0.22265	0.76138
65	korba	korba	SUMEDHA	22.40659	82.63315	BW	5.60707	1.16957	91.54328	0.00700	0.20050	0.16058	0.02591	0.29926	0.15978	0.22617	0.04443	0.07560
66	korba	korba	NAGIN BHATAN-3	22.38954	82.63583	DW	16.39873	1.72667	1.90937	0.01492	1.47691	0.00748	1.13054	0.58383	0.11810	0.22364	0.12704	1.45091
67	korba	korba	KATAINAR	22.3931	82.62019	BW	9.01879	1.25845	0.56569	0.01948	0.36316	0.00330	0.35842	0.32459	0.02772	0.19892	0.16983	0.79083
68	korba	korba	GAJRA-3	22.40024	82.61913	DW	8.27151	1.38050	0.43044	0.01719	0.53928	0.00265	0.06790	0.52679	0.01354	0.20033	0.11492	1.22490
69	korba	korba	GEWRAGHAT	22.36442	82.69591	DW	11.50161	2.46871	0.79712	0.04763	0.63090	0.00419	0.20554	0.60255	0.03479	0.20158	0.22365	0.44741
70	korba	korba	VIJAYANAGAR SEWCL COLONY	22.35394	82.56	BW	8.95308	1.59821	41.44838	0.03069	0.82888	0.02903	0.04400	0.55122	0.05163	0.19737	0.22416	0.04066
71	korba	korba	KENCHUA MODE	22.35593	82.63726	DW	11.53540	1.92766	4.89449	0.03697	36.20270	0.89808	0.15313	0.45601	0.77114	0.20102	7.11218	1.12521
72	korba	korba	KUCHENA	22.35604	82.62062	DW	26.51002	1.30095	0.48856	0.02975	0.70253	0.00611	0.51244	0.69644	0.21810	0.22732	0.14835	0.01490
73	korba	korba	KUCHENA-2	22.35417	82.62259	DW	18.33095	1.76572	0.61787	0.03141	0.60200	0.12867	0.70483	0.77086	0.22115	0.23648	0.16292	0.01067
74	korba	korba	MANGAON	22.34211	82.62409	BW	10.15380	1.28298	0.36248	0.01379	0.38189	0.00584	0.06218	0.39996	0.03346	0.19777	0.11439	0.01668
75	korba	korba	NARAIBODH	22.33134	82.62524	BW	8.01533	1.49469	91.48170	0.01692	0.58856	0.26115	0.10654	0.26152	0.03397	0.19915	0.15464	0.00461
76	korba	korba	NARIBODH-2	22.33081	82.6244	DW	9.27401	1.35734	0.53927	0.02797	1.02770	0.01035	0.09751	0.34713	0.02421	0.19649	0.42074	0.00887
77	korba	korba	NEWRA	22.33567	82.63431	BW	9.65602	1.49915	5.02601	0.02066	0.66240	0.02352	0.02937	0.31873	0.08731	0.19650	0.27217	0.02790
78	korba	korba	GEVERA(BARPALI)	22.33641	82.6397	DW	8.05039	1.01581	28.78711	0.01362	0.72386	0.04055	0.14153	0.28960	0.05228	0.19846	0.15026	0.00298
79	korba	korba	K.N. COLLEGE	22.34076	82.69507	BW	8.28896	1.23640	70.67301	0.01593	0.36578	0.00581	0.06736	0.21859	0.04244	0.20252	0.12563	3.65549
80	korba	Katghora	Khair Bhawan	22.30121	82.69754	DW	13.46991	3.51423	3.29764	0.03747	1.15000	0.06125	0.09873	0.37317	0.03030	0.19718	0.56590	0.06449

ANNEXURE V Parameters for Ground water suitability for irrigation purposes

Sl	Village	Well Type	S S P% Na*100/ Ca+Mg+Na	SAR Na / √ (Ca+Mg) / 2	RSC $(HCO_3 + CO_3)$ – (Ca + Mg)	%Na ((Na+K) / (Ca+Mg+Na+K))*100	K I Na/Ca+Mg	Mg^{+2} (Mg) / (Ca+Mg)*100	P I ((Na+ (√HCO_3) / (Ca+Mg+Na))*100
1	Dhanras	HP	63.53	2.69	0.51	64.85	1.74	33.05	103.32
2	Dhanras	HP	89.31	5.27	1.10	89.73	8.36	49.69	150.62
3	Dhanras	DW	64.32	1.61	0.30	71.30	1.80	49.69	139.42
4	purenakhar	HP	75.92	3.15	0.70	76.81	3.15	19.80	128.81
5	Chorbhati	DW	61.34	1.87	0.90	74.20	1.59	28.32	131.45
6	purenakhar	HP	86.35	5.65	1.90	90.32	6.32	24.76	138.28
7	purenakhar	DW	53.85	1.38	0.51	75.81	1.17	56.83	126.59
8	Lotlota	DW	59.06	2.49	-0.39	64.35	1.44	66.39	87.93
9	Lotlota	BW	62.47	2.23	0.50	63.32	1.66	33.05	112.02
10	Lotlota	River	36.60	0.68	0.20	42.19	0.58	28.32	122.83
11	Lotlota	DW	55.84	4.68	2.24	56.08	1.26	50.41	75.27
12	Madwa Mahua	BW	82.22	6.19	3.40	82.48	4.62	33.05	123.36
13	Nawagaon jhabu	DW	71.96	6.86	4.53	72.27	2.57	55.24	94.28
14	Nawagaon Kala	BW	85.87	6.06	2.50	86.03	6.08	39.70	135.06
15	Banki Mongra Indra Nagar Banki Mongra	HP	22.93	0.58	-0.09	29.26	0.30	26.07	77.53
16	Banki Mongra Azad Chowk Banki Mongra	BW	74.70	3.95	1.20	80.55	2.95	33.05	115.61
17	Banki Mongra SECL Banki Mongra	BW	24.18	0.87	-0.58	33.69	0.32	42.93	60.46
18	Banki Mongra 2 No.	BW	26.17	0.50	-0.09	37.29	0.35	39.70	96.56
19	Banki Mongra	HP	28.52	1.07	0.60	33.76	0.40	8.24	69.25
20	Parsabhata	HP	54.23	3.30	2.62	54.81	1.18	48.40	84.33
21	Parsabhata Dondro River	River	73.86	3.09	1.30	76.93	2.82	33.05	134.17
22	Parsabhata chowk	HP	96.60	17.96	3.80	96.67	28.39	0.00	130.62
23	Parsabhata	BW	71.58	7.36	2.13	72.48	2.52	48.52	88.40
24	Rogbahari	BW	38.72	1.29	0.71	46.44	0.63	18.85	87.67
25	Rogbahari	DW	56.33	2.99	-1.58	61.44	1.29	44.13	73.39
26	Rogbahari	River	91.83	5.02	0.50	93.30	11.24	0.00	155.13
27	Semri pali (Urga)	HP	32.51	2.58	-7.09	34.40	0.48	61.08	45.18
28	Kudurmal	BW	40.61	1.83	1.92	42.95	0.68	33.05	79.46
29	Kanberi	BW	43.49	1.03	-0.09	66.14	0.77	55.24	100.04
30	Kanberi Basti	DW	57.09	3.20	-1.68	62.88	1.33	44.52	73.39
31	PANDRIPANI	BW	27.80	0.81	-1.19	29.16	0.38	36.07	60.77
32	BADERIMUDA	hp	34.49	0.94	0.60	35.25	0.53	18.56	95.36
33	GOPALPUR	DW	60.63	2.06	-0.49	67.69	1.54	55.24	88.49
34	PREMNAGAR JELGAWN	HP	35.74	0.50	-0.20	40.70	0.56	24.76	107.81
35	PREMNAGAR	BW	68.22	3.71	2.40	68.43	2.15	19.80	110.17
36	AYODHYPURI	DW	52.79	3.04	-0.59	54.17	1.12	21.41	75.32
37	NAGAIKHOR	BW	12.61	0.25	-1.39	18.74	0.14	59.70	31.17
38	KOHADIA	BW	24.75	0.72	-0.39	26.80	0.33	33.05	69.28
39	IRRIGATION COLONY	DW	51.28	3.15	-1.18	52.83	1.05	33.05	71.03
40	SITAMANI	DW	90.60	6.08	0.00	92.90	9.64	49.69	111.75
41	BHILAI	DW	51.46	3.17	-1.58	55.09	1.06	35.27	69.91
42	SEMIPALI	DW	55.95	1.60	0.10	59.19	1.27	24.76	108.35
43	KUDURMAL	DW	74.40	4.49	-0.79	75.12	2.91	41.36	87.96
44	BALRAMPUR	DW	25.98	1.31	-1.76	27.03	0.35	39.70	50.22
45	SONPURI	DW	49.86	1.33	0.50	58.43	0.99	33.05	116.05
46	SONPURI-2	DW	44.68	1.14	0.40	50.00	0.81	19.80	110.30
47	PADANIA	BW	32.33	0.60	-0.50	42.70	0.48	37.21	78.88
48	PALI(PADANIA	HP	39.22	0.70	0.11	52.00	0.65	66.39	124.69
49	JATRAJ	DW	41.21	0.94	0.60	49.89	0.70	33.05	121.55
50	MUDAPAR	DW	28.71	1.51	-2.86	30.91	0.40	44.76	49.41
51	PODIBHAR	DW	25.30	0.50	-0.20	30.54	0.34	27.02	89.94
52	DADAR KHURD	DW	43.21	1.56	-1.39	45.06	0.76	42.55	65.96
53	DADAR KHURD	BW	15.81	0.44	-1.19	21.51	0.19	28.32	53.98
54	KASHINAGAR	DW	46.69	3.00	-0.88	46.87	0.88	30.24	66.97
55	KRSHNANAGAR	DW	29.19	1.94	-3.54	34.11	0.41	43.83	46.76
56	PATHARIA PARA(WARD-17	DW	14.85	0.81	-6.23	15.21	0.17	48.76	31.68
57	MANASNAGAR MOHALA(BHESKHAT AL	DW	46.75	2.18	-1.58	49.99	0.88	38.41	67.89
58	KOHODIA(CHARPAR A	DW	46.64	1.10	-0.49	52.38	0.87	62.20	83.46
59	DARRI	DW	43.85	1.05	-0.50	54.70	0.78	33.05	83.47
60	DARRI-2	HP	35.60	1.58	-1.39	36.05	0.55	24.16	61.49
61	JAMNIPALI	DW	44.99	1.46	-1.29	52.22	0.82	37.21	63.91

62	SEMIPALI(HARSING HPUR	BW	32.86	0.66	-0.50	38.90	0.49	33.05	80.24
63	DUMARMUDA	DW	47.89	1.69	-0.99	55.65	0.92	29.15	73.63
64	SEMIPALI	DW	49.82	1.98	-0.19	55.37	0.99	19.80	83.57
65	SUMEDHA	BW	51.80	3.18	1.21	52.18	1.07	24.76	77.81
66	NAGIN BHATAN-3	DW	41.11	2.04	-0.29	49.29	0.70	20.72	68.57
67	KATAINAR	BW	43.91	1.98	-0.59	45.03	0.78	21.66	72.25
68	GAJRA-3	DW	42.39	1.74	-1.39	45.53	0.74	31.87	66.83
69	GEWRAGHAT	DW	47.62	1.62	0.71	52.21	0.91	24.76	97.42
70	VIJAYANAGAR SEWCL COLONY	BW	36.34	1.05	-0.69	40.42	0.57	35.01	73.95
71	KENCHUA MODE	DW	22.74	0.96	-1.69	23.28	0.29	20.55	50.47
72	KUCHENA	DW	42.43	2.35	-1.17	42.94	0.74	38.92	64.83
73	KUCHENA-2	DW	42.56	2.52	-1.77	43.63	0.74	41.07	62.47
74	MANGAON	BW	30.96	0.90	-0.79	34.02	0.45	29.74	68.92
75	NARAIBODH	BW	30.80	0.79	-1.09	42.01	0.45	37.21	61.52
76	NARIBODH-2	DW	41.50	0.89	0.01	54.36	0.71	62.20	107.42
77	NEWRA	BW	48.12	1.49	-1.00	54.68	0.93	22.85	70.04
78	GEVERA(BARPALI	DW	17.38	0.36	-0.30	26.41	0.21	19.80	77.87
79	K.N. COLLEGE	BW	35.42	1.81	-1.17	38.89	0.55	43.33	59.90
80	Khair Bhawan	DW	32.36	0.64	0.00	35.60	0.48	33.05	103.96
MIN			12.61	0.25	-7.09	15.21	0.14	0.00	31.17
MAX			96.60	17.96	4.53	96.67	28.39	66.39	155.13
AVERAGE			47.69	2.37	-0.20	52.36	1.81	35.46	87.70
STD DEV			19.67	2.42	1.76	19.09	3.62	13.97	28.14

