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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

मोहनपुर एवं फ़तेहपुर प्रखण्ड, गया जिला, बिहार
Mohanpur and Fatehpur blocks, Gaya District, Bihar

मध्य पूर्वी क्षेत्र, पटना
Mid Eastern Region (MER)-Patna
March, 2024

केंद्रीय भूमि जल बोर्ड
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
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भारत सरकार

CENTRAL GROUND WATER BOARD
Department of Water Resources, RD & GR
Ministry of Jal Shakti
Government of India

जलभृत प्रबंधन योजना
AQUIFER MANAGEMENT PLAN
मोहनपुर एवं फ़तेहपुर प्रखण्ड, गया जिला, बिहार
MOHANPUR AND FATEHPUR BLOCKS, GAYA DISTRICT, BIHAR

मध्य पूर्वी क्षेत्र, पटना
MID EASTERN REGION, PATNA
(□□□: 2023-24)

जलभृत प्रबंधन योजना
मोहनपुर एवं फ़तेहपुर प्रखण्ड, गया जिला, बिहार

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Mid Eastern Region, Patna
Central Ground Water Board
March-2024

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Chairman

भारत सरकार
जल शक्ति मंत्रालय
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Government of India
Ministry of Jal Shakti
Department of Water Resources,
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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)
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भारत सरकार
जल शक्ति मंत्रालय
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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, detailed analysis, and comprehensive 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 in Mohanpur and Fatehpur blocks, Gaya district, Bihar" serves as a comprehensive outcome of the exploration results. The report embodies water level behavior, ground water exploration, geophysical exploration, geochemical analysis, hydrometeorological aspects, in both the block of Gaya district, Bihar. 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, Mid Eastern Region in the creation of the "NAQUIM 2.0 study of Mohanpur and Fatehpur blocks, Gaya district, Bihar" 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 Bihar.

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Member (East)

राजीव रंजन शुक्ला, क्षेत्रीय निदेशक
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सत्यमेव जयते

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
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PREFACE

Ground water has emerged as a primary water source for economic development in rural India, owing to its widespread availability, reliability, and cost-effectiveness. It has made significant contribution in fueling India's economic growth and fostering socio-economic progress. Along with its quantity, the quality issues also play an important role; particularly in the southern part of the state where marginal alluvium aquifer is underlain by Chhotanagpur gneissic complex and associated rocks forming the basement. The fluoride concentration more than permissible limit in parts of the study area makes it unsuitable for drinking purpose.

Central Ground Water Board has completed National Aquifer Mapping and Management (NAQUIM) studies for the entire country at 1:50000 scale. In Bihar, NAQUIM studies of entire state has been completed and findings have also been shared with State Government and district authorities. A way forward, Central Ground Water Board has taken up NAQUIM 2.0 for detailed aquifer mapping at micro level to provide information to support groundwater management decisions at village panchayat level. Central Ground Water Board, Mid Eastern Region, Patna has undertaken NAQUIM 2.0 studies in Annual Action Plan 2023-24 in water stressed area of Mohanpur and Fatehpur block of Gaya district with an objective to detailed mapping of the aquifer system, demarcation of recharge and discharge area along with proposing suitable management plans.

The sincere efforts of Sh. Satyendra Kumar, Scientist-C (Hydrogeology) and with multidisciplinary team comprising of Sh. Vishal Srivastava, Scientist-B (Hydrogeology), Sh. Santosh Kumar Sen, Assistant Hydrogeologist, Sh. Rittik Das, Scientist-B (Geophysics) and Dr. Shelja Tiwari, Assistant Chemist are appreciated. The team has completed the task overcoming various logistic issues mainly non availability of fields vehicles along with the team engaged in completing many other time bound tasks.

I hope NAQUIM 2.0 report of Mohanpur and Fatehpur blocks of Gaya district would be of immense help in knowing the aquifer and managing it resources while formulating and implementing strategies; scientifically for efficient management of ground water resources and ensuring its sustainability.

राजीव रंजन शुक्ला

(Rajeev Ranjan Shukla)
Regional Director

कार्यकारी सारांश

जलभृत मानचित्रण एक वैज्ञानिक विधि है जिसका उपयोग भूवैज्ञानिक, भूभौतिकी, जल विज्ञान और रासायनिक विश्लेषण के माध्यम से भूजल की मात्रा, गुणवत्ता और स्थिरता का आकलन करने के लिए किया जाता है। केंद्रीय भू जल बोर्ड (सीजीडब्ल्यूबी) ने राष्ट्रीय जलभृत मानचित्रण और प्रबंधन कार्यक्रम द्वारा 2012 से 2023 तक 1:50,000 scale पर भारत के 32 लाख वर्ग किलोमीटर का मानचित्रण किया, जिससे भूजल प्रबंधन के लिए महत्वपूर्ण आँकड़े संग्रहीत हुए। बिहार के समस्त जिलों का जलभृत मानचित्रण मार्च 2023 तक सम्पूर्ण कर लिया गया है। वार्षिक कार्य योजना 2023-24 से, CGWB ने अधिक विस्तृत मानचित्रण और लक्षित प्रबंधन योजनाओं के विकास के लिए water stressed areas और भू जल प्रदूषित क्षेत्रों, शहरी क्षेत्रों और औद्योगिक क्षेत्रों पर ध्यान केंद्रित करते हुए, अधिक स्थानीय स्तर (गांव या ग्राम पंचायत) पर जलभृतों के मानचित्रण के लिए NAQUIM 2.0 को प्रारंभ किया गया है।

वर्तमान अध्ययन बिहार के गया जिले के मोहनपुर और फ़तेहपुर प्रखण्डों के water stressed areas में विस्तृत विश्लेषण करने पर केंद्रित है।

यह अध्ययन सीजीडब्ल्यूबी और अन्य राज्य एजेंसी के निर्मित कूपों के आंकड़ों का उपयोग करके subsurface lithology के साथ-साथ भूभौतिकीय सर्वेक्षणों के विश्लेषण द्वारा जलभृत के मानचित्रण पर केंद्रित है। यह भूवैज्ञानिक और भूभौतिकीय सर्वेक्षणों द्वारा से जलभृत के विन्यास (गहराई एवं मोटाई) और भू जल उपलब्धता की दृष्टि से potential zones की पहचान करता है। Rockworks सॉफ्टवेयर का उपयोग करके सतह से शैलआधार (Depth to Bedrock) मानचित्र और 3D मॉडल तैयार करता है। इस अध्ययन में 127 Key wells की स्थापना और पंपिंग परीक्षण द्वारा हाइड्रोजियोलॉजिकल सर्वेक्षण किए गए। अध्ययन क्षेत्र में 37 TEM और 27 VES सहित भूभौतिकीय सर्वेक्षण आयोजित किए गए। प्री-मॉनसून और पोस्ट-मॉनसून अवधि के दौरान भू जल स्तर की निगरानी की गई और भू जल स्तर मानचित्र और contour map भी तैयार किया गया। भूजल गुणवत्ता का अध्ययन के लिए 127 मानसून पूर्व और 113 मॉनसून पश्चात भू जल नमूनों को एकत्रित और विश्लेषण किया गया है।

बिहार के गया जिले के मोहनपुर और फ़तेहपुर प्रखण्डों को NAQUIM 2.0 परियोजना के तहत 'water stressed area' के रूप में अध्ययन किया गया, जिसके स्थायी भूजल प्रबंधन के लिए एक कृत्रिम पुनर्भरण रणनीति की आवश्यकता है। पुनर्भरण के लिए उपयुक्त क्षेत्र वे हैं जहां मानसून के बाद का जल स्तर 3 m bgl से अधिक है। प्रस्तावित उपायों में खड़ी ढलानों के लिए गली प्लग और मध्यम ढलानों के लिए percolation tanks, check dams, and Nala Bunds शामिल हैं। सीजीडब्ल्यूबी और जल शक्ति मंत्रालय विभिन्न आवश्यकताओ के लिए भूजल पर निर्भर