ANNEXURE VI Parameters for Ground Water Suitability for Industrial Purposes

Sl. No.	Block	Village	Latitude	Longitude	Well Type	CR	LSI	RSI
1	Katghora	Dhanras	22.4774	82.6373	HP	0.70	-1.40	10.21
2	Katghora	Dhanras	22.4752	82.6351	HP	0.13	-2.68	12.47
3	Katghora	Dhanras	22.4770	82.6388	DW	0.71	-0.21	7.81
4	Katghora	purenakhar	22.4726	82.6510	HP	0.55	-1.94	11.17
5	Katghora	Chorbhati	22.4596	82.6465	DW	0.41	-1.67	10.65
6	Katghora	purenakhar	22.4714	82.6519	HP	0.51	-2.40	11.48
7	Katghora	purenakhar	22.4732	82.6511	DW	0.28	-2.13	10.95
8	Katghora	Lotlota	22.4715	82.6618	DW	0.76	-3.51	13.24
9	Katghora	Lotlota	22.4701	82.6618	BW	0.39	-2.23	11.23
10	Katghora	Lotlota	22.4796	82.6777	River	0.36	-2.04	11.23
11	Katghora	Lotlota	22.4728	82.6648	DW	0.35	-2.02	11.01
12	Katghora	Madwa Mahua	22.4576	82.6578	BW	0.10	-0.67	9.19
13	Katghora	Nawagaon jhabu	22.4556	82.6766	DW	0.22	-2.01	10.97
14	Katghora	Nawagaon Kala	22.4510	82.6735	BW	0.15	-1.74	10.75
15	Katghora	Banki Mongra Indra Nagar Banki Mongra	22.4118	82.6000	HP	0.35	-1.53	10.09
16	Katghora	Banki Mongra Azad Chowk Banki Mongra	22.4032	82.6071	BW	0.86	-1.93	10.70
17	Katghora	Banki Mongra SECL Banki Mongra	22.3573	82.5961	BW	0.53	-0.60	8.71
18	Katghora	Banki Mongra 2 No.	22.3945	82.6053	BW	0.27	-2.15	11.32
19	Katghora	Banki Mongra	22.4070	82.6087	HP	0.24	-0.17	7.97
20	Korba	Parsabhata	22.4059	82.7317	HP	0.28	-0.57	8.40
21	Korba	Parsabhata Dondro River	22.4070	82.7314	River	0.32	-1.09	10.13
22	Korba	Parsabhata chowk	22.4033	82.7398	HP	0.23	-1.15	10.20
23	Korba	Parsabhata	22.4083	82.7392	BW	0.78	-0.07	7.89
24	Korba	Rogbahari	22.4218	82.7441	BW	0.27	-0.66	8.93
25	Korba	Rogbahari	22.4218	82.7386	DW	0.92	0.04	7.69
26	Korba	Rogbahari	22.4198	82.7496	River	1.08	-2.29	12.39
27	Korba	Semri pali (Urga)	22.2771	82.7226	HP	1.32	-0.10	7.44
28	Korba	Kudurmal	22.2755	82.6974	BW	0.20	-0.46	8.31
29	Katghora	Kanberi	22.2915	82.6965	BW	1.11	-2.54	11.94
30	Katghora	Kanberi Basti	22.2906	82.6966	DW	0.55	-2.65	12.05
31	korba	PANDRIPANI	22.4554	82.6363	BW	1.60	-2.37	11.20
32	korba	BADERIMUDA	22.4399	82.6393	hp	0.15	-1.18	9.65
33	korba	GOPALPUR	22.4366	82.6498	DW	0.60	-1.30	10.32
34	korba	PREMNAGAR JELGAWN	22.4224	82.6654	HP	1.64	-3.60	13.65
35	korba	PREMNAGAR	22.4338	82.6745	BW	0.24	-0.18	8.46
36	korba	AYODHYPURI	22.4320	82.6632	DW	2.89	-2.00	11.01
37	korba	NAGAIKHOR	22.4073	82.8170	BW	7.61	-3.60	13.69
38	korba	KOHADIA	22.3951	82.7090	BW	0.47	-0.93	9.37
39	korba	IRRIGATION COLONY	22.4067	82.6865	DW	1.16	0.12	7.54
40	korba	SITAMANI	22.3377	82.7090	DW	0.84	0.66	6.63
41	korba	BHILAI	22.3143	82.7227	DW	1.59	-1.93	11.09
42	korba	SEMIPALI	22.2770	82.7194	DW	1.47	0.23	7.35
43	korba	KUDURMAL	22.2791	82.7031	DW	0.58	0.49	7.04
44	korba	BALRAMPUR	22.2894	82.6869	DW	0.61	0.16	7.73
45	korba	SONPURI	22.3154	82.6972	DW	2.42	-2.26	11.25
46	korba	SONPURI-2	22.3154	82.6922	DW	2.10	-4.95	15.39
47	korba	PADANIA	22.3151	82.6897	BW	2.21	-4.30	14.51
48	korba	PALI(PADANIA	22.3199	82.6800	HP	0.60	-3.63	13.85
49	korba	JATRAJ	22.3251	82.6927	DW	2.15	-3.36	13.38
50	korba	MUDAPAR	22.3515	82.7138	DW	3.15	-3.46	12.70
51	korba	PODIBHAR	22.3553	82.7337	DW	3.26	-1.93	11.10
52	korba	DADAR KHURD	22.3405	82.7423	DW	5.20	-2.50	12.45
53	korba	DADAR KHURD	22.3389	82.7414	BW	0.83	-1.91	10.83
54	korba	KASHINAGAR	22.3618	82.7454	DW	3.94	-3.10	13.32
55	korba	KRSHNANAGAR	22.3421	82.7224	DW	2.53	-3.34	12.84
56	korba	PATHARIA PARA(WARD-17	22.3696	82.7256	DW	0.97	-2.66	11.63
57	korba	MANASNAGAR MOHALA(BHESKHATAL	22.3753	82.7190	DW	1.16	-1.42	9.92
58	korba	KOHODIA(CHARPARA	22.3954	82.7102	DW	1.28	-1.00	9.47
59	korba	DARRI	22.4067	82.6902	DW	0.75	-1.13	9.45
60	korba	DARRI-2	22.4010	82.6978	HP	0.83	-1.20	9.72
61	korba	JAMNIPALI	22.4202	82.6585	DW	1.74	-2.46	11.47
62	korba	SEMIPALI(HARSINGHPUR	22.4128	82.6434	BW	1.80	-3.46	13.47
63	korba	DUMARMUDA	22.4335	82.6240	DW	0.34	-1.49	10.46
64	korba	SEMIPALI	22.4107	82.6341	DW	0.75	-0.82	9.08
65	korba	SUMEDHA	22.4066	82.6331	BW	0.56	-0.68	8.88
66	korba	NAGIN BHATAN-3	22.3895	82.6358	DW	9.98	-5.19	16.30
67	korba	KATAINAR	22.3931	82.6202	BW	1.02	-1.82	10.44
68	korba	GAJRA-3	22.4002	82.6191	DW	1.04	-1.21	9.58
69	korba	GEWRAGHAT	22.3644	82.6959	DW	1.55	-1.52	10.06
70	korba	VIJAYANAGAR SEWCL COLONY	22.3539	82.7067	BW	1.32	-2.52	11.89

71	korba	KENCHUA MODE	22.3559	82.6373	DW	1.00	-1.24	9.57
72	korba	KUCHENA	22.3560	82.6206	DW	0.90	-2.71	12.73
73	korba	KUCHENA-2	22.3542	82.6226	DW	1.00	-2.25	11.92
74	korba	MANGAON	22.3421	82.6241	BW	0.85	-2.29	11.48
75	korba	NARAIBODH	22.3313	82.6252	BW	2.46	-3.39	13.10
76	korba	NARIBODH-2	22.3308	82.6244	DW	0.32	-2.19	11.43
77	korba	NEWRA	22.3357	82.6343	BW	4.98	-2.84	12.78
78	korba	GEVERA(BARPALI	22.3364	82.6397	DW	8.30	-3.48	13.46
79	korba	K.N. COLLEGE	22.3408	82.6951	BW	0.85	-1.53	9.87
80	Katghora	Khair Bhawan	22.3012	82.6975	DW	0.42	-2.46	12.11
Min						0.10	-5.19	6.63
Max						9.98	0.66	16.30
Average						1.39	-1.85	10.79
SDV						1.78	1.24	2.02

12

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

135 Lpcd पानी की आवश्यकता है परन्तु आज की स्थिति के जल संरक्षण वृद्धि पानी का दुरुपयोग ~~[illegible]~~ पानी की अनुपलब्धता के कारण मांग अनुरूप पानी उपलब्ध न[illegible]

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है? हाँ पाना

पानी का दुरुपयोग, पानी की अनउपलब्धता, जल संरक्षण वृद्धि के कारण पर्याप्त नहीं है

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

कोरबा में नदी से जल आपूर्ति का मुख्य स्रोत है। बोरवेल से भी पानी का स्रोत है

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

कोरबा में पानी ट्रीट करके उपलब्ध कराया जाता है ग्राउंड वाटर में फ्लोराइड, आयरन की अधिकता है

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

पानी का स्तर लगातार ~~[illegible]~~ डाउन हो रहा है जिसके कारण पानी में कमी देखी जा रही है

6. जल आपूर्ति में सुधार हेतु सुझाव?

पानी का दुरुपयोग कम करना / ~~[illegible]~~

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

वाटर हार्वेस्टिंग, ~~[illegible]~~ बरसात के पानी को वाटर हार्वेस्टिंग के माध्यम से संरक्षित करने की आवश्यकता है

8. कोई अन्य सुझाव/टिप्पणी

तालाबों की संख्या बढ़ानी चाहिए, जिससे वाटर हार्वेस्टिंग हो/ मकानों में वाटर हार्वेस्टिंग अनिवार्य होनी चाहिए।

Name: Leeladhar Patel
Mobile No: 9406039683
Industry Type:
Address: Nagar Palik Nigam Korba

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

वर्तमान में सभी एवं पाईप लाईन के जरिये जल प्रदाय किया जा रहा है खदान क्षेत्रों में ज्यादा मांग है।

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

कहीं कहीं जल की बहुत समस्या है वनांचल क्षेत्र पथरीला क्षेत्र में जल नहीं है तो परियोजनाएं नहीं है।

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

जल आपूर्ति का प्रमुख स्रोत नदी, नहर एवं बोरवेल ही है ग्रामीण क्षेत्रों में कुआं सूखते नजर आ रहे हैं बोरवेल के कारण

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

नदी नहर की पानी को फिल्टर से स्वच्छ कर पी रहे हैं हैण्डपंप का पानी में आयरन की मात्रा ज्यादा है।

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

हां देखा गया है दिनोंदिन जल का स्रोत कमी के कारण भूजल सूखते जा रहे हैं।

6. जल आपूर्ति में सुधार हेतु सुझाव?

गांवों में तालाब, स्टाप डेम, नहर नदी में बांध की आवश्यकता है नदी से नदी को जोड़ा जावे तभी छोटे 2 नदियों में भी बारहमासी जल भराव रहे झरी, नालों को संरक्षित की आवश्यकता है।

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

पानी बचायें जल है तो ही कल है
वृक्ष लगायें। खेत में कृत्रिम नहर, नाली, के जरूरत आधार पर

8. कोई अन्य सुझाव/टिप्पणी

घर घर वाटरहार्वेस्टिंग निर्माण हो वर्षा का जल को बहने से बचाना होगा। गांव गांव में स्टापडेम के निर्माण हेतु सरकार को ही ठोस कदम उठाना ही होगा।

[signature]

Name: Narendra Kumar Sahu
Mobile No: 8839441137
Industry Type:
Address: M. P. M. Korba. CG
(W. 15 DHONDHI PARA. CS-EB. Collony Near.)

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

   ~~305 lakh~~ ~~4 lakh/lot~~ / 93 MCM/year

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

   हाँ

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

   नहर

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   नहीं

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   NA

6. जल आपूर्ति में सुधार हेतु सुझाव?

   * भूमिगत जल को अलग से रिचार्ज करके
   * पुराने तालाबो और कुओं का उपयोग करके

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

   STP Plant & ZLD ,

8. कोई अन्य सुझाव/टिप्पणी

   ~~पहले~~ गाव के लोगो को भी खेतो मे पानी की मात्रा फसल के हिसाब से देते है।
   सीवर वाले पानी को दुबारा use करने के लिये क्या करना चाहिये।

Name:
Mobile No:
Industry Type:
Address:

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?
हाँ

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
हाँ

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
हाँ

6. जल आपूर्ति में सुधार हेतु सुझाव?
अधिक से अधिक मात्रा में groundwater और surface water को Recharge करना आवश्यक है।

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?
Rainwater Harvesting

8. कोई अन्य सुझाव/टिप्पणी

Name: Chhabilal Uraon
Mobile No: 7869225427
Industry Type: Municipal Corporation
Address: Nagar Nigam Colony.

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

93 mcm/year

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

हाँ

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

बोरेवेल

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

नहीं

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

उपलब्धता और गुणवत्ता दोनों में बदलाव हुआ है।

6. जल आपूर्ति में सुधार हेतु सुझाव?

जल आपूर्ति को सुधार और जल संरक्षण को ध्यान में रखते हुए कुछ ऐसी स्कीम Introduce करनी चाहिये जिससे लोग जल संरक्षण पर ध्यान दें। उदाहरण के लिए यदि कोई परिवार predefined quantity का water use करता है तो उसको water bill में exemption (some fix amount) मिलना चाहिये।

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

थोड़ा गंदा पानी को पेड़ों के लिए use करके। water waste को रोका जा सकता है।

8. कोई अन्य सुझाव/टिप्पणी

Name: Naresh
Mobile No: 9425534461
Industry Type:
Address: NTPC KORBA

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

परियोजना के तहत वर्तमान के पानी की मांग अधिक है।

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

नहीं परियोजना के लिए जल आपूर्ति पर्याप्त नहीं है।

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

वर्तमान के जल आपूर्ति के स्रोत नदी व नहर है।

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

हाँ, पानी का स्वाद बदल गया है।

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है? हां पिछले 5-10 वर्षों में भूजल की उपलब्धता कम हुई है। तथा गुणवत्ता में भी बदलाव आया है।

6. जल आपूर्ति में सुधार हेतु सुझाव?

आधुनिक आपूर्ति विधि द्वारा जल आपूर्ति करना चाहिए

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

बड़े-बड़े घरों में रैनवाटर हार्वेस्टिंग का निर्माण करवाया जा रहा

8. कोई अन्य सुझाव/टिप्पणी

Name: - विनोद कुमार गोंड़
Mobile No: 8319436202
Industry Type: म.न. कोरबा
Address: - कोरबा

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है? 93 MCM/year

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है? हाँ

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? नहीं

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है? NTPC Korba भूजल का प्रयोग नहीं करता है।

6. जल आपूर्ति में सुधार हेतु सुझाव? Rain water harvesting to be installed to improve the availability of groundwater.

7. आपके स्तर पर जल संरक्षण से संबंधित पहल? rain water harvesting

8. कोई अन्य सुझाव/टिप्पणी

Name:
Mobile No:
Industry Type:
Address:

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

96 MCM / Year.

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

नहर (Right Bank Canal)

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

नहीं।

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

नहीं।

6. जल आपूर्ति में सुधार हेतु सुझाव?

• जल संरक्षण हेतु सरकार के बनाए गए विभिन्न प्रकार के योजना को कार्य में लाना जैसे कि :- 1) Dug well Recharge 2) Recharge Pit and shaft etc.

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

→ STP & ZLD (Zero level (liquid) discharge) by using Pit.

8. कोई अन्य सुझाव/टिप्पणी

— Roof top rain water harvesting system.

Name:
Mobile No:
Industry Type: PSU (NTPC Ltd.)
Address: – NTPC - Korba.

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?
53 mcm/year.

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है? हाँ

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर ✓ / बोरेवेल / कुवां / अन्य)

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? नहीं

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है? हाँ
भू-जल स्तर गिरा है।

6. जल आपूर्ति में सुधार हेतु सुझाव? वर्षा जल को अधिक से अधिक मात्रा में भू-जल में रिस्टोर करना और समुद्र में जाने से रोकना। पानी को नेचुरल फ्लो को बनाये रखना आवश्यक है।

7. आपके स्तर पर जल संरक्षण से संबंधित पहल? उद्योग और टाउनशिप फैसिलिटी में पानी की बर्बादी को रोकना और केमिकल्स को शुद्ध पानी में मिलने से रोकना।

8. कोई अन्य सुझाव/टिप्पणी
शुद्ध पानी को इकट्ठा करने के लिए जो संग्रहण क्षेत्र जैसे झील, तालाब, कुआं आदि को बचाए रखना आवश्यक है। साथ ही साथ इनके कैचमेंट एरिया को बचाना अति आवश्यक है।

Name: RAM GOVIND RATHORE
Mobile No: 9425276603
Industry Type: Power plant
Address:
Q.No. B/1551 Krishna vihar NTPC Township
Korba (C.G.) 495450

Feedback Form (Industries)

कोरवा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

130 लीटर पानी की आवश्यकता है।

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

पानी का दुरुपयोग, पानी की उपलब्धता

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

कोरबा में जल आपूर्ति नदी, बोरवेल

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

पानी में आयरन की मात्रा अधिक, नदियों में प्लांट का स्लज युक्त पानी बहना

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

भू-जल स्तर नीचे जा रहा है

6. जल आपूर्ति में सुधार हेतु सुझाव?

(1) वर्षा के पानी को संचित कर जल संरक्षण किया जाना

(2) पुनर्भरण पीट का निर्माण

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

रेन वाटर हार्वेस्टिंग, वर्षा जल का संचय करना

8. कोई अन्य सुझाव/टिप्पणी

पानी की अपव्ययता को रोकना हेतु, तालाब नाला, नदी का पानी रोक वाटर बाड़ी तैयार करना

Name: Hriday Ram Baghel
Mobile No: 9752094127
Industry Type:
Address: alafur aijow Korba

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. **परियोजना में पानी की वर्तमान मांग क्या है?**

परियोजना में पानी की वर्तमान मांग अति आवश्यक है

2. **क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?**

परियोजना के लिये जल आपूर्ति पर्याप्त नही है

3. **वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)**

वर्तमान में जल आपूर्ति का स्रोत

4. **क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?**

पानी में गुणवत्ता लाना अति आवश्यक है ताकि हमारा शरीर स्वस्थ रहे।

5. **क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?**

5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता में बदलाव लाना आवश्यक है

6. **जल आपूर्ति में सुधार हेतु सुझाव?**

हम अपने जीवन में जल आपूर्ति लाना व अपने क्षेत्र में पानी बचाव का सुझाव देना आवश्यक है।

7. **आपके स्तर पर जल संरक्षण से संबंधित पहल ?**

जल संरक्षण के लिये रेन वाटर हार्वेस्टिंग व वृक्षारोपण करना भूजल स्तर के लिये आवश्यक है

8. **कोई अन्य सुझाव/टिप्पणी**

भूजल स्तर की कमी को दूर करने के लिये शौकता वृक्षारोपण नदी नाले की पानी को संरक्षण रखना हमारे जीवन के लिये आवश्यक है ताकि भूजल स्तर में जल की कमी न हो।

Name: देवचरण वरठ [signature]
Mobile No: 9669836392
Industry Type:
Address:

जल प्रदाय न.पा.नि. कोरबा छ.ग.

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

परियोजना में पानी की वर्तमान मांग अति आवश्यक है

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

परियोजना के लिये जल आपूर्ति पर्याप्त नहीं है

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

वर्तमान में जल आपूर्ति का स्रोत

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

पानी में गुणवत्ता लाना अति आवश्यक है ताकि हमारा शरीर स्वस्थ रहे।

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता में बदलाव लाना आवश्यक है

6. जल आपूर्ति में सुधार हेतु सुझाव?

हम अपने जीवन में जल आपूर्ति लाना व अपने क्षेत्र में
पानी बचाव का सुझाव देना आवश्यक है।

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

जल संरक्षण के लिये रेन वाटर हार्वेस्टिंग व वृक्षारोपण करना
भूजल स्तर के लिये आवश्यक है

8. कोई अन्य सुझाव/टिप्पणी

भूजल स्तर की कमी को दूर करने के लिये अधिकता वृक्षारोपण
नदी नाले की पानी को संरक्षण रखना हमारे जीवन के लिये
आवश्यक है ताकि भूजल स्तर में जल की कमी न हो।

Name: देवचरण वरo [signature]
Mobile No: 9669836392
Industry Type:
Address:

जल प्रदाय न.पा. नि. कोरबा छ.ग.

Feedback Form (Industries)

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. परियोजना में पानी की वर्तमान मांग क्या है?

—

2. क्या परियोजना के लिए जल आपूर्ति पर्याप्त है?

पर्याप्त है।

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (नदी/ नहर / बोरेवेल / कुवां / अन्य)

नदी

4. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

1) जलस्तर गिरते है।

5. क्या पिछले 5-10 वर्षों में भूजल की उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

(1) जल स्तर में गिरावट
(2) जल संबन्धी तकनीक का उपयोग
(3) स्थानीय जल संचयन

6. जल आपूर्ति में सुधार हेतु सुझाव?

1) वर्षा के पानी को संचित करने के लिये जल संचय की योजनाओ को बढ़ावा दे।
2) जल का सही उपयोग करे और उसकी बर्बादी को रोकें।
3) जल संचालन के तकनीकी और उपयोग की सुविधा सुनिश्चित करे।
4) जल संरक्षण के लिये सामुदायिक और व्यक्तिगत स्तर पर जागरूकता बढ़ाए।

7. आपके स्तर पर जल संरक्षण से संबंधित पहल ?

(1) जल की बचत
(2) जल संचयन
(3) जल प्रदूषण कम करे
(4) जल संरक्षण
(5) जल संबंधी शिक्षा

8. कोई अन्य सुझाव/टिप्पणी

(1) लोगो को जल के उपयोग मे सावधानी बरतने की जागरूकता दिलाना।
(2) जल का सही तरीके से प्रबंधन करना और बचाव के उपयोग को अपनाना।
(3) जल की गुणवत्ता को बनाए रखने के लिये जल प्रदूषण के विरुद्ध कदम उठाना।
(4) जल संरक्षण से संबंधित कानून को मजबूत करना और पालन को सुनिश्चित करना।
(5) समुद्र के पानी को शुद्ध करने की तकनीक का विकास करना

Name: BIPIN KUMAR MISHRA
Mobile No: 9131695020
Industry Type: N.P.N.ILom.
Address: MIG-2 SADA COLONY KORBA Kar

ANNEXURE VIII Drinking Water Supply Feedback Form

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?

Ans. नहीं, No

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

Ans. Right now I am not facing water scarcity problems in Katghora. but in future there will be

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

Ans. Borewell

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

Ans. Borewell + Nagar palika Katghora supply system

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

Ans. Morning 5 to 7 Am & evening 3 to 5 pm

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

Ans. Hair fall problem occurs due to Hard water, & in our field areas there may be fluride contamination (Information given by local people)

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

Ans. NO.

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

Ans. I am living in Katghora ~~[illegible]~~ since 2 years.

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

Ans. ① Install Water meter in every houses.
② Rain water harvesting systems.

Name: Naveen Shrivas
Mobile No: 8319697265
Address: PWD Colony, Katghora

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   नहीं – क्योंकि CSEB, West द्वारा सप्लाई स्वोर्ड जल का प्रदान किया जाता है

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   —

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई ✓ / बोरेवेल / कुवां)

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   हाँ

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   सुबह 8:00 बजे, सायं 6:00 बजे

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   स्वोर्ड पानी के क्लोरिनेशन का विकल्प होना चाहिए।

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   स्वोर्ड पानी के क्लोरिनेशन के कारण सम्भवतः दूरगामी नुकसान हो सकते हैं

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   जी बिल्कुल, पानी का स्तर निरन्तर घटता जा रहा है

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

    आधुनिक अथवा प्राकृतिक तरीके से शुद्ध किया हुआ जल आम जन के लिए उपलब्ध किया जाना चाहिए।

Name: सिद्धार्थ पाण्डेय
Mobile No: 7987443307
Address: CSEB, West

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   हां ~~पर्याप्त पानी~~ WHO के मानक से कम है
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी के मौसम में औसतन से कम अधिक समस्या होती है)
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)
   नगर निगम द्वारा सप्लाई
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? — हां
5. यदि हां तो कृपया आपूर्ति का समय बताएं? - सुबह 7.00 - 8.00 एवं संध्या 4.00-5.00 बजे
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? —
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? — पानी गुणवत्ता मानक अनुसार सप्लाई किया जा रहा है
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है? - नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है? — हां
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव? ~~पेयजल~~ जल आपूर्ति हेतु जन जागरूकता अभियान चलाया जावे, ~~अधिक से अधिक~~ नल के टोटी को खुला न छोड़े

Name: Rakesh Masih
Mobile No: 8223009610
Address: - Municipal. ~~Corp~~ Corporation Korba

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   नहीं
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई ✓ / बोरेवेल / कुवां)
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? हाँ
5. यदि हां तो कृपया आपूर्ति का समय बताएं? 7 Am and 4 pm (30 minut)
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? ^
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   Rainy Season में मटमैला पानी आता है।
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   हाँ
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    surface water and ground water को ज्यादा से ज्यादा Recharge करके जल आपूर्ति में सुधार किया जा सकता है।

Name: Chhabilal Uraon
Mobile No: 7869225427
Address: Nagar Nigam korba.

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यो और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   हां पर कभी-कभी करना पड़ता है।

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   ग्रीष्म ऋतु में

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

   सप्लाई वाटर

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   हां, पाईप से पानी की आपूर्ति की जाती है।

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   हां सुबह 7:30 AM To 8:30 AM एवं शाम 5:00 बजे से 6:00 बजे तक

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

   —

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   नहीं है।

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   —

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   भूजल की उपलब्धता में कमी हुई है।

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

    जल आपूर्ति के लिए आधुनिक विधियों का उपयोग करना चाहिए। रिंग प्रणाली एवं ग्रीड प्रणाली जल प्रदाय हेतु उपयोग करना चाहिए।

Name: AKASH AGRAWAL
Mobile No: 9752094225
Address:

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यो और पीने के लिए पानी की कमी का सामना कर रहे हैं? हां
   135 LCD से कम है
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी में पानी की कमी का सामना करना पड़ता है
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां) सप्लाई
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? हां
5. यदि हां तो कृपया आपूर्ति का समय बताएं? सुबह 7 बजे से 8.30 तक शाम 4 बजे 5.30 तक
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? –
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? ट्रीट करके वाटर सप्लाई किया
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है? नहीं
   भू जल उपलब्ध कम होती जा रही, गाड़ी वाश व अन्य कार्य आदि
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

Name: Hriday Ram Baghel
Mobile No: 9752094127
Address: Gopur Atijan Korba

Feedback Form 01

कोरवा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं? हां
   135 Lpcd से कम है
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी में पानी की कमी का सामना करना पड़ता है
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां) सप्लाई
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? हां
5. यदि हां तो कृपया आपूर्ति का समय बताएं? सुबह 7-0 बजे से 8 बजे एवं शाम 4 से 5 बजे
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? ——
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? ट्रीटेड वाटर सप्लाई किया जाता है
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है? नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   भूजल उपलब्धता कम होती जा रही है कोरबा में ग्राउंडवाटर के आयरन की मात्रा एवं फ्लोराइड की मात्रा पायी जाती है
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    पानी का दुरुपयोग नही होने से पानी पर्याप्त मात्रा में मिल सकेगी

Name: Leeladhar Patel
Mobile No: 9406039687
Address: NPN Korba

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यो और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   नहीं

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   गर्मी के समय में पानी के सामना करना पड़ता है।

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

   सप्लाई नगर निगम से आता है।

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   हाँ

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   7.30 से 8.30 तक सुबह शाम 4.30 से 5 बजे

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

   पानी की आपूर्ति होती है।

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   पानी की गुणवत्ता सही है।

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   पानी से कोई बीमार नहीं हुआ है।

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   10 वर्षों में भूजल का पानी लेवल जो ~~70~~ 60' से 70' में था वो 90' से 100' फुट में चला गया है

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

    बरसाती पानी का संरक्षण होना चाहिए।

Name: नरेश चन्द्र श्रीवास
Mobile No: 9131081988
Address: नगर पालिक निगम कालोनी

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   नहीं

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   नहीं

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

   सप्लाई

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   हाँ

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   सुबह 7 to 8·30 AM 5 to 6·30 PM.

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   नहीं

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   नहीं

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   ग्रामीण क्षेत्र में वाटर लेवल नीचे (हैंडपंप में लाल पीला जल

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

    अवैध नल कनेक्शन की जांच किया जाये पानी व्यर्थ में बहते रहते है नल भी नहीं लगाते हैं

Name: नरेन्द्र कुमार साहू
Mobile No: 8839441137
Address: 14. P. H. Korba.

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   नहीं

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   नहीं

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

   जल संयोजन से

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   हां

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   सुबह 7AM to 8:30 Am / शाम 4pm to 6pm

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

   बोरवेल से पानी की आपूर्ति की जाती है

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   नहीं है पानी की गुणवत्ता सही है

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   नहीं

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   शहरी एवं ग्रामीण क्षेत्रों में भूजल उपलब्धता और गुणवत्ता में बदलाव देखा गया है

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

   जल आपूर्ति में [illegible] घर के पास रेन वाटर हार्वेस्टिंग बनाना व वृक्षारोपण करना आवश्यक है ताकि पानी को संचित कर सके व भूजल स्तर में पानी उपलब्ध रहे।

Name: देवचरण पटेल
Mobile No: 9669836392
Address:
जल प्रदाय न.पा. निगम कोरबा।

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   नहीं

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   गर्मी के दिनों में

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

   ✓ (सप्लाई)

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   जी हां

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   सुबह एवं शाम को 1-1 घण्टा

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   नगर ~~निग~~ निगम क्षेत्रों में नहीं है
   लेकिन इस क्षेत्र के Hand Pump से ~~A~~ Iron पानी आता है

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   नहीं

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   Water level प्रत्येक वर्ष डाउन हो रहा है

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

    (i) 24×7 water supply होना चाहिए
    (ii) उपभोक्ता को पानी का महत्व को ~~$~~ समझना चाहिए
    (iii) कड़ा कानून होना चाहिए ताकि पानी का व्यर्थ बहाव / उपयोग / ~~व~~ पानी बचाव किया जा सके

Name:
Mobile No:
Address:

Ramesh kr. Suryawanshi
Mob. No. 8962985823
N.P.N. Korba.

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   कभी कभी
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी मे
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)
   सप्लाई और बोर से
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?
   हां
5. यदि हां तो कृपया आपूर्ति का समय बताएं?
   2 घंटा
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?
   सप्लाई और बोर से
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   नहीं है।
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   अभी तक ऐसा कुछ पता नही चला है
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   भूजल पहले से कम हो रहा
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    स्वच्छ और जरूरत के हिसाब से आपुर्ति करना चाहिए

Name:
Mobile No:
Address:

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?

   नहीं

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?

   गर्मी के मौसम में

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

   सप्लाई

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?

   हां

5. यदि हां तो कृपया आपूर्ति का समय बताएं?

   1 घंटा

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

   सप्लाई द्वारा पानी की आपूर्ति की जाती है।

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?

   हां: पानी को साफ करने के लिए अत्यधिक केमिकल का प्रयोग किया जाता है, जिससे कई प्रकार की समस्या उत्पन्न होती है

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?

   जी हां मेरे परिवार में कई सदस्य को त्वचा एवं पेट संबंधित बिमारी दूषित पानी से हो रहा है।

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

   भूजल से, अत्यधिक जल का ~~[illegible]~~ उपयोग किया जा रहा है। परन्तु भूजल संचय नहीं किया जा रहा

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

   "1" आवश्यकता अनुसार जल आपूर्ति करना चाहिए, अनावश्यक रूप से जल की आपूर्ति कर जल संचय पर ध्यान देना चाहिए

Name: C. R. Marong.
Mobile No: 9575045400
Address: Kusmunda. SECL

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं? नहीं
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है? ग्रीष्मकालीन (मई जून)
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां) बोरवेल
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? नहीं
5. यदि हां तो कृपया आपूर्ति का समय बताएं? ✗
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? बोरवेल से
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? नहीं
   PH value ज्ञात नहीं
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है? नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है? हाँ
   जल स्तर में कमी
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    नदी, नाला के पानी को स्टापडेम बनाकर एवं हर मकान में water Harvesting System एवं पानी का उपयोग बिना बर्बाद किये हुए

Name: Vinod kumar Norge
Mobile No: 7869820771
Address:

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   नहीं
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   ग्रीष्म ऋतु में
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई ✓ / बोरवेल ✓ / कुवां)
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?
   हाँ
5. यदि हां तो कृपया आपूर्ति का समय बताएं?
   8 AM.
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?
   —
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   नहीं
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   —
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई वदलाव देखा गया है?
   भूजल ~~अधिक~~ गहराई बढ़ गई है।
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    जल आपूर्ति पानी का अपव्यय न हो व उसकी PH Value सुधार करने की आवश्यकता है। गंदे जल के लिए Sedimantory tank की व्यवस्था हो जिससे water recharge हो व अधिक से अधिक Rain water को filterd करके store करने की आवश्यकता है।

Name:
Mobile No:
Address:

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यो और पीने के लिए पानी की कमी का सामना कर रहे हैं? No

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है? गर्मी

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां) सप्लाई

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? yes

5. यदि हां तो कृपया आपूर्ति का समय बताएं? सुबह 7 से 8.20 शाम 4:30 से 5:00

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? —

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? No बारिश के समय गुणवत्ता खराब रहती है।

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
बारिश में बच्चे बीमार हुआ है।

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
भूजल का स्तर कम हो रहा है

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
प्राकृतिक जल स्तर के सुधार हेतु जल विभाग को शामिल करना चाहिए (भूजल संरक्षण के कार्यों पर) ताकि जल स्तर में सुधार हो। वनीकरण

Name: Rajendra Singh kanwar
Mobile No: 8109337551
Address: PWD colony Rampur Korba

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   नहीं
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)
   सप्लाई
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?
   हाँ
5. यदि हां तो कृपया आपूर्ति का समय बताएं?
   सुबह 7:00 से 8:00 शाम 4:30 to 5:30
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   excess of potassium use
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   हाँ पीने के पानी में गुणवत्ता कम हुई है पहले के तुलना में मुझे लगता है न खारीया पानी लगता है टेस्ट में
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    सही तरीका से पहुँचाया जाए पानी

Name: Omprakash Vishwakarma.
Mobile No: 8827251098
Address: I+T P.W.D Colony Rampur Korba (C.G)

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं? – नहीं
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है? – गर्मी
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई ✓ / बोरेवेल / कुवां)
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? – हां
5. यदि हां तो कृपया आपूर्ति का समय बताएं? – 6:30 to 7:30 & 4:30 to 5:30
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है? –
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है? – नहीं
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है? – नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है? – हां
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव? – भूजल को बढ़ाना + तालाब को बढ़ाना + Stop Dam

Name: Narendra mishra
Mobile No: –98934-06720
Address: – RG-4, P.W.D collony Korba - 495677

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं? नहीं।

2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है? गर्मी

3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)

4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है? हाँ

5. यदि हां तो कृपया आपूर्ति का समय बताएं? 6:30 a.m. / 1.00 Pm / 7.00 P.m.