गांवों में risk assessment के लिए मानक संचालन प्रक्रिया (SOP) का पालन करते हैं, जिसमें sustainable जल आपूर्ति प्रणालियों को सुनिश्चित करने के लिए geotagging, गांव के बुनियादी ढांचे का डेटा संग्रह, जलभृत प्रकार, जल स्रोत की reliability और वार्षिक मूल्यांकन शामिल हैं।

अध्ययन से पता चलता है कि इस क्षेत्र में दो जलभृत प्रणालियाँ हैं: सीमांत जलोढ़ (marginal alluvium) से निर्मित जलभृत-I (उथला), और अपक्षयित (weathered) चट्टान एवं fractured कठोर चट्टान से निर्मित जलभृत-II (गहरा)। जलभृत-I में विकास की सीमित क्षमता है और उथले कुओं द्वारा उस तक पहुंच बनाई जाती है, जबकि जलभृत-II, गहरे बोरवेलों द्वारा उपयोग किया जाता है, जो अपक्षयित एवं फ्रैक्चर के माध्यम से विकसित होता है। जलभृत-I में जल स्तर 1.3 से 9.85 m bgl तक है, जबकि जलभृत-II में 7 से 35 m bgl तक है। भूजल में फ्लोराइड का सांद्रण आमतौर पर पीने के लिए उपयुक्त है, हालांकि कुछ क्षेत्रों में, विशेष रूप से दक्षिणी भागों में, फ्लोराइड का सांद्रण मानक (permissible) सीमा से अधिक है।

यह अध्ययन भूजल प्रबंधन के लिए पुनर्भरण क्षेत्रों की पहचान करने के महत्व पर प्रकाश डालता है। अध्ययन क्षेत्र के दक्षिणी भाग को संभावित पुनर्भरण क्षेत्र के रूप में पहचाना गया है। इन क्षेत्रों की सुरक्षा के लिए नियमन, संरक्षण और पुनर्स्थापन जैसी जल प्रबंधन कार्यों की अनुशंसा की जाती है। अध्ययन क्षेत्र में sustainable drinking water supply की दृष्टिकोण से 295 गाँव व 188 गाँव क्रमश risk और high risk श्रेणी में आते हैं, विशेष रूप से दक्षिणी (मोहनपुर प्रखण्ड) और पहाड़ी क्षेत्रों (फतेहपुर प्रखण्ड) में। अध्ययन में जलोड़िय और अपक्षयित क्षेत्रों में जल संरक्षण और कृत्रिम पुनर्भरण पर ध्यान केंद्रित करने का सुझाव दिया गया है। इसमें पुनर्भरण को बढ़ाने के लिए 117 percolation tanks, 155 चेक डैम और 135 नाला बंड के निर्माण प्रस्तावित है, साथ ही टैंकों से गाद निकालने, अहार पाइन प्रणाली का नवीनीकरण करने और बेहतर water sustainability के लिए सरकारी भवनों में roof top वर्षा जल संचयन को लागू करने का भी सुझाव है।

अध्ययन के नतीजे से राज्य सरकार और संबंधित विभागों को बेहतर निर्णय लेने और स्थानीय स्तर पर प्रभावी रणनीतियों को लागू करने में मदद मिलेगी। इसका निष्कर्ष भूजल प्रबंधन में सुधार और क्षेत्र में sustainability सुनिश्चित करने के लिए नीतियों और कार्यों के विकास का मार्गदर्शन करेंगे।

Executive Summary

Aquifer mapping is a scientific method used to assess ground water quantity, quality, and sustainability through geological, geophysical, hydrological, and chemical analyses. The National Aquifer Mapping and Management Programme, led by the Central Ground Water Board (CGWB), mapped 32 lakh square kilometres of India from 2012 to 2023 at a 1:50,000 scale, providing critical data for groundwater management. By March 2023, mapping of Bihar was completed. In 2023, the CGWB launched NAQUIM 2.0 to map aquifers at a more localized level (village or gram panchayat), focusing on water-stressed and contaminated areas, urban zones, and industrial regions for more detailed mapping and the development of targeted management plans.

The present study focuses on conducting a detailed analysis in the water-stressed areas of the Mohanpur and Fatehpur block in Gaya District, Bihar, India.

The study focuses on mapping the aquifer by analyzing subsurface lithology using CGWB and other state agency well data, along with geophysical surveys. It determines aquifer depth, thickness, and potential zones through geological and geophysical interpretations, creating a Depth to Bedrock map and 3D models using Rockworks software. The study includes hydrogeological survey by establishment of 127 key wells and conducting pumping test. Geophysical survey including 37 Transient Electromagnetic Surveys (TEM) & 27 Vertical Electrical Soundings (VES) were conducted in the study area. Water levels during pre-monsoon and post-monsoon periods were monitored and depth to water level map & contour maps prepared. Ground water quality is studied by collecting and analysing 127 pre-monsoon and 113 post-monsoon ground water samples.

Mohanpur and Fatehpur blocks in Gaya district, Bihar, are identified as ‘Water Stressed Areas’ under the NAQUIM 2.0 project, requiring an artificial recharge strategy for sustainable ground water management. Suitable areas for recharge are those with post-monsoon water levels greater than 3 m bgl. Proposed measures include gully plugs for steep slopes and percolation tanks, check dams, and Nala Bunds for moderate slopes. CGWB and Ministry of Jal Shakti follow a Standard Operating Procedure (SOP) for risk assessment in ground water dependent villages, involving geotagging, data collection on village infrastructure, aquifer type, water source reliability, and annual assessments to ensure sustainable water supply systems.

The study reveals that the area has two aquifer systems: Aquifer I (shallow), consist of marginal alluvium, and Aquifer II (deeper), from weathered and fractured hard rock. Aquifer I has limited development potential and is accessed by shallow wells where thickness ranges from 4.9 to 45.3 m, while Aquifer II, is tapped by deep borewells, developed through weathered & fractured of which thickness varies from 4 to 82 m. Water levels in Aquifer I range from 1.3 to 9.85 m bgl, while in Aquifer II, it ranges from 7.0 to 35.0 m bgl. Fluoride levels in ground water are generally suitable for drinking, though some areas, except some patch in southern parts, have fluoride concentration greater than permissible limit.

The study highlights the importance of identifying recharge areas for ground water management. The southern part of the study area is identified as a potential recharge zone. To protect these areas, water management practices such as regulations, conservation, and restoration are recommended. In the study area, 295 villages are at risk, and 188 are in the high-risk category for sustainable drinking water supply, particularly in the southern (Mohanpur block) and hilly regions (Fatehpur block). The study suggests focusing on water conservation and artificial recharge in alluvial and weathered zones. It estimates the construction of 117 percolation tanks, 155 check dams, and 135 nala bunds to enhance recharge, along with de-silting tanks, renovating the Ahar Pyne system, and implementing rooftop rainwater harvesting in government buildings for improved water sustainability.

The outcome of the study will help the state government and relevant departments make informed decisions and implement effective strategies at the local level. The findings will guide the development of policies and actions to improve ground water management and ensure sustainability in the region.

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Chapter 1: Introduction

1.1 NAQUIM: Background

National Aquifer Mapping (NAQUIM) has been taken up in XII five-year plan by CGWB to carry out detailed hydrogeological investigations on 1:50,000 scale. As on March 2023, entire mappable area i.e., 90,567.0 Sq. km of Bihar has been covered under NAQUIM.

Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrological, and chemical analyses is applied to characterize the quantity, quality, and sustainability of ground water in aquifers. NAQUIM was taken up with the objectives of delineating aquifers, characterizing aquifers, and preparing aquifer management plans. National level mapping of Aquifers on 1:50,000 scale was considered sufficient for planning requirements up to block level. The findings of NAQUIM studies are being utilized by many agencies including State Ground Water Departments or agencies working in Ground Water Development and Management works.

1.2 NAQUIM 2.0: A Way Forward

Though the NAQUIM output has been useful for sustainable ground water management in numerous ways as enumerated above, large scale implementation of its recommendations at ground level by the user agencies is lacking. As per the feedback received from the agencies using the NAQUIM outputs, major limitations of the on-going studies include i) non availability of printed maps at usable scales and ii) lack of site-specific recommendations for implementation at Panchayat or village level.

Keeping the above limitations in mind and considering the future requirements, broad objectives of NAQUIM 2.0 studies will be 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 upto Panchayat level, iii) providing printed maps to the users iv) putting in place a strategy to ensure implementation of the recommended strategies and v) Involving State agencies in the studies for a sense of ownership.

The NAQUIM 2.0 studies are envisaged to be multidisciplinary. The study 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 one of the main identified issues is Water Stressed Areas.

Chapter- 2: About the Study area

2.1 Introduction

The Mohanpur and Fatehpur blocks of Gaya district have been included in the NAQUIM 2.0 project in Annual Action Plan (AAP) 2023-24, covering a total geographical area of 679.03 square kilometers. The area taken for study as recommended by the State Government during State Ground Water Coordination Committee (SGWCC) meeting citing issues of Sustainability of groundwater. These regions face groundwater scarcity and sustainability challenges primarily due to the low or limited yield potential of aquifers. The study falls under the "Water Stressed Area" category, which is one of the 11 priority areas identified by the Central Ground Water Board's national mandate.

2.2 Locations, Extent and Accessibility

Geographically, the study area is situated between 24°27' and 24°45' North latitude and 84°58' and 85°23' East longitude, and fall in SOI Toposheets 72 H/2, 72 H/6, 72 H/3, 72 H/7, and 72 D/14. Study area encompasses a total geographical area of 679.07 Sq. Km, where Mohanpur and Fatehpur block covers the geographical area of 336.29 Sq. km and 335.94 Sq. km respectively. The study area is bounded in the North by Bodhgaya, Tankuppa and Wazirganj block of Gaya district, in the south by Jharkhand state, in the west by Barachatti block and in east by Nawada district (Figure-1).

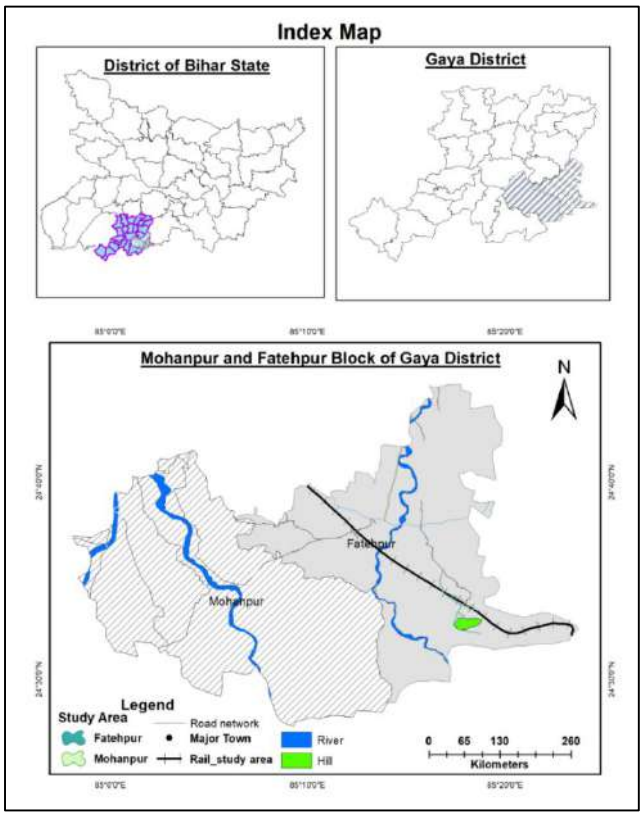


Figure 1: Index Map showing study area

2.3 Demography

Mohanpur is administratively divided into 18 Village Panchayats which covers 231 villages. As of the 2011 Census, Mohanpur has a total population of 2,00,149 comprising 1,00,848 males (50.39%) and 99,301 females (49.61%). Fatehpur divided into 19 Village Panchayats which covers 176 villages. As per Census 2011, Fatehpur has a total population of 2,35,612 comprising 1,20,884 males (51.31%) and 1,14,728 females (48.69%). The demography of the study area is illustrated in figure 2.

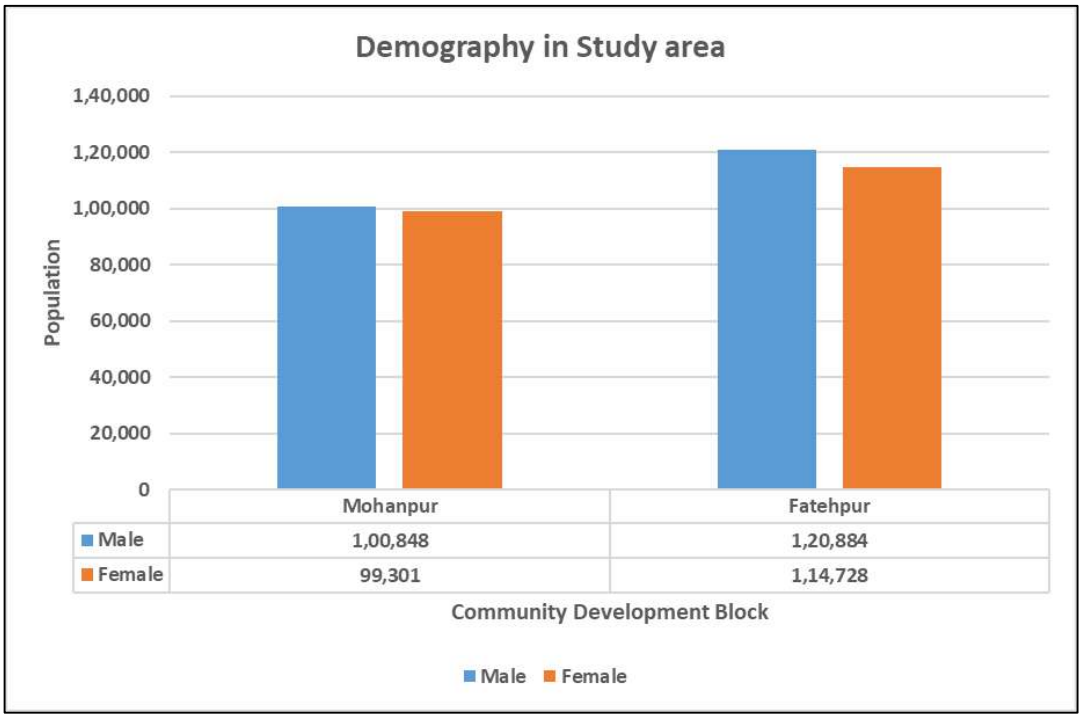


Figure 2: Demography in the Study Area

2.4 Climate and Rainfall :

The area experienced subtropical climate, extremely hot, often exceeding 45°C (113°F) with dry and sunny, with occasional heatwaves in May and June and cool to cold, with January being the coldest month, temperatures can drop to around 1.5°C (34.7°F) with dry and clear, with occasional foggy mornings. Average annual rainfall (from 2021-2023 period) of Mohanpur block is 765 mm of which 87.5% occurs during the monsoon season (figure 4). Whereas, in Fatehpur block, average annual rainfall is 685 mm of which 87.5% occurs during the monsoon season (Figure 3). However, Normal rainfall (period 1951-2000) of Gaya district is 1003.9 mm.