6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?

7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
नहीं।

8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
बीमार नहीं हुए हैं किंतु Hair fall, एवं Thyroid की समस्या Bore के पानी से आ रही है इसलिए पीने के पानी की उपलब्धता में सुधार की आवश्यकता है।

9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?

10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

Name:
Mobile No:
Address:

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यो और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   नहीं कर रहे हैं।
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी के मौसम में।
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)
   सप्लाई (नगर निगम)
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?
   हाँ
5. यदि हां तो कृपया आपूर्ति का समय बताएं?
   सुबह 6 से 8 एवं शाम 4 से 6
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?
   —
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   नहीं
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   नहीं
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

Name: [signature]
Mobile No:
Address: P.W.D.

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यो और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   नहीं कर रहे हैं।
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी के मौसम में।
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)
   सप्लाई (नगर निगम)
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?
   हाँ
5. यदि हां तो कृपया आपूर्ति का समय बताएं?
   सुबह 6 से 8 एवं शाम 4 से 6
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?
   —
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   नहीं
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   नहीं
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   नहीं
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?

Name: Alley [illegible] SIR
Mobile No:
Address: P.W.D.

22/12/23

Feedback Form 01

कोरबा क्षेत्र में भूजल मुद्दे और प्रबंधन (NAQUIM 2.0)

1. क्या आप घरेलू कार्यों और पीने के लिए पानी की कमी का सामना कर रहे हैं?
   नहीं।
2. किस मौसम में आपको पानी की अधिक कमी का सामना करना पड़ता है?
   गर्मी के मौसम।
3. वर्तमान जल आपूर्ति का स्रोत क्या है? (सप्लाई / बोरेवेल / कुवां)
   बोरेवेल।
4. क्या आपके घर में पाइप से पानी की आपूर्ति की जाती है?
   नहीं।
5. यदि हां तो कृपया आपूर्ति का समय बताएं?
   —
6. यदि नहीं, तो पानी की आपूर्ति कैसे की जाती है?
   बोरेवेल से।
7. क्या पानी की गुणवत्ता से संबंधित कोई समस्या है?
   नहीं।
8. यदि हां, तो क्या आपके परिवार में कोई दूषित पानी के कारण बीमार हुआ है?
   —
9. क्या पिछले 5-10 वर्षों में भूजल उपलब्धता और गुणवत्ता के मामले में कोई बदलाव देखा गया है?
   नदियों एवं तालाब में जल नहीं रहता।
10. आपके क्षेत्र में जल आपूर्ति में सुधार के लिए सुझाव?
    —

Name: Seema Naetik
Mobile No:
Address:

ANNEXURE IX Pumping Test/ PYT Datasheet for Korba Industrial Area

1. PYT DATASHEET, Banki Mongra Stadium, Korba (Lat- 22.407441, Long-82.596012)

Time since pumping started (min) t	Time since pumping stopped (min) t'	Depth to water (m)	Residual Draw down (m)	t/t'	SWL (m bgl)
100	0	38.6	28.6	0.00	10
101	1	35.61	25.61	101.00	10
102	2	32.8	22.8	51.00	10
103	3	30.18	20.18	34.33	10
104	4	27.97	17.97	26.00	10
105	5	26.06	16.06	21.00	10
106	6	24.45	14.45	17.67	10
107	7	23.06	13.06	15.29	10
108	8	21.9	11.9	13.50	10
109	9	20.85	10.85	12.11	10
110	10	19.95	9.95	11.00	10
112	12	18.55	8.55	9.33	10
114	14	17.65	7.65	8.14	10
116	16	16.82	6.82	7.25	10
118	18	16.22	6.22	6.56	10
120	20	15.67	5.67	6.00	10
125	25	14.75	4.75	5.00	10
130	30	14.05	4.05	4.33	10
135	35	13.55	3.55	3.86	10
140	40	13.05	3.05	3.50	10
145	45	12.8	2.8	3.22	10
150	50	12.53	2.53	3.00	10
155	55	12.26	2.26	2.82	10
160	60	12.12	2.12	2.67	10
170	70	11.75	1.75	2.43	10
180	80	11.53	1.53	2.25	10
180	90	11.35	1.35	2.00	10
190	100	11.2	1.2	1.90	10
200	110	11.06	1.06	1.82	10

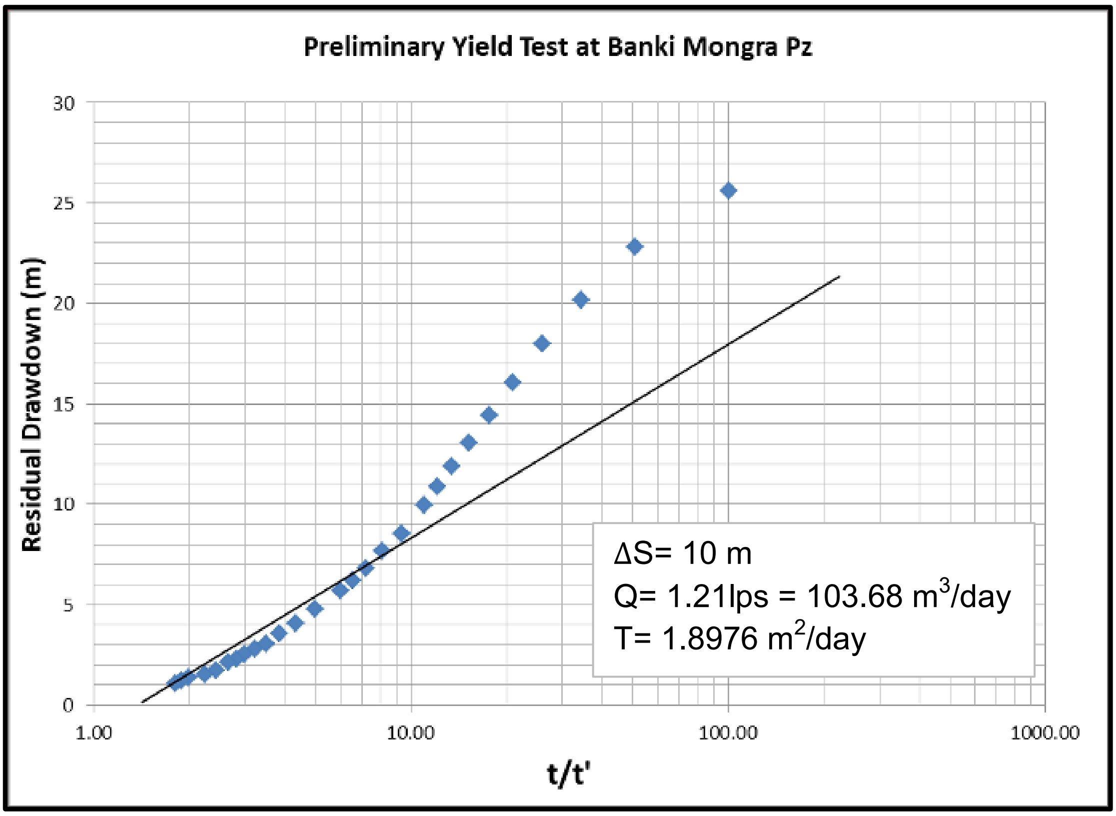


Fig 1. t/t' Vs. RDD plot for Banki Mongra Stdium

2. SLUG TEST DATASHEET, GOPALPUR PZ (Lat- 22.4410877, Long- 82.6442550)

Time (min)	Time (t) in Sec since injection of Slug	DTW (mbmp)	SWL (mbmp)	Residual drawdown/ head(m)	H/H'	1/t
1	60	2.53	4.78	2.25	3.722412	0.016667
2	120	2.62	4.78	2.16	3.573515	0.008333
3	180	2.7	4.78	2.08	3.441163	0.005556
4	240	2.78	4.78	2	3.308811	0.004167
5	300	2.84	4.78	1.94	3.209546	0.003333
6	360	2.9	4.78	1.88	3.110282	0.002778
7	420	2.95	4.78	1.83	3.027562	0.002381
8	480	2.98	4.78	1.8	2.97793	0.002083
9	540	3.04	4.78	1.74	2.878665	0.001852
10	600	3.1	4.78	1.68	2.779401	0.001667
12	720	3.15	4.78	1.63	2.696681	0.001389
14	840	3.21	4.78	1.57	2.597416	0.00119
16	960	3.29	4.78	1.49	2.465064	0.001042
18	1080	3.36	4.78	1.42	2.349256	0.000926

20	1200	3.38	4.78	1.4	2.316167	0.000833
25	1500	3.5	4.78	1.28	2.117639	0.000667
30	1800	3.61	4.78	1.17	1.935654	0.000556
35	2100	3.71	4.78	1.07	1.770214	0.000476
40	2400	3.76	4.78	1.02	1.687493	0.000417
45	2700	3.83	4.78	0.95	1.571685	0.00037
50	3000	3.89	4.78	0.89	1.472421	0.000333
55	3300	3.94	4.78	0.84	1.3897	0.000303
60	3600	3.99	4.78	0.79	1.30698	0.000278
70	4200	4.07	4.78	0.71	1.174628	0.000238
80	4800	4.14	4.78	0.64	1.058819	0.000208
90	5400	4.2	4.78	0.58	0.959555	0.000185
100	6000	4.24	4.78	0.54	0.893379	0.000167
110	6600	4.27	4.78	0.51	0.843747	0.000152
120	7200	4.29	4.78	0.49	0.810659	0.000139

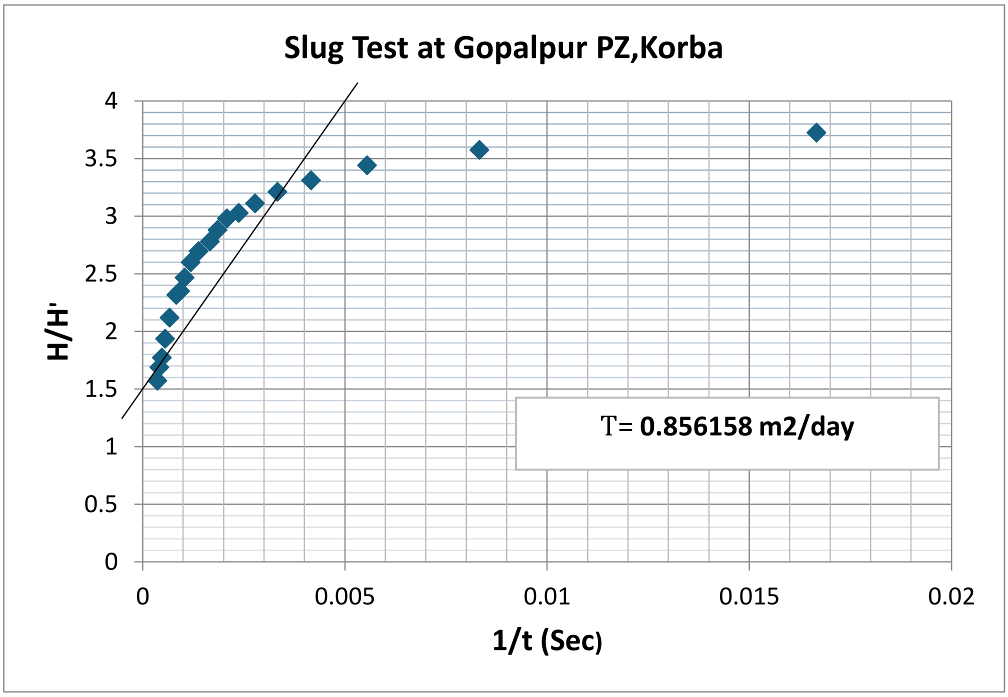


Fig.2-(H/H' versus 1/t plot)

2. **PYT DATASHEET, Indira Nagar Stadium, Korba (Lat- 22.3593450, Long-82.7026102)**

Time since pumping started (min) t	Time since pumping stopped	Depth to water (m)	Residual Draw down	t/t’	SWL (m bgl)
	(min) t’		(m)		
100	0	18.72	0.57	0.00	18.15
101	1	18.22	0.07	101.00	18.15
102	2	18.2	0.05	51.00	18.15
103	3	18.2	0.05	34.33	18.15
104	4	18.2	0.05	26.00	18.15
105	5	18.2	0.05	21.00	18.15
106	6	18.19	0.04	17.67	18.15
107	7	18.19	0.04	15.29	18.15
108	8	18.19	0.04	13.50	18.15
109	9	18.19	0.04	12.11	18.15
110	10	18.19	0.04	11.00	18.15
112	12	18.18	0.03	9.33	18.15
114	14	18.18	0.03	8.14	18.15
116	16	18.18	0.03	7.25	18.15
118	18	18.18	0.03	6.56	18.15
120	20	18.17	0.02	6.00	18.15
125	25	18.16	0.01	5.00	18.15
130	30	18.16	0.01	4.33	18.15
135	35	18.16	0.01	3.86	18.15
140	40	18.16	0.01	3.50	18.15

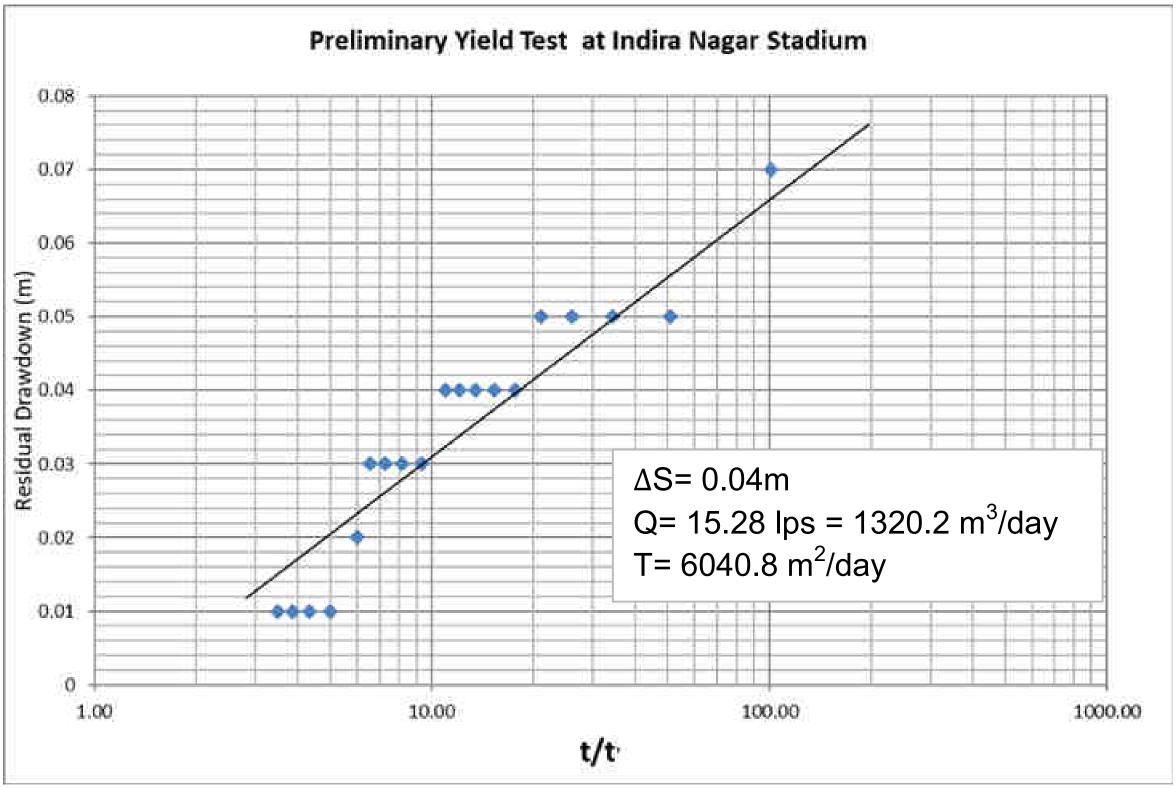


Fig 3. t/t' Vs. RDD plot for Indira nagar Stdium

3. PYT DATASHEET, Rishdi, Korba (Lat- 22.3654945, Long- 82.7606364)

Date/hrs	Time since pumping started (min) t	Time since pumping stopped (min) t'	Depth to water (m)	Residual Draw down (m)	t/t'	SWL (m bgl)
11.3.2024	100	0	33.55	26.13	0.00	7.42
	101	1	31.6	24.18	101.00	7.42
	102	2	25.71	18.29	51.00	7.42
	103	3	21.51	14.09	34.33	7.42
	104	4	18.79	11.37	26.00	7.42
	105	5	16.8	9.38	21.00	7.42
	106	6	15.46	8.04	17.67	7.42
	107	7	14.46	7.04	15.29	7.42
	108	8	13.65	6.23	13.50	7.42
	109	9	13.09	5.67	12.11	7.42
	110	10	12.61	5.19	11.00	7.42
	112	12	11.95	4.53	9.33	7.42
	114	14	11.43	4.01	8.14	7.42
	116	16	11.07	3.65	7.25	7.42