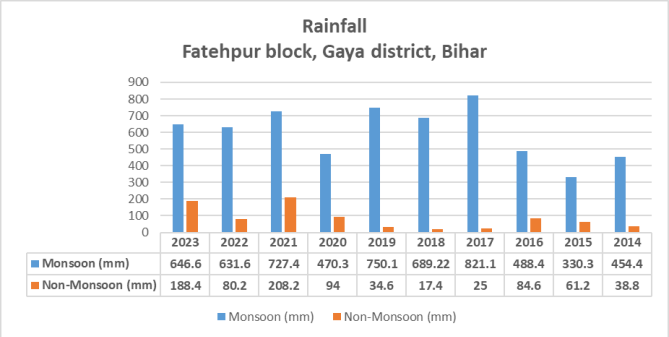


Figure 3: Rainfall in Fatehpur block, Gaya district

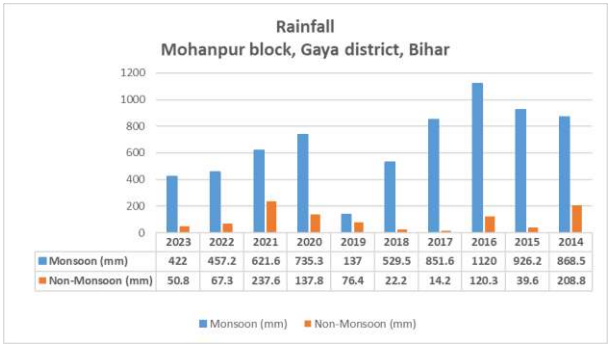


Figure 4: Rainfall in Mohanpur block, Gaya district

2.5 Geology

The geology of area is predominantly shaped by the Chotanagpur Gneissic Complex and various sedimentary formations from different geological periods. The Chotanagpur Gneissic Complex, a significant geological feature in the region, primarily comprises biotite gneiss and porphyritic granite. These rock types date back to the lower to middle Proterozoic era, which spans approximately 2.5 to 1.6 billion years ago. The gneiss is a high-grade metamorphic rock formed under intense heat and pressure, while porphyritic granite indicates a history of magmatic activity where large crystals are embedded in a finer-grained matrix.

Overlaying this ancient foundation are sedimentary deposits from more recent geological periods. The Nawada Formation, which dates from the Late Pleistocene to Early Holocene epochs, consists of soft, unconsolidated sediments such as silt and clay. This formation also features caliche nodules, which are indicative of past environmental conditions that favoured the accumulation of such deposits. The Nawada Formation provides insights into the region's climate and sedimentary processes during the transition from the ice age to the modern climate

In addition to these, the Diara Formation from the Late Holocene period contributes to the geological diversity of the district. This formation is characterized by the presence of sand and silt deposits, which reflect more recent sedimentary processes. These sediments often accumulate in river valleys and floodplains, illustrating the dynamic and ongoing nature of geological processes in the area. Together, these geological formations provide a comprehensive view of Gaya district's complex and varied geological history. The geological map of study area is illustrated in figure 5.

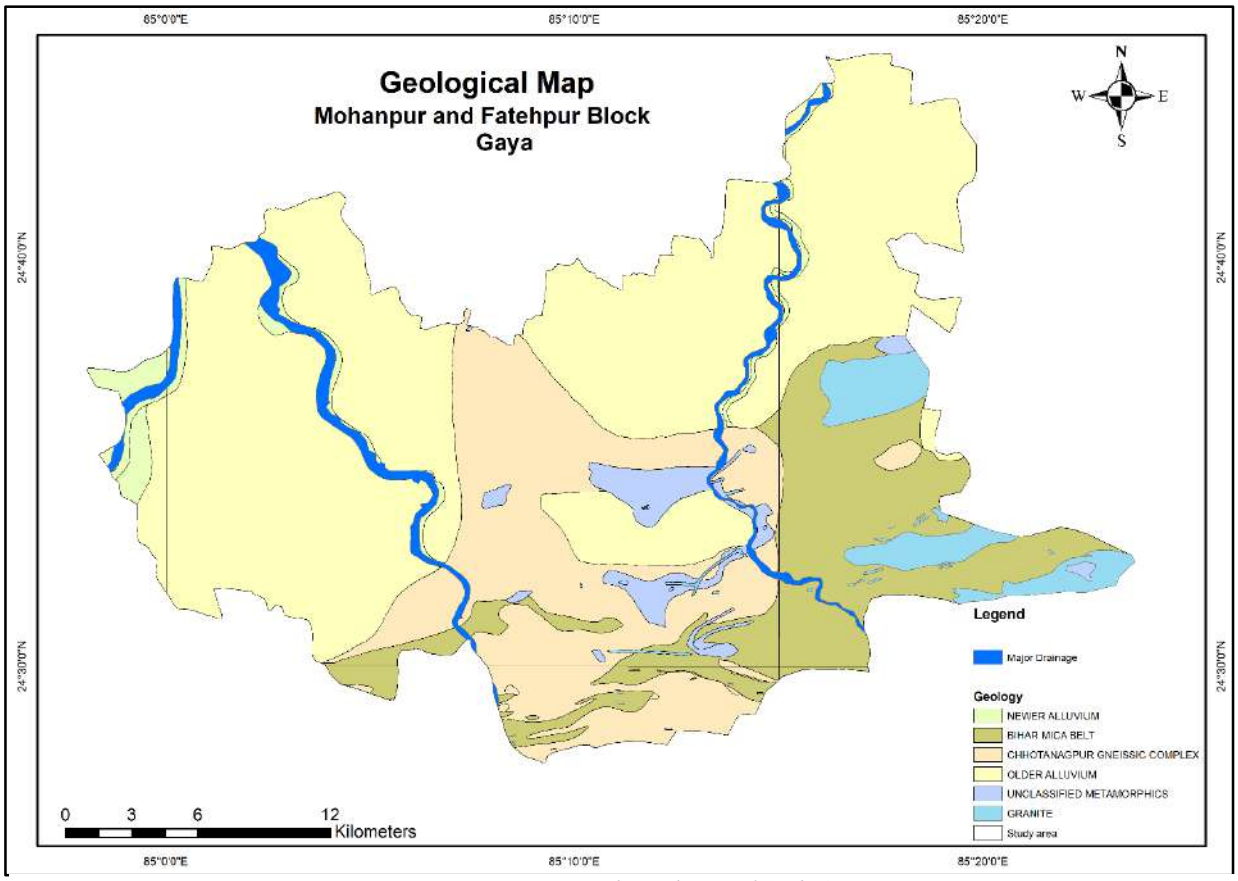


Figure 5: Geological Map of Study Area

2.6 Geomorphology

The geomorphology of the Fatehpur and Mohanpur blocks in Gaya district presents a diverse and dynamic landscape shaped by a combination of geological formations, topographical variations, and hydrological processes. In both blocks, the southern regions are predominantly characterized by rugged, high-relief terrains composed of hard, layered rocks such as granite and metamorphic formations from the Proterozoic era. These robust geological features create moderate to steep slopes that are resistant to erosion, providing a stark contrast to the flatter, sediment-rich areas found further north.

In Fatehpur, the transition from the elevated southern regions to the northern part of the block is marked by a gentler pediplain. This area features flat to gently sloping surfaces covered with unconsolidated sediments like silt and clay, which are more prone to erosion. The elevation in these sedimentary plains ranges from 75 to 100 meters above mean sea level, illustrating a noticeable shift from the rugged highlands to the more level terrain.

Similarly, Mohanpur exhibits a varied geomorphology with its own distinctive features. The block includes regions with foliated and massive rocks, contributing to its rugged terrain with moderate to steep slopes. In contrast, the pediplains in Mohanpur also display gently sloping areas, with elevations ranging from 75 to 100 meters above mean sea level. These

flatter areas are formed from unconsolidated sediments and are more conducive to agriculture and settlement.

A significant hydrological feature in both blocks is the Phalgu River, which originates from the Chotanagpur hills and flows northward through the diverse landscapes of both Fatehpur and Mohanpur. The river's seasonal flow influences sediment transport and water availability, shaping the landscape and impacting local agriculture.

Overall, the geomorphological diversity of the Fatehpur and Mohanpur blocks reflects the complex interplay between geological processes, topographical variations, and hydrological dynamics, which together define the physical and cultural landscape of Gaya district. Understanding these interactions is essential for effective natural resource management and sustainable development in the region. The geomorphological map of the study area is illustrated in figure 6.

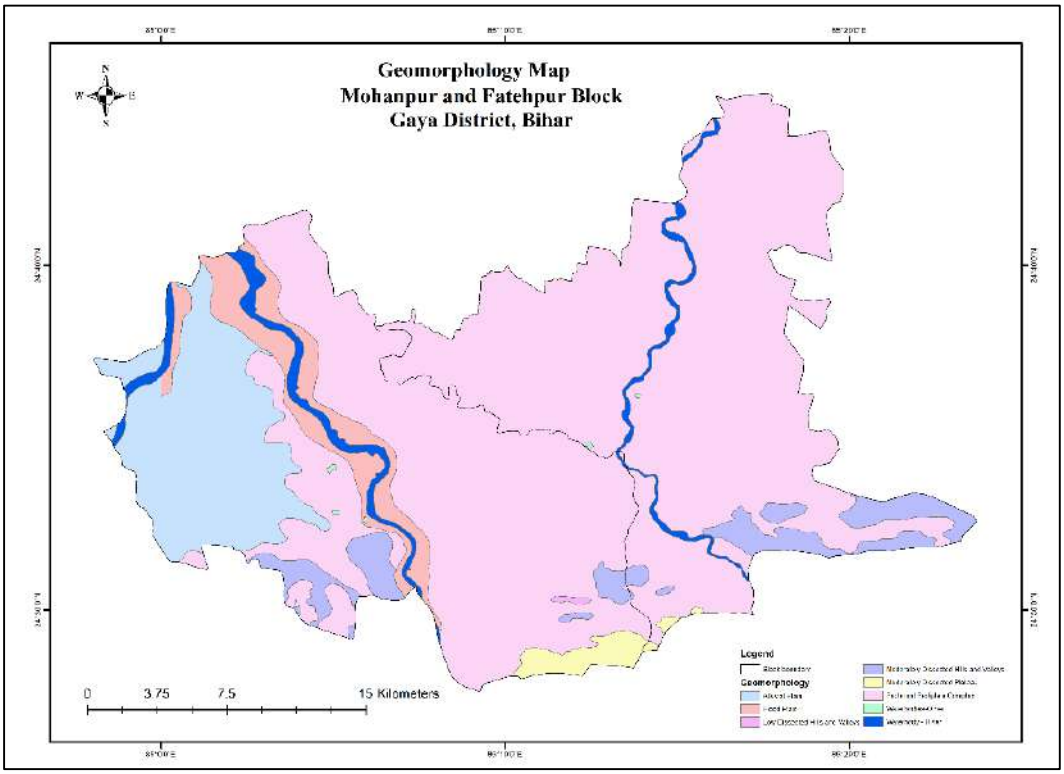


Figure 6: Geomorphological Map of the Study Area

2.7 Drainage

The drainage network in the area is composed by four parallel streams, the Morhar, the Phalgu (Falgu), the Paimar and the Dhadhar all emanating from the southern plateau and flowing north and northeasterly. The river Phalgu flows from south to north through the area especially through Mohanpur block. The river Dhadhar also flows from south to north through the area especially through Fatehpur block. The Phalgu River further divides near Barabar Hill, with one branch flowing north and the other northeast. Historically, Gaya District was dotted with numerous surface water bodies such as tanks, ahars, and pynes, which were crucial for both domestic use and irrigation. However, many of these structures have been lost or filled in due to poor maintenance and encroachment. The ahar-pyne system, used for managing river water and supporting agriculture, suffered greatly under British colonial rule, and continued to decline post-independence. The drainage map of the study area is illustrated in figure 7.

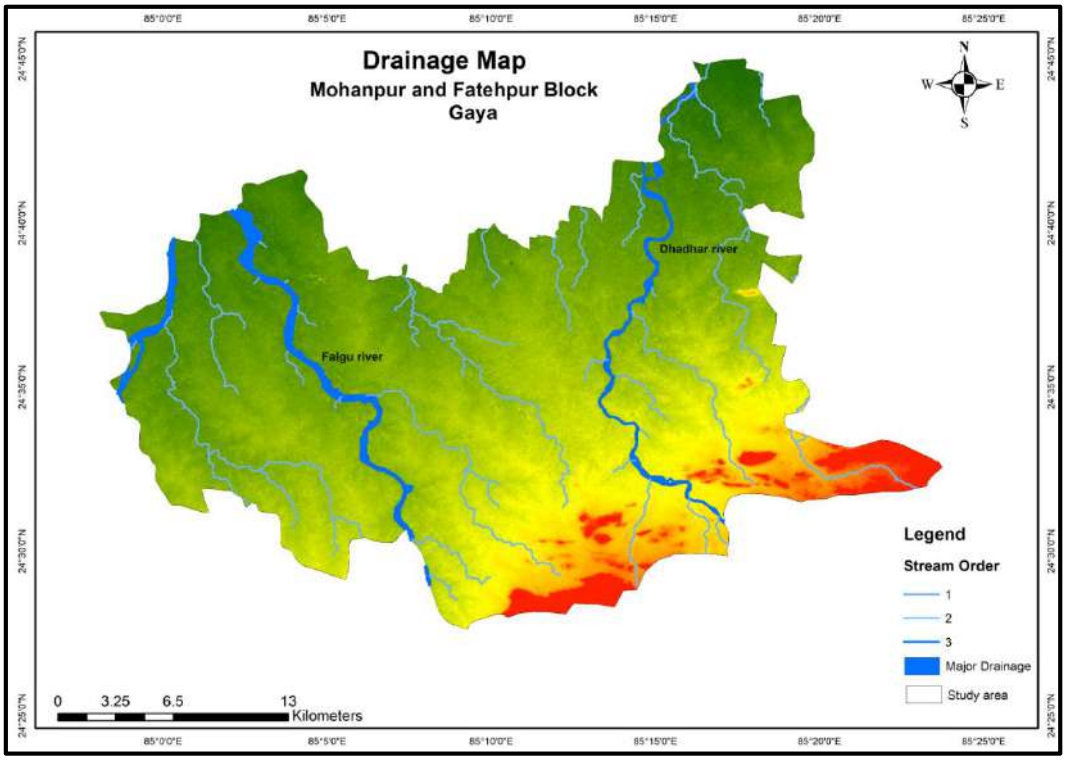


Figure 7: Drainage Map of the Study Area

2.8 Land use

Based on DIP 2015-20 and PMKSY data, in Mohanpur, the forest area spans 89.69 square kilometres, while in Fatehpur, it covers 84.55 square kilometres. The amount of barren land is significantly higher in Mohanpur, with 27.89 square kilometres, compared to 8.27 square kilometres in Fatehpur (figure 9). When it comes to agricultural land, Mohanpur has a net sown area of 97.46 square kilometres, whereas Fatehpur has a slightly larger net sown area of 102.87 square kilometres. Additionally, the gross cropped area is 176.02 square kilometres in Mohanpur and 192.67 square kilometres in Fatehpur. LULC map of the study area are shown in figure 8.