	118	18	10.79	3.37	6.56	7.42
	120	20	10.55	3.13	6.00	7.42
	125	25	10.14	2.72	5.00	7.42
	130	30	9.85	2.43	4.33	7.42
	135	35	9.62	2.2	3.86	7.42
	140	40	9.43	2.01	3.50	7.42
	145	45	9.25	1.83	3.22	7.42
	150	50	9.18	1.76	3.00	7.42
	155	55	9.06	1.64	2.82	7.42
	160	60	8.96	1.54	2.67	7.42
	170	70	8.82	1.4	2.43	7.42
	180	80	8.69	1.27	2.25	7.42
	190	90	8.58	1.16	2.11	7.42
	200	100	8.5	1.08	2.00	7.42
	210	110	8.44	1.02	1.91	7.42

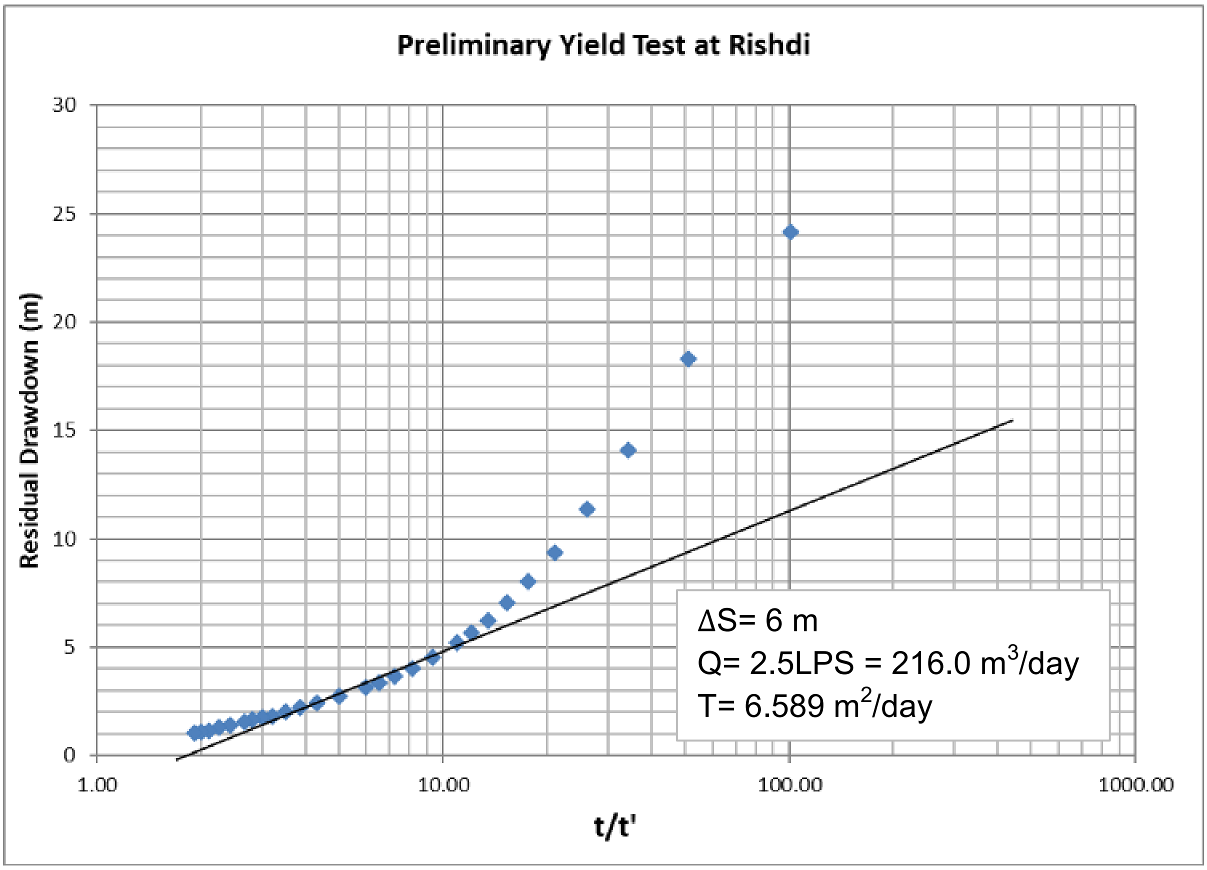


Fig 4. t/t' Vs. RDD plot for Rishdi Stadium

ANNEXURE X Geophysical Study TEM/VES Datasheet

1. Salora1 Coordinates: 22.4857346, 82.5983215

AB/2	MN/2	R	K'=2K	Apparent Resistivity
2	0.5	19.6529	23.5619449019234	463.060546963011
4	0.5	4.66173	98.9601685880785	461.325586712103
6	0.5	2.41702	224.62387473167	542.920397703942
8	0.5	1.54899	400.553063332699	620.452689571717
10	0.5	1.1066	626.747734391164	693.559042877262
15	0.5	0.5911	1412.14589778861	834.719440182849
20	0.5	0.37869	2511.70332654504	951.156932729341
25	0.5	0.27115	3925.42002066045	1064.37763860208
30	0.5	0.20264	5653.29598013483	1145.58389741452
30	5	2.1108	549.778714378214	1160.47291030953
35	5	1.576	753.98223686155	1188.2760052938
40	5	1.22897	989.601685880785	1216.19078389691
50	5	0.84062	1555.08836352695	1307.23838014802
60	5	0.6334	2246.2387473167	1422.7676225504
70	5	0.50502	3063.05283725005	1546.90294386802
80	5	0.40844	4005.53063332699	1636.01893187607
90	5	0.33419	5073.67213554752	1695.57049097862
100	5	0.2637	6267.47734391164	1652.7337755895
120	5	0.16966	9032.07887907065	1532.38250262313
150	5	0.07771	14121.4589778861	1097.37857717153

2. Salora2 Coordinates: 22.4884516, 82.6016478

AB/2	MN/2	R	K	Apparent Resistivity
2	0.5	18.3995	11.7809724509617	216.76400261147
4	0.5	5.30686	49.4800842940392	262.583880136665
6	0.5	2.481	112.311937365835	278.645916604637
8	0.5	1.48146	200.276531666349	296.70167060243
10	0.5	1.10496	313.373867195582	346.26558829643
12	0.5	0.88508	451.603943953533	399.705618714393
15	0.5	0.72038	706.072948894306	508.64083092448
20	0.5	0.61331	1255.85166327252	770.226383601669
25	0.5	0.50343	1962.71001033022	988.087100500544
30	0.5	0.39961	2826.64799006742	1129.55680331084
35	0.5	0.39536	3847.6656024841	1521.21307259811
35	2	1.00741	958.971157508284	966.077133785421
40	2	0.84694	1253.49546878233	1061.6354523305
50	2	0.64208	1960.35381584003	1258.70397807457
60	2	0.49311	2824.29179557722	1392.68652731709
70	2	0.37358	3845.30940799391	1436.53068863836
80	2	0.28051	5023.40665309008	1409.1158002583

3. Dhanras Coordinates: 22.47346, 82.6420983

AB/2	MN/2	R	K'=2K	Apparent Resistivity
2	0.5	8.78104	23.5619449019234	206.898380661586
4	0.5	1.6415	98.9601685880785	162.443116737331
6	0.5	0.77694	224.62387473167	174.519273234024
8	0.5	0.54181	400.553063332699	217.023655244289
10	0.5	0.41627	626.747734391164	260.89627939501
15	0.5	0.30403	1412.14589778861	429.334717304672
20	0.5	0.256	2511.70332654504	642.99605159553
25	0.5	0.22301	3925.42002066045	875.407918807486
30	0.5	0.20069	5653.29598013483	1134.55997025326
30	5	2.24161	549.778714378214	1232.38946393735
40	5	1.44	989.601685880785	1425.02642766833
50	5	1.01201	1555.08836352695	1573.76497477291
60	5	0.776	2246.2387473167	1743.08126791776
80	5	0.47061	4005.53063332699	1885.04277135001
100	5	0.216	6267.47734391164	1353.77510628491
120	5	0.14769	9032.07887907065	1333.94772964994
150	5	0.06623	14121.4589778861	935.264228105398
200	5	0.02124	25117.0332654504	533.485786558166

4. Indira Stadium Coordinates: 22.3593887, 82.7026964

AB/2	MN/2	R	K'=2K	Apparent Resistivity
2	0.5	4.18001	23.5619449019234	98.489165309489
4	0.5	1.44041	98.9601685880785	142.543216435954
6	0.5	0.86724	224.62387473167	194.802809122294
8	0.5	0.54522	400.553063332699	218.389541190254
10	0.5	0.38696	626.747734391164	242.526303300005
15	0.5	0.17509	1412.14589778861	247.252625243808
20	0.5	0.09407	2511.70332654504	236.275931928092
25	0.5	0.06409	3925.42002066045	251.580169124128
30	0.5	0.04718	5653.29598013483	266.722504342761
30	5	0.46417	549.778714378214	255.190785852935
40	5	0.2938	989.601685880785	290.744975311775
50	5	0.21482	1555.08836352695	334.064082252859
60	5	0.15641	2246.2387473167	351.334202467805
80	5	0.09315	4005.53063332699	373.115178494409
100	5	0.07958	6267.47734391164	498.765847028488
120	5	0.06727	9032.07887907065	607.587946195083
150	5	0.05487	14121.4589778861	774.844454116612

ANNEXURE XI Soil Infiltration Test Datasheet

sl no.	Location	Lattitude	Longitude	Date of SIT	mean or avg. K (cm/sec)	mean or avg. (cm/hr)	Test duration in min.	Soil type
1	Dhanras	22.4791269	82.638435	24/1/2024	0.001462439266	5.264781358	60	alfi red loamy soil
2	Balgi(pump house premise)	22.383979	82.650875	25/1/2024	0.01333411867	48.0028272	60	alfi red loamy soil
3	Gopalpur	22.44291	82.64871	26/1/2024	0.001642284972	5.912225898	100	alfi red loamy soil
4	Indira Nagar Stadium (right side of auditorim)	22.3613725	82.700405	15/2/2024	0.0007212976318	2.596671475	100	compacted sandy soil
5	Indira Nagar Stadium (left side of auditorim laterite exposure)	22.3593776	82.699828	15/2/2024	0.003836097698	13.80995171	115	lateritic soil
6	Daganiyakhar	22.3715782	82.6507044	14/2/2024	0.002092324592	7.532368532	80	compacted soil
7	Purenakhar (on top of fly ash)	22.474983	82.653817	13/2/2024	0.0008383441075	3.018038787	90	compact overburden over fly ash
8	Purenakhar (on top of fly ash)	22.474283	82.653968	13/2/2024	0.007505812764	27.02092595	80	fly ash

1.Dhanras (near ash pond). maximum k-0.004032787374 cm/sec, minimum k-0.00008008534853cm/sec

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.016	314	706.5	392.5	18.5	18.2	60	5809	23550	0.2466666667	1.016483516	0.016349138	0.004032787374
0.033	314	706.5	392.5	18.2	18	60	5714.8	23550	0.2426666667	1.011111111	0.01104983619	0.002681426915
0.05	314	706.5	392.5	18	17.8	60	5652	23550	0.24	1.011235955	0.0111733006	0.002681592144
0.066	314	706.5	392.5	17.8	17.6	60	5589.2	23550	0.2373333333	1.011363636	0.01129955525	0.002681761114
0.083	314	706.5	392.5	17.6	17.5	60	5526.4	23550	0.2346666667	1.005714286	0.005698021115	0.001337135622
0.1	314	706.5	392.5	17.5	17.4	60	5495	23550	0.2333333333	1.005747126	0.005730674709	0.001337157432
0.116	314	706.5	392.5	17.4	17.3	60	5463.6	23550	0.232	1.005780347	0.005763704717	0.001337179494
0.133	314	706.5	392.5	17.3	17.2	60	5432.2	23550	0.2306666667	1.005813953	0.005797117684	0.001337201813
0.15	314	706.5	392.5	17.2	17.1	60	5400.8	23550	0.2293333333	1.005847953	0.005830920311	0.001337224391
0.166	314	706.5	392.5	17.1	17	120	5369.4	47100	0.114	1.005882353	0.005865119452	0.0006686236176
0.2	314	706.5	392.5	17	16.8	120	5338	47100	0.1133333333	1.011904762	0.01183445765	0.001341238533
0.233	314	706.5	392.5	16.8	16.6	120	5275.2	47100	0.112	1.012048193	0.01197619105	0.001341333397
0.266	314	706.5	392.5	16.6	16.4	120	5212.4	47100	0.1106666667	1.012195122	0.01212136053	0.001341430566
0.3	314	706.5	392.5	16.4	16.2	120	5149.6	47100	0.1093333333	1.012345679	0.01227009259	0.001341530123
0.333	314	706.5	392.5	16.2	16	300	5086.8	117750	0.0432	1.0125	0.01242252	0.0005366528639
0.416	314	706.5	392.5	16	15.7	300	5024	117750	0.04266666667	1.01910828	0.01892800989	0.0008075950884
0.5	314	706.5	392.5	15.7	15.02	300	4929.8	117750	0.04186666667	1.045272969	0.04427806602	0.001853775031
0.58	314	706.5	392.5	15.02	14.08	300	4716.28	117750	0.04005333333	1.066761364	0.06462729561	0.002588538613
0.66	314	706.5	392.5	14.08	14.05	300	4421.12	117750	0.03754666667	1.002135231	0.00213295495	0.00008008534853
0.75	314	706.5	392.5	14.05	14	300	4411.7	117750	0.03746666667	1.003571429	0.003565066164	0.0001335711456
0.83	314	706.5	392.5	14	13.08	600	4396	235500	0.01866666667	1.070336391	0.06797298359	0.001268829027
1	314	706.5	392.5	13.08	13	600	4107.12	235500	0.01744	1.006153846	0.006134988568	0.0001069942006