Table 1: LULC data of the study area

Name of the Block	No. of Gram panchayat	Total Geographical Area (ha)	Gross cropped Area (ha)	Net Sown Area (ha)	Area Sown more than once (ha)	Area under Forest (ha)	Area under Wasteland (ha)	Cropping Intensity (%)
Fatehpur	19	33594	19267	10287	8980	8455.74	827.004	187
Mohanpur	18	34309	17602	9746	7856	8969.41	2789.8	181
	37	**67903**	**36869**	**20033**	**16836**	**17425.15**	**3616.804**	

Source: District Statistical Department

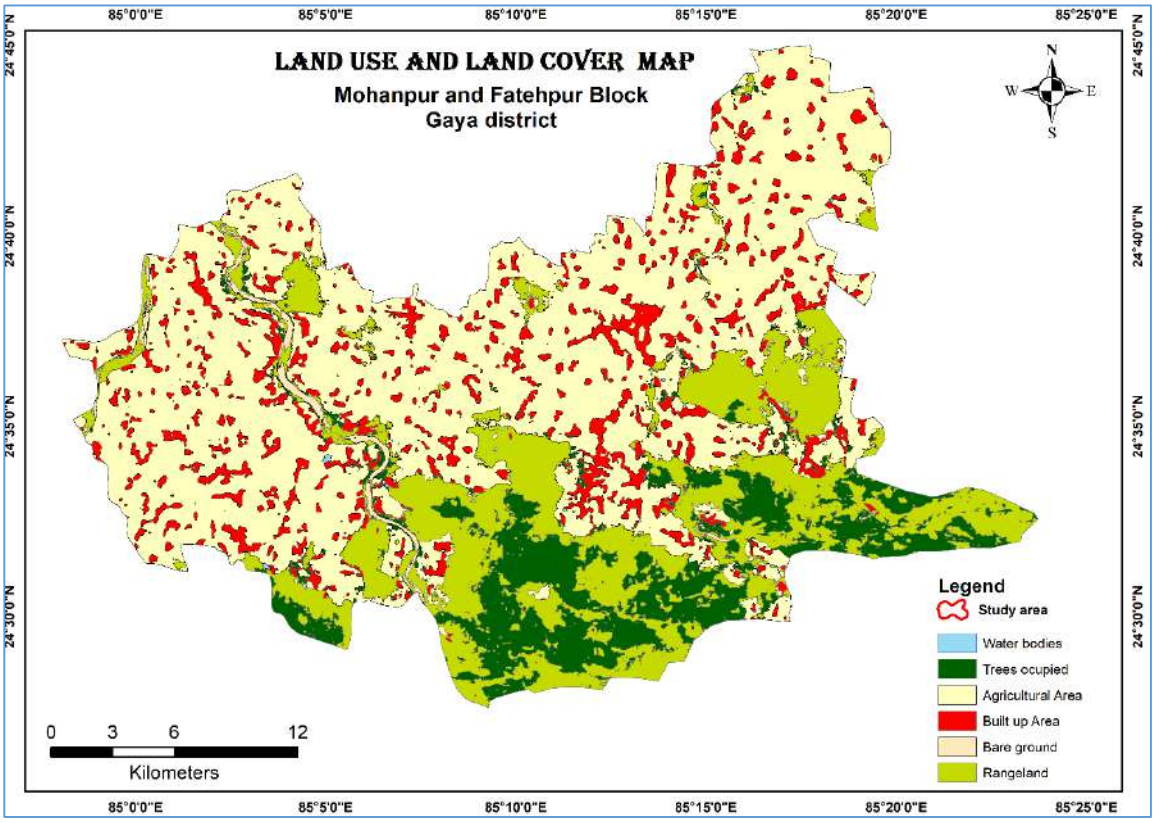


Figure 8: LULC map of the Study Area

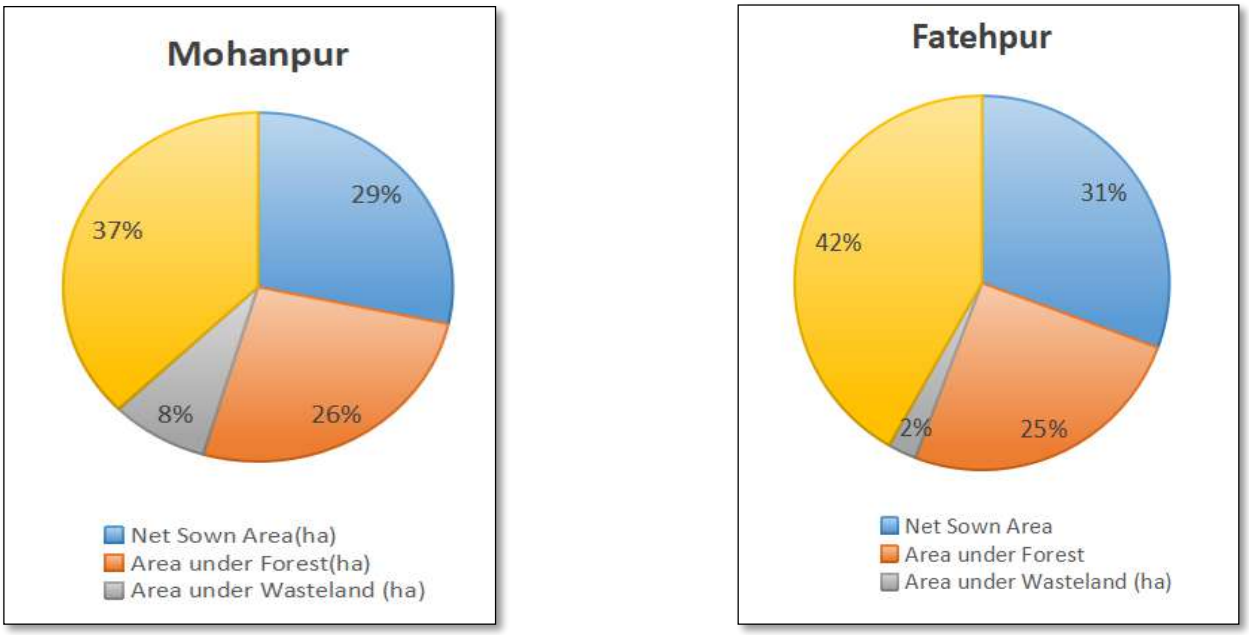


Figure 9: Graphical Representation of LULC prevalent in the Study Area

Irrigation and Cropping Pattern

In the Mohanpur and Fatehpur blocks of Gaya district, where agriculture is the primary livelihood, monsoon rainfall is vital for crop cultivation. The monsoon season, running from June to September, provides crucial water for irrigation and groundwater replenishment.

Adequate rainfall ensures healthy crop growth and high yields, whereas insufficient or irregular rains can lead to poor harvests and financial strain.

Table 2: Details of irrigated area in the Study Area

S. No.	Block	Irrigated (Area in ha)		Rainfed (Area in ha)	
		Gross Irrigated Area	Net Irrigated Area	Partially Irrigated /Protective Irrigation	Un- Irrigated or Totally Rainfed
1	Fatehpur	12258	6423	1973.4	4604.6
2	Mohanpur	10320	5602	2061.9	4811.1
	Total	22578	12025	4035.3	9415.7

Source: Dist. Stat. Office/Irrigation Department.

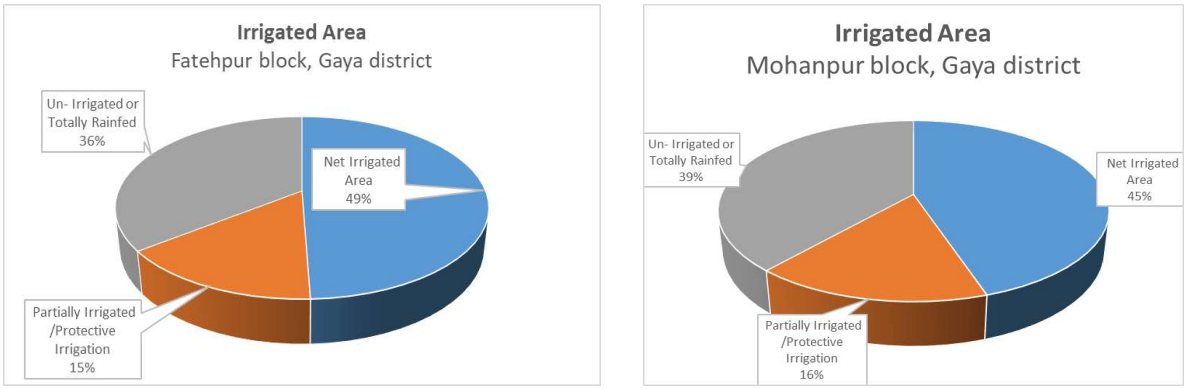


Figure 10: Details of irrigated area in the Study Area

The most common source of irrigation is the ground water tapped through ground water schemes comprising dug wells, shallow, medium, and deep tubewells. According to 6th MI census, the tube wells may be categorized into 3 categories based on depth of bore as the depth of bore is most common aspect during irrigation well construction in India;

Table 3: MI census data of the Study Area

Sl. No.	Block	4th MI Census (2006-07)			5th MI Census (2013-14)				6th MI Census (2017-18)			
		DW	STW	DTW	DW	STW	MDTW	DTW	DW	STW	MDTW	DTW
1	Fatehpur	35	1244	11	1	1295	12	0	300	925	502	3
2	Mohanpur	649	1194	4	88	470	265	8	409	405	830	193
Total		684	2438	15	89	1765	277	8	709	1330	1332	196

2.9 Soil Type

In our study area in Gaya District, the soil exhibits diverse characteristics due to its fertile alluvial deposits and varying textures fine to coarser from north to south. Near the river beds, sandy loam is predominant, combining sand and clay in a predominantly sandy matrix, making it well-draining and suitable for some crops. Moving towards the hills, loamy soil, enriched by rain washings from higher elevations, offers a balanced mixture of sand, silt, and clay, which enhances its fertility and agricultural potential. Sandy soil, locally known as "balui," is found close to river banks; it is coarse and well-draining but may require added nutrients for optimal use. The district also features Kewal Soil, a productive black soil with a mixture of clay and loam, which is neutral in nature and ideal for agriculture. In transitional areas between the plain and dissected plateau, Foothill Balthar Soil, or red soil, is acidic, affecting its suitability for certain crops without proper soil management. The soil map of the study area is illustrated in figure 11.

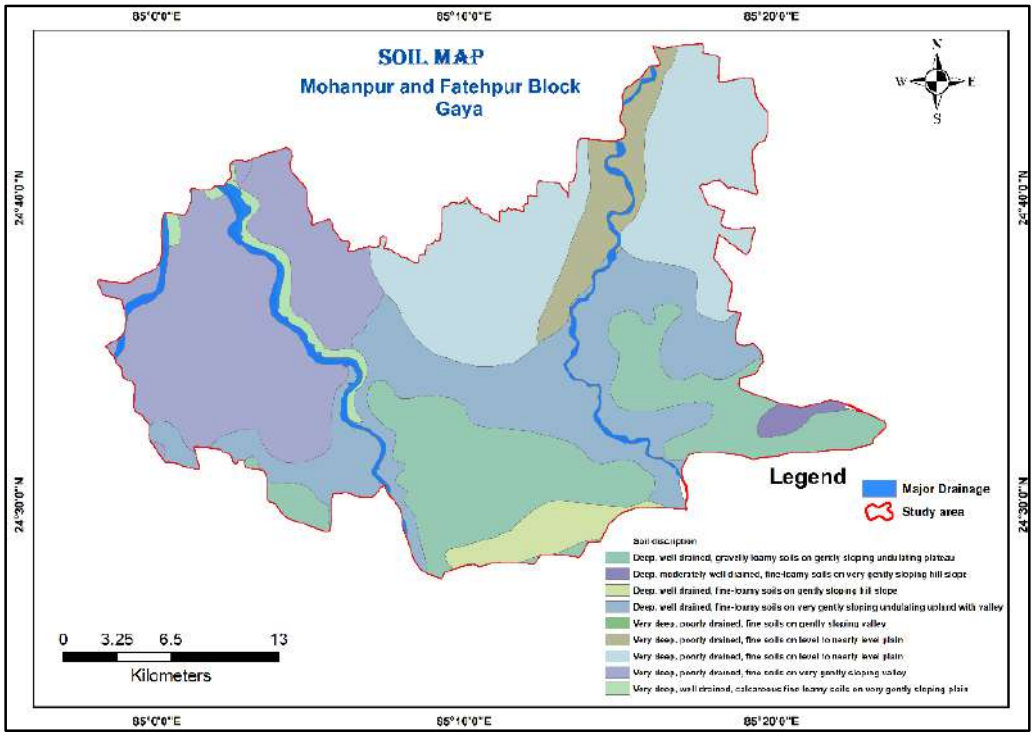


Figure 11: Soil type characterisation in study area, (Source: NRSC)

Chapter 3: Priority Types

The studies under NAQIUM 2.0 are proposed based on issues specific and undertaken in prioritized focus area of toolkit. The Priority of the study area mainly water stress and drinking water source sustainability in water stressed area of Mohanpur and Fatehpur block of Gaya district was conveyed in the State Ground Water Coordination meeting. The Study area covered 680 sq. km and drained by Phalgu and Dhadhar River. Geologically area is predominantly underlain by Chotanagpur Gneissic Complex of lower to middle Proterozoic era and various sedimentary formations from different geological periods.

Hydrogeologically, weathered and fractured formation of granitic gneiss rock type overlain by marginal alluvium form major aquifer system in the area which has very low aquifer potential/ lack of sufficient prolific water bearing zone leading to limited well yield in regions coupled with minimal natural recharge to groundwater. Due to its geological characteristics, aquifer form limited storage capacity as they have low porosity and permeability and have heterogeneity in distribution of fractures and joints in hard rock is highly irregular, leading to uneven groundwater availability. This makes it difficult to predict and manage water resources effectively. Due to these factors, wells in the area often suffer with negligible to limited discharge. This scarcity of sources of groundwater makes it challenging to implement sustainable water supply network. As almost communities are dependent on groundwater for their daily need, it required systematic and scientific approach for managing the resources.

These sustainability of groundwater sources coupled with contamination of fluoride in upper stream and reaches to lower part through river water and reported along the channel.