2. Balgi-pump house premise, maximum k-0.02848669709 cm/sec, minimum k-0.003405504158 cm/sec

Time (hrs)	Ai (Inner ring cross section area)	Ai (Inner ring cross section area)	A (outer ring - inner ring area)	h0 initial water level start of interval	ht water level end of interval	t time duartion of interval in sec	Ai*h0	A*t	Ai*h0/ A*t	ho/ht	ln(ho/ht)	k=(Ai*h0/ A*t)*ln(ho/ht)
0.016	314	706.5	392.5	16	14	60	5024	23550	0.2133333333	1.142857143	0.1335313926	0.02848669709
0.033	314	706.5	392.5	14	12.5	60	4396	23550	0.1866666667	1.12	0.1133286853	0.02115468792
0.05	314	706.5	392.5	12.5	11	60	3925	23550	0.1666666667	1.136363636	0.1278333715	0.02130556192
0.066	314	706.5	392.5	11	10.5	60	3454	23550	0.1466666667	1.047619048	0.04652001563	0.006822935626
0.083	314	706.5	392.5	10.5	9.4	60	3297	23550	0.14	1.117021277	0.1106655679	0.0154931795
0.1	314	706.5	392.5	9.4	8	60	2951.6	23550	0.1253333333	1.175	0.1612681476	0.0202122745
0.116	314	706.5	392.5	8	7	60	2512	23550	0.1066666667	1.142857143	0.1335313926	0.01424334855
0.133	314	706.5	392.5	7	6.5	60	2198	23550	0.09333333333	1.076923077	0.07410797215	0.006916744068
0.15	314	706.5	392.5	6.5	5.8	60	2041	23550	0.08666666667	1.120689655	0.1139442593	0.009875169144
0.166	314	706.5	392.5	5.8	4.7	120	1821.2	47100	0.03866666667	1.234042553	0.2102954088	0.008131422475
0.2	314	706.5	392.5	4.7	3.6	120	1475.8	47100	0.03133333333	1.305555556	0.2666286633	0.008354364782
0.233	314	706.5	392.5	16	14	120	5024	47100	0.1066666667	1.142857143	0.1335313926	0.01424334855
0.266	314	706.5	392.5	14	12.5	120	4396	47100	0.09333333333	1.12	0.1133286853	0.01057734396
0.3	314	706.5	392.5	12.5	10.4	120	3925	47100	0.08333333333	1.201923077	0.1839228382	0.01532690318
0.333	314	706.5	392.5	10.4	9	300	3265.6	117750	0.02773333333	1.155555556	0.1445812288	0.004009719412
0.416	314	706.5	392.5	9	6	300	2826	117750	0.024	1.5	0.4054651081	0.009731162595
0.5	314	706.5	392.5	6	3	300	1884	117750	0.016	2	0.6931471806	0.01109035489
0.58	314	706.5	392.5	16	10.8	300	5024	117750	0.04266666667	1.481481481	0.3930425881	0.01676981709
0.66	314	706.5	392.5	10.8	5.8	300	3391.2	117750	0.0288	1.862068966	0.6216882166	0.01790462064
0.75	314	706.5	392.5	16	10	300	5024	117750	0.04266666667	1.6	0.4700036292	0.02005348818
0.83	314	706.5	392.5	10	5	600	3140	235500	0.01333333333	2	0.6931471806	0.009241962407
1	314	706.5	392.5	5	3	600	1570	235500	0.006666666667	1.666666667	0.5108256238	0.003405504158

3.Gopalpur, maximum k-0.002697796011 cm/sec, minimum k-0.0006818659799 cm/sec

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.016	314	706.5	392.5	19	18.9	**60**	5966	23550	0.2533333333	1.005291005	0.005277057101	0.001336854466
0.033	314	706.5	392.5	18.9	18.8	**60**	5934.6	23550	0.252	1.005319149	0.00530505223	0.001336873162
0.05	314	706.5	392.5	18.8	18.7	**60**	5903.2	23550	0.2506666667	1.005347594	0.005333345975	0.001336892058
0.066	314	706.5	392.5	18.7	18.5	**60**	5871.8	23550	0.2493333333	1.010810811	0.01075279178	0.002681029416
0.083	314	706.5	392.5	18.5	18.3	**60**	5809	23550	0.2466666667	1.010928962	0.01086967224	0.002681185818
0.1	314	706.5	392.5	18.3	18.1	**60**	5746.2	23550	0.244	1.011049724	0.01098912158	0.002681345664
0.116	314	706.5	392.5	18.1	18	**60**	5683.4	23550	0.2413333333	1.005555556	0.005540180376	0.001337030197
0.133	314	706.5	392.5	18	17.9	**60**	5652	23550	0.24	1.005586592	0.005571045049	0.001337050812
0.15	314	706.5	392.5	17.9	17.8	**60**	5620.6	23550	0.2386666667	1.005617978	0.005602255549	0.001337071658
0.166	314	706.5	392.5	17.8	17.4	**120**	5589.2	47100	0.1186666667	1.022988506	0.02272825108	0.002697085795
0.2	314	706.5	392.5	17.4	17	**120**	5463.6	47100	0.116	1.023529412	0.02325686216	0.002697796011
0.233	314	706.5	392.5	17	16.8	**120**	5338	47100	0.1133333333	1.011904762	0.01183445765	0.001341238533
0.266	314	706.5	392.5	16.8	16.5	**120**	5275.2	47100	0.112	1.018181818	0.0180185055	0.002018072616
0.3	314	706.5	392.5	16.5	16.2	**120**	5181	47100	0.11	1.018518519	0.01834913867	0.002018405254
0.333	314	706.5	392.5	16.2	15.7	**300**	5086.8	117750	0.0432	1.031847134	0.03135052988	0.001354342891
0.416	314	706.5	392.5	15.7	15.2	**300**	4929.8	117750	0.04186666667	1.032894737	0.0323652845	0.001355026578
0.5	314	706.5	392.5	15.2	14.5	**300**	4772.8	117750	0.04053333333	1.048275862	0.04714677843	0.001911016086
0.58	314	706.5	392.5	14.5	14	**300**	4553	117750	0.03866666667	1.035714286	0.03509131981	0.001356864366
0.66	314	706.5	392.5	14	13.3	**300**	4396	117750	0.03733333333	1.052631579	0.05129329439	0.001914949657
0.75	314	706.5	392.5	13.3	12.8	**300**	4176.2	117750	0.03546666667	1.0390625	0.0383188643	0.001359042387
0.83	314	706.5	392.5	12.8	11.9	**600**	4019.2	235500	0.01706666667	1.075630252	0.07290677081	0.001244275555
1	314	706.5	392.5	11.9	11.3	**600**	3736.6	235500	0.01586666667	1.053097345	0.0517356744	0.0008208727005
1.166666667	314	706.5	392.5	11.3	10.8	**600**	3548.2	235500	0.01506666667	1.046296296	0.04525659159	0.0006818659799
1.333333333	314	706.5	392.5	10.8	9.9	**600**	3391.2	235500	0.0144	1.090909091	0.08701137699	0.001252963829

1.5	314	706.5	392.5	9.9	9.2	**600**	3108.6	235500	0.0132	1.076086957	0.07333127309	0.0009679728047

4.Korba Indira Nagar Stadium (right side), maximum k-0.001337440118 cm/sec, minimum k-0

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.01666666667	314	706.5	392.5	17	16.9	**60**	5338	23550	0.2266666667	1.00591716	0.005899722127	0.001337270349
0.03333333333	314	706.5	392.5	16.9	16.8	**60**	5306.6	23550	0.2253333333	1.005952381	0.00593473552	0.001337293737
0.05	314	706.5	392.5	16.8	16.7	**60**	5275.2	23550	0.224	1.005988024	0.005970166987	0.001337317405
0.06666666667	314	706.5	392.5	16.7	16.6	**60**	5243.8	23550	0.2226666667	1.006024096	0.00600602406	0.001337341357
0.08333333333	314	706.5	392.5	16.6	16.5	**60**	5212.4	23550	0.2213333333	1.006060606	0.006042314456	0.0013373656
0.1	314	706.5	392.5	16.5	16.4	**60**	5181	23550	0.22	1.006097561	0.006079046076	0.001337390137
0.1166666667	314	706.5	392.5	16.4	16.4	**60**	5149.6	23550	0.2186666667	1	0	0
0.1333333333	314	706.5	392.5	16.4	16.3	**60**	5149.6	23550	0.2186666667	1.006134969	0.006116227017	0.001337414974
0.15	314	706.5	392.5	16.3	16.2	**60**	5118.2	23550	0.2173333333	1.00617284	0.006153865574	0.001337440118
0.1666666667	314	706.5	392.5	16.2	16.1	**120**	5086.8	47100	0.108	1.00621118	0.006191970248	0.0006687327868
0.2	314	706.5	392.5	16.1	16	**120**	5055.4	47100	0.1073333333	1.00625	0.006230549751	0.0006687456732
0.2333333333	314	706.5	392.5	16	16	**120**	5024	47100	0.1066666667	1	0	0
0.2666666667	314	706.5	392.5	16	15.9	**120**	5024	47100	0.1066666667	1.006289308	0.006269613014	0.0006687587215
0.3	314	706.5	392.5	15.9	15.8	**120**	4992.6	47100	0.106	1.006329114	0.006309169193	0.0006687719345
0.3333333333	314	706.5	392.5	15.8	15.7	**300**	4961.2	117750	0.04213333333	1.006369427	0.006349227679	0.0002675141262
0.4166666667	314	706.5	392.5	15.7	15.5	**300**	4929.8	117750	0.04186666667	1.012903226	0.01282068843	0.0005367594889
0.5	314	706.5	392.5	15.5	15.3	**300**	4867	117750	0.04133333333	1.013071895	0.01298719553	0.0005368040818
0.5833333333	314	706.5	392.5	15.3	15.1	**300**	4804.2	117750	0.0408	1.013245033	0.01315808458	0.0005368498508
0.6666666667	314	706.5	392.5	15.1	14.9	**300**	4741.4	117750	0.04026666667	1.013422819	0.01333353087	0.000536896843
0.75	314	706.5	392.5	14.9	14.7	**300**	4678.6	117750	0.03973333333	1.013605442	0.01351371917	0.0005369451082
0.8333333333	314	706.5	392.5	14.7	14.5	**600**	4615.8	235500	0.0196	1.013793103	0.01369884436	0.0002684973494
1	314	706.5	392.5	14.5	14.1	**600**	4553	235500	0.01933333333	1.028368794	0.02797385204	0.0005408278062

1.166666667	314	706.5	392.5	14.1	13.8	**600**	4427.4	235500	0.0188	1.02173913	0.02150620522	0.0004043166582
1.333333333	314	706.5	392.5	13.8	13.4	**600**	4333.2	235500	0.0184	1.029850746	0.02941388521	0.0005412154878
1.5	314	706.5	392.5	13.4	13.1	**600**	4207.6	235500	0.01786666667	1.022900763	0.02264247675	0.0004045455846
1.666666667	314	706.5	392.5	13.1	12.9	**600**	4113.4	235500	0.01746666667	1.015503876	0.01538491884	0.0002687232491
1.916666667	314	706.5	392.5	12.9	12.4	**601**	4050.6	235892.5	0.01717138103	1.040322581	0.03953083876	0.0006787990948

5.Korba Indira Nagar Stadium (left side), maximum k-0.0116291813 cm/sec, minimum k-0.001087515333 cm/sec

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.016	314	706.5	392.5	16.85	16	**60**	5290.9	23550	0.2246666667	1.053125	0.05176193456	0.0116291813
0.033	314	706.5	392.5	16	15.2	**60**	5024	23550	0.2133333333	1.052631579	0.05129329439	0.01094256947
0.05	314	706.5	392.5	15.2	14.5	**60**	4772.8	23550	0.2026666667	1.048275862	0.04714677843	0.009555080428
0.066	314	706.5	392.5	14.5	14.2	**60**	4553	23550	0.1933333333	1.021126761	0.02090668482	0.004041959065
0.083	314	706.5	392.5	14.2	14	**60**	4458.8	23550	0.1893333333	1.014285714	0.01418463499	0.002685624225
0.1	314	706.5	392.5	14	13.5	**60**	4396	23550	0.1866666667	1.037037037	0.03636764417	0.006788626912
0.116	314	706.5	392.5	13.5	13.2	**60**	4239	23550	0.18	1.022727273	0.02247285585	0.004045114053
0.133	314	706.5	392.5	13.2	13.1	**60**	4144.8	23550	0.176	1.007633588	0.007604599385	0.001338409492
0.15	314	706.5	392.5	13.1	12.8	**60**	4113.4	23550	0.1746666667	1.0234375	0.02316705928	0.004046513021
0.166	314	706.5	392.5	12.8	12.5	**120**	4019.2	47100	0.08533333333	1.024	0.02371652662	0.002023810271
0.2	314	706.5	392.5	12.5	12	**120**	3925	47100	0.08333333333	1.041666667	0.04082199452	0.003401832877
0.233	314	706.5	392.5	12	11.4	**120**	3768	47100	0.08	1.052631579	0.05129329439	0.004103463551
0.266	314	706.5	392.5	11.4	10.8	**120**	3579.6	47100	0.076	1.055555556	0.05406722127	0.004109108817
0.3	314	706.5	392.5	10.8	10.5	**120**	3391.2	47100	0.072	1.028571429	0.02817087697	0.002028303142
0.333	314	706.5	392.5	10.5	10.1	**300**	3297	117750	0.028	1.03960396	0.03883983332	0.001087515333
0.416	314	706.5	392.5	10.1	9.1	**300**	3171.4	117750	0.02693333333	1.10989011	0.1042610103	0.002808096545
0.5	314	706.5	392.5	18	17	**300**	5652	117750	0.048	1.058823529	0.05715841384	0.002743603864
0.58	314	706.5	392.5	17	15.8	**300**	5338	117750	0.04533333333	1.075949367	0.07320340402	0.003318554316

0.66	314	706.5	392.5	15.8	14.6	**300**	4961.2	117750	0.04213333333	1.082191781	0.07898841132	0.003328045064
0.75	314	706.5	392.5	14.6	13.5	**300**	4584.4	117750	0.03893333333	1.081481481	0.07833184327	0.003049719765
0.83	314	706.5	392.5	13.5	12.6	**600**	4239	235500	0.018	1.071428571	0.06899287149	0.001241871687
1	314	706.5	392.5	12.6	10.8	**600**	3956.4	235500	0.0168	1.166666667	0.1541506798	0.002589731421
1.166666667	314	706.5	392.5	10.8	9.1	**600**	3391.2	235500	0.0144	1.186813187	0.1712717206	0.002466312777
1.333333333	314	706.5	392.5	9.1	7.5	**600**	2857.4	235500	0.01213333333	1.213333333	0.193371393	0.002346239568
1.5	314	706.5	392.5	7.5	6.2	**600**	2355	235500	0.01	1.209677419	0.1903537285	0.001903537285
1.666666667	314	706.5	392.5	6.2	4.8	**600**	1946.8	235500	0.008266666667	1.291666667	0.2559333741	0.002115715893

6.Daganiyakhar-maximum k-0.006761010472 cm/sec, minimum k-0.0004052175879 cm/sec

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.016	314	706.5	392.5	18	17.5	**60**	5652	23550	0.24	1.028571429	0.02817087697	0.006761010472
0.033	314	706.5	392.5	17.5	17.1	**60**	5495	23550	0.2333333333	1.023391813	0.02312241742	0.005395230732
0.05	314	706.5	392.5	17.1	16.9	**60**	5369.4	23550	0.228	1.01183432	0.01176484158	0.00268238388
0.066	314	706.5	392.5	16.9	16.7	**60**	5306.6	23550	0.2253333333	1.011976048	0.01190490251	0.002682571365
0.083	314	706.5	392.5	16.7	16.5	**60**	5243.8	23550	0.2226666667	1.012121212	0.01204833852	0.002682763376
0.1	314	706.5	392.5	16.5	16.2	**60**	5181	23550	0.22	1.018518519	0.01834913867	0.004036810507
0.116	314	706.5	392.5	16.2	16	**60**	5086.8	23550	0.216	1.0125	0.01242252	0.00268326432
0.133	314	706.5	392.5	16	15.9	**60**	5024	23550	0.2133333333	1.006289308	0.006269613014	0.001337517443
0.15	314	706.5	392.5	15.9	15.7	**60**	4992.6	23550	0.212	1.012738854	0.01265839687	0.002683580137
0.166	314	706.5	392.5	15.7	15.5	**120**	4929.8	47100	0.1046666667	1.012903226	0.01282068843	0.001341898722
0.2	314	706.5	392.5	15.5	15.3	**120**	4867	47100	0.1033333333	1.013071895	0.01298719553	0.001342010204
0.233	314	706.5	392.5	15.3	15	**120**	4804.2	47100	0.102	1.02	0.0198026273	0.002019867984
0.266	314	706.5	392.5	15	14.8	**120**	4710	47100	0.1	1.013513514	0.01342302033	0.001342302033
0.3	314	706.5	392.5	14.8	14.5	**120**	4647.2	47100	0.09866666667	1.020689655	0.02047853134	0.002020548426
0.333	314	706.5	392.5	14.5	14.2	**300**	4553	117750	0.03866666667	1.021126761	0.02090668482	0.000808391813

0.416	314	706.5	392.5	14.2	13.6	**300**	4458.8	117750	0.03786666667	1.044117647	0.04317217187	0.001634786241
0.5	314	706.5	392.5	13.6	13.1	**300**	4270.4	117750	0.03626666667	1.038167939	0.03745756253	0.001358460935
0.58	314	706.5	392.5	13.1	12.5	**300**	4113.4	117750	0.03493333333	1.048	0.0468835859	0.001637799934
0.66	314	706.5	392.5	12.5	12.1	**300**	3925	117750	0.03333333333	1.033057851	0.03252319171	0.00108410639
0.75	314	706.5	392.5	12.1	11.7	**300**	3799.4	117750	0.03226666667	1.034188034	0.0336166108	0.001084695975
0.83	314	706.5	392.5	11.7	11.4	**600**	3673.8	235500	0.0156	1.026315789	0.0259754864	0.0004052175879
1	314	706.5	392.5	11.4	10.7	**600**	3579.6	235500	0.0152	1.065420561	0.06336961393	0.0009632181318
1.166666667	314	706.5	392.5	10.7	10.1	**600**	3359.8	235500	0.01426666667	1.059405941	0.05770831762	0.0008233053314
1.333333333	314	706.5	392.5	10.1	9.1	**600**	3171.4	235500	0.01346666667	1.10989011	0.1042610103	0.001404048272

7.Purenakhar -maximum k-0.004032787374 cm/sec, minimum k-0

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.016	314	706.5	392.5	18.5	18.2	**60**	5809	23550	0.2466666667	1.016483516	0.016349138	0.004032787374
0.033	314	706.5	392.5	18.2	18.1	**60**	5714.8	23550	0.2426666667	1.005524862	0.005509655811	0.00133700981
0.05	314	706.5	392.5	18.1	18	**60**	5683.4	23550	0.2413333333	1.005555556	0.005540180376	0.001337030197
0.066	314	706.5	392.5	18	17.9	**60**	5652	23550	0.24	1.005586592	0.005571045049	0.001337050812
0.083	314	706.5	392.5	17.9	17.9	**60**	5620.6	23550	0.2386666667	1	0	0
0.1	314	706.5	392.5	17.9	17.8	**60**	5620.6	23550	0.2386666667	1.005617978	0.005602255549	0.001337071658
0.116	314	706.5	392.5	17.8	17.7	**60**	5589.2	23550	0.2373333333	1.005649718	0.005633817718	0.001337092738
0.133	314	706.5	392.5	17.7	17.7	**60**	5557.8	23550	0.236	1	0	0
0.15	314	706.5	392.5	17.7	17.6	**60**	5557.8	23550	0.236	1.005681818	0.005665737536	0.001337114058
0.166	314	706.5	392.5	17.6	17.5	**120**	5526.4	47100	0.1173333333	1.005714286	0.005698021115	0.0006685678108
0.2	314	706.5	392.5	17.5	17.5	**120**	5495	47100	0.1166666667	1	0	0
0.233	314	706.5	392.5	17.5	17.3	**120**	5495	47100	0.1166666667	1.011560694	0.01149437943	0.001341010933
0.266	314	706.5	392.5	17.3	17.3	**120**	5432.2	47100	0.1153333333	1	0	0
0.3	314	706.5	392.5	17.3	17.2	**120**	5432.2	47100	0.1153333333	1.005813953	0.005797117684	0.0006686009063

0.333	314	706.5	392.5	17.2	17.1	**300**	5400.8	117750	0.04586666667	1.005847953	0.005830920311	0.0002674448783
0.416	314	706.5	392.5	17.1	16.9	**300**	5369.4	117750	0.0456	1.01183432	0.01176484158	0.000536476776
0.5	314	706.5	392.5	16.9	16.7	**300**	5306.6	117750	0.04506666667	1.011976048	0.01190490251	0.000536514273
0.58	314	706.5	392.5	16.7	16.2	**300**	5243.8	117750	0.04453333333	1.030864198	0.03039747718	0.001353700984
0.66	314	706.5	392.5	16.2	16	**300**	5086.8	117750	0.0432	1.0125	0.01242252	0.0005366528639
0.75	314	706.5	392.5	16	15.9	**300**	5024	117750	0.04266666667	1.006289308	0.006269613014	0.0002675034886
0.83	314	706.5	392.5	15.9	15.5	**600**	4992.6	235500	0.0212	1.025806452	0.0254790853	0.0005401566084
1	314	706.5	392.5	15.5	15.1	**600**	4867	235500	0.02066666667	1.026490066	0.0261452801	0.0005403357888
1.166666667	314	706.5	392.5	15.1	14.8	**600**	4741.4	235500	0.02013333333	1.02027027	0.02006756305	0.0004040269361
1.333333333	314	706.5	392.5	14.8	14.5	**600**	4647.2	235500	0.01973333333	1.020689655	0.02047853134	0.0004041096852

8.Purenakhar - 2 (top of fly ash), maximum k-0.01393240118 cm/sec, minimum k-0.003033686684 cm/sec

Time (hrs)	**Ai** (Inner ring cross section area)	Ai (Inner ring cross section area)	**A** (outer ring -inner ring area)	**h0** initial water level start of interval	**ht** water level end of interval	**t** time duartion of interval in sec	**Ai*h0**	**A*t**	**Ai*h0/ A*t**	**ho/ht**	**ln(ho/ht)**	**k=(Ai*h0/ A*t)*ln(ho/ht)**
0.016	314	706.5	392.5	14	13.2	**60**	4396	23550	0.1866666667	1.060606061	0.05884050002	0.01098356
0.033	314	706.5	392.5	13.2	12.5	**60**	4144.8	23550	0.176	1.056	0.05448818528	0.00958992061
0.05	314	706.5	392.5	12.5	11.8	**60**	3925	23550	0.1666666667	1.059322034	0.05762911284	0.009604852139
0.066	314	706.5	392.5	11.8	10.8	**60**	3705.2	23550	0.1573333333	1.092592593	0.08855339734	0.01393240118
0.083	314	706.5	392.5	10.8	10.2	**60**	3391.2	23550	0.144	1.058823529	0.05715841384	0.008230811593
0.1	314	706.5	392.5	10.2	9.6	**60**	3202.8	23550	0.136	1.0625	0.06062462182	0.008244948567
0.116	314	706.5	392.5	9.6	9.1	**60**	3014.4	23550	0.128	1.054945055	0.05348868495	0.006846551674
0.133	314	706.5	392.5	9.1	8.5	**60**	2857.4	23550	0.1213333333	1.070588235	0.06820825003	0.008275934337
0.15	314	706.5	392.5	8.5	8	**60**	2669	23550	0.1133333333	1.0625	0.06062462182	0.006870790473
0.166	314	706.5	392.5	8	7.5	**120**	2512	47100	0.05333333333	1.066666667	0.06453852114	0.003442054461
0.2	314	706.5	392.5	20	18.3	**120**	6280	47100	0.1333333333	1.092896175	0.08883121371	0.01184416183
0.233	314	706.5	392.5	18.3	16.8	**120**	5746.2	47100	0.122	1.089285714	0.08552217344	0.01043370516
0.266	314	706.5	392.5	16.8	15.4	**120**	5275.2	47100	0.112	1.090909091	0.08701137699	0.009745274223

0.3	314	706.5	392.5	15.4	14	**120**	4835.6	47100	0.1026666667	1.1	0.0953101798	0.00978517846
0.333	314	706.5	392.5	14	12.8	**300**	4396	117750	0.03733333333	1.09375	0.08961215869	0.003345520591
0.416	314	706.5	392.5	12.8	11	**300**	4019.2	117750	0.03413333333	1.163636364	0.1515498981	0.005172903189
0.5	314	706.5	392.5	11	8.6	**300**	3454	117750	0.02933333333	1.279069767	0.2461330695	0.007219903373
0.58	314	706.5	392.5	8.6	6.8	**300**	2700.4	117750	0.02293333333	1.264705882	0.2348395911	0.005385654622
0.66	314	706.5	392.5	18	16	**300**	5652	117750	0.048	1.125	0.1177830357	0.005653585712
0.75	314	706.5	392.5	16	14	**300**	5024	117750	0.04266666667	1.142857143	0.1335313926	0.005697339419
0.83	314	706.5	392.5	14	11.9	**600**	4396	235500	0.01866666667	1.176470588	0.1625189295	0.003033686684
1	314	706.5	392.5	11.9	8.4	**600**	3736.6	235500	0.01586666667	1.416666667	0.3483066943	0.005526466216
1.166666667	314	706.5	392.5	8.4	6	**600**	2637.6	235500	0.0112	1.4	0.3364722366	0.00376848905

ANNEXURE XII Location of Recommended Artificial Recharge Structure

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
1	Agarkhar	82.65592	22.40985	Katghora	Korba	4G2D2A2i	Ahiran	Gully Plug/ Gabbion Structure
2	Agarkhar	82.66439	22.40968	Katghora	Korba	4G2D2A2i	Ahiran	Gully Plug/ Gabbion Structure
3	Arda	82.59788	22.44833	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
4	Arda	82.60164	22.44706	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
5	Balgikhar	82.66191	22.38424	Katghora	Korba	4G2D2A1a	Ahiran	Nalas Bunding/ Check Dam
6	Bancher	82.62939	22.45807	Katghora	Korba	4G2D2A3e	Ahiran	Pond with Recharge Bore Well
7	Banki	82.60642	22.38482	Katghora	Korba	4G2D2A2f	Ahiran	Nalas Bunding/ Check Dam
8	Banki	82.60584	22.38840	Katghora	Korba	4G2D2A2f	Ahiran	Gully Plug/ Gabbion Structure
9	Banki	82.60599	22.39836	Katghora	Korba	4G2D2A2f	Ahiran	Gully Plug/ Gabbion Structure
10	Baredimuda	82.64447	22.43067	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
11	Bhairotal	82.63022	22.37054	Katghora	Korba	4G2D2A2e	Ahiran	Pond with Recharge Bore Well
12	Bhairotal	82.62352	22.37025	Katghora	Korba	4G2D2A2e	Ahiran	Nalas Bunding/ Check Dam
13	Bhejenara	82.58892	22.44052	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
14	Bhejenara	82.59096	22.43752	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
15	Birkona	82.60762	22.42035	Katghora	Korba	4G2D2A2g	Ahiran	Pond with Recharge Bore Well
16	Birkona	82.60691	22.42554	Katghora	Korba	4G2D2A2g	Ahiran	Nalas Bunding/ Check Dam
17	Birkona	82.59796	22.42307	Katghora	Korba	4G2D2A2g	Ahiran	Gully Plug/ Gabbion Structure
18	Birwat	82.63479	22.45697	Katghora	Korba	4G2D2A3e	Ahiran	Nalas Bunding/ Check Dam
19	Birwat	82.64091	22.45664	Katghora	Korba	4G2D2A3e	Ahiran	Nalas Bunding/ Check Dam
20	Birwat	82.63935	22.46072	Katghora	Korba	4G2D2A3e	Ahiran	Gully Plug/ Gabbion Structure
21	Bundeli	82.57076	22.41513	Katghora	Korba	4G2D2B1d	Ahiran	Nalas Bunding/ Check Dam
22	Bundeli	82.56715	22.41560	Katghora	Korba	4G2D2B1d	Ahiran	Gully Plug/ Gabbion Structure
23	Bundeli	82.56466	22.41281	Katghora	Korba	4G2D2B1d	Ahiran	Gully Plug/ Gabbion Structure
24	Chhirhut	82.63146	22.43168	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
25	Chhirhut	82.62226	22.43546	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
26	Chorbhatti	82.64967	22.45588	Katghora	Korba	4G2D2A3e	Ahiran	Gully Plug/ Gabbion Structure
27	Chorbhatti	82.64758	22.45502	Katghora	Korba	4G2D2A3e	Ahiran	Gully Plug/ Gabbion Structure

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
28	Dewari	82.57174	22.40475	Katghora	Korba	4G2D2B1d	Ahiran	Pond with Recharge Bore Well
29	Dewari	82.58382	22.40722	Katghora	Korba	4G2D2B1d	Ahiran	Pond with Recharge Bore Well
30	Dewari	82.57898	22.40788	Katghora	Korba	4G2D2B1d	Ahiran	Nalas Bunding/ Check Dam
31	Dewari	82.57626	22.40350	Katghora	Korba	4G2D2B1d	Ahiran	Nalas Bunding/ Check Dam
32	Dewari	82.57439	22.39552	Katghora	Korba	4G2D2B1d	Ahiran	Nalas Bunding/ Check Dam
33	Dewari	82.57384	22.40658	Katghora	Korba	4G2D2B1d	Ahiran	Gully Plug/ Gabbion Structure
34	Dewari	82.58819	22.40697	Katghora	Korba	4G2D2B1d	Ahiran	Gully Plug/ Gabbion Structure
35	Dewari	82.57806	22.39566	Katghora	Korba	4G2D2B1d	Ahiran	Gully Plug/ Gabbion Structure
36	Dhanras	82.63559	22.47224	Katghora	Korba	4G2D2A4e	Ahiran	Pond with Recharge Bore Well
37	Dhanras	82.64332	22.47036	Katghora	Korba	4G2D2A4e	Ahiran	Nalas Bunding/ Check Dam
38	Dhanras	82.64052	22.48035	Katghora	Korba	4G2D2A4e	Ahiran	Gully Plug/ Gabbion Structure
39	Dhanras	82.63483	22.47743	Katghora	Korba	4G2D2A4e	Ahiran	Gully Plug/ Gabbion Structure
40	Dhanras	82.64858	22.47501	Katghora	Korba	4G2D2A4e	Ahiran	Gully Plug/ Gabbion Structure
41	Dhanras	82.64327	22.47313	Katghora	Korba	4G2D2A4e	Ahiran	Gully Plug/ Gabbion Structure
42	Dhanras	82.64607	22.47047	Katghora	Korba	4G2D2A4e	Ahiran	Gully Plug/ Gabbion Structure
43	Dhurena	82.59210	22.36101	Katghora	Korba	4G2D2A2b	Ahiran	Pond with Recharge Bore Well
44	Dhurena	82.59483	22.36361	Katghora	Korba	4G2D2A2b	Ahiran	Nalas Bunding/ Check Dam
45	Dhurena	82.57701	22.36986	Katghora	Korba	4G2D2A2b	Ahiran	Gully Plug/ Gabbion Structure
46	Dhurena	82.57444	22.37568	Katghora	Korba	4G2D2A2b	Ahiran	Gully Plug/ Gabbion Structure
47	Dhurena	82.59149	22.35568	Katghora	Korba	4G2D2A2b	Ahiran	Gully Plug/ Gabbion Structure
48	Dhurena	82.58767	22.36499	Katghora	Korba	4G2D2A2b	Ahiran	Gully Plug/ Gabbion Structure
49	Dindolbhatta	82.61930	22.44092	Katghora	Korba	4G2D2A3e	Ahiran	Gully Plug/ Gabbion Structure
50	Dindolbhatta	82.61973	22.44495	Katghora	Korba	4G2D2A3e	Ahiran	Gully Plug/ Gabbion Structure
51	Gajra	82.63150	22.41489	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
52	Gajra	82.63092	22.40493	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
53	Gajra	82.61795	22.41243	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
54	Gajra	82.62460	22.40304	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
55	Gajra	82.62386	22.39893	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
56	Gajra	82.61815	22.40655	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
57	Gajra	82.61812	22.41624	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
58	Gajra	82.61346	22.41583	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
59	Ghanakachhar	82.60898	22.44286	Katghora	Korba	4G2D2A3a	Ahiran	Nalas Bunding/ Check Dam
60	Ghanakachhar	82.61421	22.44132	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
61	Ghanakachhar	82.61347	22.44273	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
62	Ghanakachhar	82.60464	22.44598	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
63	Gopalpur	82.65402	22.44075	Katghora	Korba	4G2D2A4d	Ahiran	Gully Plug/ Gabbion Structure
64	Gopalpur	82.65586	22.43722	Katghora	Korba	4G2D2A4d	Ahiran	Gully Plug/ Gabbion Structure
65	Harrabhatta	82.60123	22.43817	Katghora	Korba	4G2D2A3a	Ahiran	Nalas Bunding/ Check Dam
66	Harrabhatta	82.59536	22.44274	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
67	Harrabhatta	82.59777	22.43903	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
68	Harrabhatta	82.59257	22.43031	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
69	Harrabhatta	82.59597	22.43028	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
70	Harrabhatta	82.58863	22.43066	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
71	Jamnimuda	82.60783	22.43846	Katghora	Korba	4G2D2A3a	Ahiran	Pond with Recharge Bore Well
72	Jamnimuda	82.61664	22.43880	Katghora	Korba	4G2D2A3a	Ahiran	Pond with Recharge Bore Well
73	Jamnimuda	82.61565	22.43499	Katghora	Korba	4G2D2A3a	Ahiran	Nalas Bunding/ Check Dam
74	Jamnipali	82.65194	22.42218	Katghora	Korba	4G2D2A2i	Ahiran	Nalas Bunding/ Check Dam
75	Jamnipali	82.65359	22.42058	Katghora	Korba	4G2D2A2i	Ahiran	Gully Plug/ Gabbion Structure
76	Jamnipali	82.65793	22.42563	Katghora	Korba	4G2D2A2i	Ahiran	Gully Plug/ Gabbion Structure
77	Jamnipali	82.65000	22.42112	Katghora	Korba	4G2D2A2i	Ahiran	Gully Plug/ Gabbion Structure
78	Jatangpur	82.62527	22.46286	Katghora	Korba	4G2D2A3e	Ahiran	Pond with Recharge Bore Well
79	Jatangpur	82.63091	22.46480	Katghora	Korba	4G2D2A3e	Ahiran	Nalas Bunding/ Check Dam
80	Jatangpur	82.61810	22.45886	Katghora	Korba	4G2D2A3e	Ahiran	Nalas Bunding/ Check Dam
81	Jatangpur	82.61729	22.46304	Katghora	Korba	4G2D2A3e	Ahiran	Gully Plug/ Gabbion Structure
82	Kandaikhar	82.66014	22.39137	Katghora	Korba	4G2D2A1a	Ahiran	Pond with Recharge Bore Well
83	Kandaikhar	82.66530	22.39649	Katghora	Korba	4G2D2A1a	Ahiran	Pond with Recharge Bore Well
84	Kandaikhar	82.66456	22.39158	Katghora	Korba	4G2D2A1a	Ahiran	Nalas Bunding/ Check Dam
85	Kasaipali	82.57039	22.40205	Katghora	Korba	4G2D2B1d	Ahiran	Gully Plug/ Gabbion Structure

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
86	Korai	82.58123	22.38353	Katghora	Korba	4G2D2A2e	Ahiran	Pond with Recharge Bore Well
87	Korai	82.57763	22.38541	Katghora	Korba	4G2D2A2e	Ahiran	Pond with Recharge Bore Well
88	Korai	82.58169	22.37914	Katghora	Korba	4G2D2A2e	Ahiran	Pond with Recharge Bore Well
89	Korai	82.58413	22.38120	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
90	Korai	82.58697	22.39346	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
91	Kumgari	82.63181	22.42701	Katghora	Korba	4G2D2A2h	Ahiran	Pond with Recharge Bore Well
92	Kumgari	82.64706	22.42254	Katghora	Korba	4G2D2A2h	Ahiran	Pond with Recharge Bore Well
93	Kumgari	82.62833	22.42251	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
94	Kumgari	82.63767	22.42638	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
95	Kumgari	82.64358	22.41963	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
96	Kumgari	82.64166	22.41917	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
97	Lata	82.66690	22.40221	Katghora	Korba	4G2D2A1a	Ahiran	Gully Plug/ Gabbion Structure
98	Mandawadhorda	82.61347	22.37739	Katghora	Korba	4G2D2A2e	Ahiran	Nalas Bunding/ Check Dam
99	Mandawadhorda	82.59748	22.36477	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
100	Mongra	82.61340	22.39874	Katghora	Korba	4G2D2A2g	Ahiran	Pond with Recharge Bore Well
101	Mongra	82.61584	22.40949	Katghora	Korba	4G2D2A2g	Ahiran	Pond with Recharge Bore Well
102	Mongra	82.60326	22.40453	Katghora	Korba	4G2D2A2g	Ahiran	Gully Plug/ Gabbion Structure
103	Paunsara	82.62181	22.42322	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
104	Paunsara	82.61474	22.42185	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
105	Purena	82.59001	22.37010	Katghora	Korba	4G2D2A2e	Ahiran	Pond with Recharge Bore Well
106	Purena	82.59009	22.37483	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
107	Purena	82.59289	22.37146	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
108	Purena	82.59281	22.38577	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
109	Purena	82.59522	22.36719	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
110	Purena	82.59554	22.37117	Katghora	Korba	4G2D2A2e	Ahiran	Gully Plug/ Gabbion Structure
111	Samepali	82.64324	22.41353	Katghora	Korba	4G2D2A2h	Ahiran	Pond with Recharge Bore Well
112	Suklakhar	82.58243	22.41474	Katghora	Korba	4G2D2A2g	Ahiran	Gully Plug/ Gabbion Structure
113	Sumedha	82.64451	22.40815	Katghora	Korba	4G2D2A2h	Ahiran	Nalas Bunding/ Check Dam
114	Sumedha	82.65270	22.40884	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
115	Sumedha	82.64968	22.40852	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
116	Sumedha	82.65041	22.39623	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
117	Sumedha	82.65276	22.39156	Katghora	Korba	4G2D2A2h	Ahiran	Gully Plug/ Gabbion Structure
118	Telsara	82.61767	22.42803	Katghora	Korba	4G2D2A3a	Ahiran	Nalas Bunding/ Check Dam
119	Telsara	82.62271	22.42563	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
120	Telsara	82.62068	22.42933	Katghora	Korba	4G2D2A3a	Ahiran	Gully Plug/ Gabbion Structure
121	Bhalpahri	82.67880	22.28512	Katghora	Korba	4G2D1C5g	Lower Hasdeo	Pond with Recharge Bore Well
122	Bhalpahri	82.68187	22.28039	Katghora	Korba	4G2D1C5g	Lower Hasdeo	Nalas Bunding/ Check Dam
123	Bhalpahri	82.67608	22.28220	Katghora	Korba	4G2D1C5g	Lower Hasdeo	Gully Plug/ Gabbion Structure
124	Bhalpahri	82.68124	22.27502	Katghora	Korba	4G2D1C5g	Lower Hasdeo	Gully Plug/ Gabbion Structure
125	Ghanadabri	82.68396	22.29067	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Pond with Recharge Bore Well
126	Ghanadabri	82.68633	22.29495	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Nalas Bunding/ Check Dam
127	Ghanadabri	82.68096	22.28894	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Nalas Bunding/ Check Dam
128	Ghanadabri	82.68789	22.29612	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Gully Plug/ Gabbion Structure
129	Japeli	82.67842	22.29782	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Gully Plug/ Gabbion Structure
130	Japeli	82.68313	22.29839	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Gully Plug/ Gabbion Structure
131	Kanberi	82.69454	22.28409	Katghora	Korba	4G2D1D1e	Lower Hasdeo	Pond with Recharge Bore Well
132	Kanberi	82.70229	22.28690	Katghora	Korba	4G2D1D1e	Lower Hasdeo	Nalas Bunding/ Check Dam
133	Kanberi	82.70550	22.29475	Katghora	Korba	4G2D1D1e	Lower Hasdeo	Nalas Bunding/ Check Dam
134	Kanberi	82.69699	22.28827	Katghora	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
135	Kanberi	82.69294	22.28112	Katghora	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
136	Kanberi	82.69734	22.29217	Katghora	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
137	Khairbhavna	82.70470	22.30240	Katghora	Korba	4G2D1D1a	Lower Hasdeo	Gully Plug/ Gabbion Structure
138	Khairbhavna	82.70229	22.29597	Katghora	Korba	4G2D1D1a	Lower Hasdeo	Gully Plug/ Gabbion Structure
139	Nawagaon	82.65696	22.29412	Katghora	Korba	4G2D1C3g	Lower Hasdeo	Nalas Bunding/ Check Dam
140	Salora	82.64653	22.30941	Katghora	Korba	4G2D1C3e	Lower Hasdeo	Nalas Bunding/ Check Dam
141	Salora	82.64447	22.30491	Katghora	Korba	4G2D1C3e	Lower Hasdeo	Gully Plug/ Gabbion Structure
142	Sirbida	82.65024	22.29878	Katghora	Korba	4G2D1C3a	Lower Hasdeo	Pond with Recharge Bore Well
143	Sirbida	82.65172	22.30695	Katghora	Korba	4G2D1C3a	Lower Hasdeo	Pond with Recharge Bore Well

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
144	Sirbida	82.65175	22.30271	Katghora	Korba	4G2D1C3a	Lower Hasdeo	Nalas Bunding/ Check Dam
145	Sirbida	82.65440	22.30650	Katghora	Korba	4G2D1C3a	Lower Hasdeo	Gully Plug/ Gabbion Structure
146	Sirbida	82.65339	22.29766	Katghora	Korba	4G2D1C3a	Lower Hasdeo	Gully Plug/ Gabbion Structure
147	Sonpuri	82.69896	22.31106	Katghora	Korba	4G2D1D1a	Lower Hasdeo	Gully Plug/ Gabbion Structure
148	Sonpuri	82.70477	22.30871	Katghora	Korba	4G2D1D1a	Lower Hasdeo	Gully Plug/ Gabbion Structure
149	Barbaspur	82.71960	22.28814	Korba	Korba	4G2D1D1e	Lower Hasdeo	Pond with Recharge Bore Well
150	Barbaspur	82.73680	22.29270	Korba	Korba	4G2D1D1e	Lower Hasdeo	Pond with Recharge Bore Well
151	Barbaspur	82.72976	22.28588	Korba	Korba	4G2D1D1e	Lower Hasdeo	Pond with Recharge Bore Well
152	Barbaspur	82.73549	22.29633	Korba	Korba	4G2D1D1e	Lower Hasdeo	Nalas Bunding/ Check Dam
153	Barbaspur	82.71334	22.28575	Korba	Korba	4G2D1D1e	Lower Hasdeo	Nalas Bunding/ Check Dam
154	Barbaspur	82.72071	22.28579	Korba	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
155	Barbaspur	82.71939	22.29108	Korba	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
156	Barbaspur	82.71725	22.29082	Korba	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
157	Barbaspur	82.72754	22.29313	Korba	Korba	4G2D1D1e	Lower Hasdeo	Gully Plug/ Gabbion Structure
158	Kudri	82.74880	22.29943	Korba	Korba	4G2D1D1d	Lower Hasdeo	Nalas Bunding/ Check Dam
159	Kudri	82.74701	22.30590	Korba	Korba	4G2D1D1d	Lower Hasdeo	Gully Plug/ Gabbion Structure
160	Kudri	82.74620	22.30234	Korba	Korba	4G2D1D1d	Lower Hasdeo	Gully Plug/ Gabbion Structure
161	Kudri	82.75062	22.30087	Korba	Korba	4G2D1D1d	Lower Hasdeo	Gully Plug/ Gabbion Structure
162	Kudri	82.73667	22.30002	Korba	Korba	4G2D1D1d	Lower Hasdeo	Gully Plug/ Gabbion Structure
163	Kudurmal	82.69327	22.27856	Korba	Korba	4G2D1C5h	Lower Hasdeo	Nalas Bunding/ Check Dam
164	Kudurmal	82.70538	22.28508	Korba	Korba	4G2D1C5h	Lower Hasdeo	Nalas Bunding/ Check Dam
165	Kudurmal	82.73276	22.28124	Korba	Korba	4G2D1C5h	Lower Hasdeo	Gully Plug/ Gabbion Structure
166	Kudurmal	82.72343	22.28277	Korba	Korba	4G2D1C5h	Lower Hasdeo	Gully Plug/ Gabbion Structure
167	Kudurmal	82.71955	22.27910	Korba	Korba	4G2D1C5h	Lower Hasdeo	Gully Plug/ Gabbion Structure
168	Kudurmal	82.71776	22.28283	Korba	Korba	4G2D1C5h	Lower Hasdeo	Gully Plug/ Gabbion Structure
169	Kurudih	82.74778	22.28544	Korba	Korba	4G2D1D5a	Lower Hasdeo	Nalas Bunding/ Check Dam
170	Kurudih	82.75345	22.28577	Korba	Korba	4G2D1D5a	Lower Hasdeo	Nalas Bunding/ Check Dam
171	Kurudih	82.75504	22.29854	Korba	Korba	4G2D1D5a	Lower Hasdeo	Gully Plug/ Gabbion Structure
172	Kurudih	82.75854	22.29708	Korba	Korba	4G2D1D5a	Lower Hasdeo	Gully Plug/ Gabbion Structure

Sl No	Village Name	Longitude	Latitude	BLOCK	DISTRICT	MICRO_WS_CODE	WATERSHED	Recharge Structure Type
173	Kurudih	82.75479	22.29127	Korba	Korba	4G2D1D5a	Lower Hasdeo	Gully Plug/ Gabbion Structure
174	Kurudih	82.75373	22.27973	Korba	Korba	4G2D1D5a	Lower Hasdeo	Gully Plug/ Gabbion Structure
175	Semipali	82.74301	22.28415	Korba	Korba	4G2D1D5b	Lower Hasdeo	Nalas Bunding/ Check Dam
176	Semipali	82.74732	22.28208	Korba	Korba	4G2D1D5b	Lower Hasdeo	Gully Plug/ Gabbion Structure

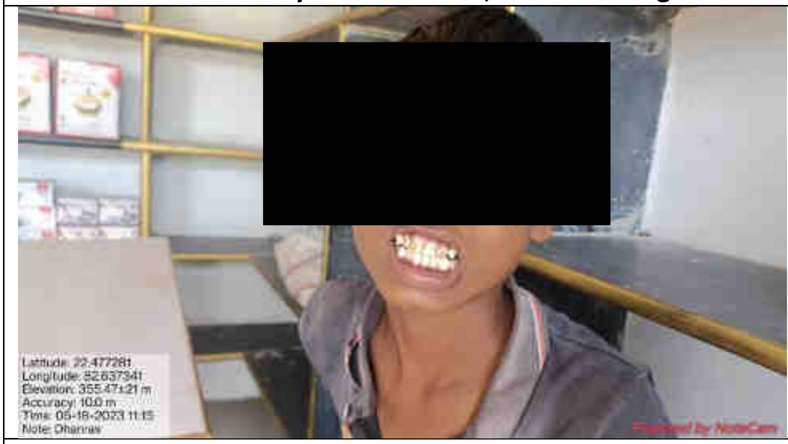
ANNEXURE XIII Field Photographs

1. **Hydrogeological Test for Piezometer Construction in Indira Stadium, Korba**

2. **Soil Infiltration Test at Purenakhar Fly Ash Deposit Site**

3. **Field Survey with GSI, Raipur**

4. **Field survey and feedback , Dhanras village. Korba**



5. **Mottled tooth due to Dental Fluorosis in Dhanras Village, Korba**

6. **Mixing of contaminated streams to natural stream near Balgi Coal Mines**

7. Tier III training cum stakeholder meeting organised at India Auditorium, Korba

8. Geophysical demonstration during training cum stakeholder meeting at Korba