6th Minor Irrigation Census report 2016-17, reveals that majority of Minor irrigation scheme is mainly based on ground water and tapping through Dug Well, Shallow to Medium tube well structure. It shows that majority of wells became temporarily not in used due to un-availability of sufficient/ less discharge (figure 12). It has been observed from well statistics of consecutive Census of Minor Irrigation (MI) that there is significant rise in number of tube well comprising all type viz. Shallow, Medium and Deep Tube well in the area (figure 13).

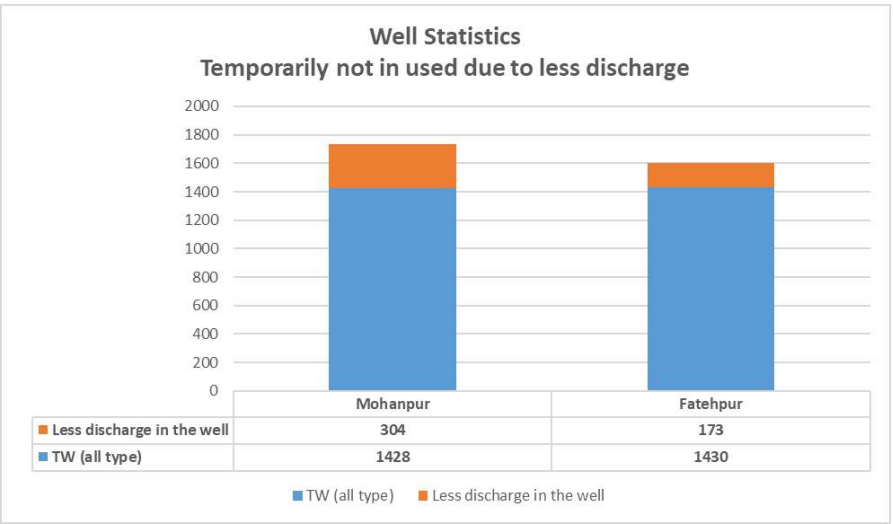
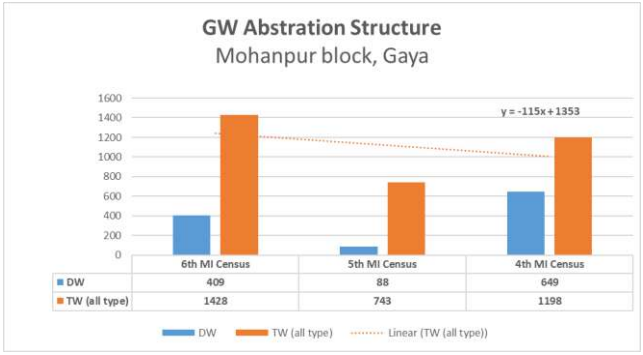


Figure 12: MI census data for the Study Area -well temporarily not in used



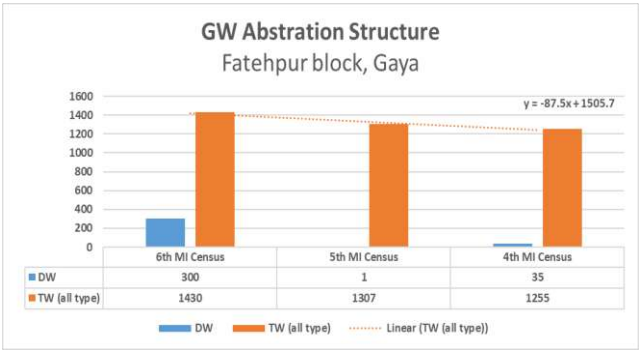


Figure 13: Groundwater Abstraction Structure details in the Study Area (Source: MI Census)

Chapter 4: Previous Studies

Central Ground Water Board, Middle Eastern Region, Patna has carried out various studies previously related to groundwater. A summary of these studies is provided as below;

4.1. NAQUIM Studies

During XII five-year plan (2012-17) National Aquifer Mapping (NAQUIM) study was initiated by CGWB to carry out detailed hydrogeological investigation. The Aquifer Mapping programme has been continued till 2023 to cover whole country. During 2020-2021 under National Aquifer Mapping programme, all the 24 blocks of Gaya district covering an area of4986 Sq.km have been taken up for detailed hydrogeological survey and preparation of Aquifer maps and Management plan. The aquifer maps and management plans will be shared with the administration of Gaya district and other user agencies for its effective implementation.

4.2 District Brochure

The district brochure for Gaya District was utilised to develop an understanding of the regional hydrogeology and other parameters relevant to ground water studies for the study area viz. Mohanpur and Fatehpur block in the southern part of the Gaya district.

4.3 Dynamic Ground Water Resource Estimation

The estimation of Dynamic Ground Water Resources of the State was conducted collaboratively by the Central Ground Water Board, Mid-Eastern Region, Patna and Minor Water Resources Department, Govt. of Bihar. Based on the Assessments in 2017, 2020, and 2022, blocks of study area in Gaya district have been categorized as "Safe".

4.4 Other work carried out by CGWB, MER, Patna

- Short-Term Water Supply Investigation at Gaya Cantonment Area, Bihar (December 1978):
- Systematic Groundwater Investigation in the Eastern Part of Gaya District, Bihar (January 1981):
- Groundwater Management Study in Gaya District, Bihar, (AAP 2010-11):
- Geophysical Study conducted in Power Grid Corporation complex, Bodh Gaya, Gaya
- Geophysical Study conducted in MES, cantonment, Gaya, Bihar
- Geophysical Study conducted in Campus of Magadh University, Bodhgaya, Gaya district
- Geophysical Study conducted in Campus of Magadh University, Bodhgaya, Gaya district

Chapter 5: Objective of the Study

The present study aims to address key aspects of groundwater management, particularly in water-stressed regions, through the following objectives:

5.1 Demarcation of aquifer dispositions

The study aims to thoroughly understand the aquifer systems in the area by conducting detailed hydrogeological and geophysical surveys to derive the vertical and horizontal extent of aquifer, its properties by conducting test. Survey reveals the potential zone of water bearing and disposition of weathered thickness of these weathered zones for determining groundwater storage and movement. Study seeks to identify the best zones for groundwater extraction and recharge, which is vital for managing water resources in scarcity-prone areas.

5.2 Aquifer wise water level monitoring

The objective entails the systematic monitoring and recording of groundwater levels of existing aquifers to comprehend their season wise fluctuations and analysing trends for evaluating the health and sustainability of these aquifers. This data is instrumental in developing predictive tools for future water availability, which is essential for effective water resource management in regions experiencing water stress.

5.3 Identification and delineation of recharge and discharge areas

Identifying natural and potential artificial recharge areas is vital in water-stressed regions, where groundwater replenishment is essential. This process involves a comprehensive examination of depth to water level and its long-term trend, soil characteristics, topography, existing water flow patterns, and aquifer type along with geochemical signatures. The study delineates these recharge areas to aid in developing sustainable groundwater development and management strategies. Identifying suitable areas for recharge practices will help maximize the replenishment of depleted aquifers. In this study, a detailed artificial recharge plan was proposed. This plan includes constructing structures such as check dam, percolation tanks, nala bunds, renovation of existing water bodies and water conservation structure to enhance natural groundwater recharge.

5.4 Groundwater quality assessment

Ensuring groundwater quality is crucial, especially in regions where water scarcity makes every drop valuable. This segment of the study involved collecting and analysing water samples from existing aquifers in pre & post monsoon to evaluate parameters such as pH, salinity, hardness, and contaminant levels etc. The resulting data will guide management practices to address quality issues, ensuring groundwater meets safety standards for

consumption and other uses. This is particularly important in water-stressed areas, where poor water quality can worsen the situation.

5.5 Identification of Potential Aquifers for Drinking Water Supply

This objective focused on identifying aquifers with the potential to serve as reliable and safe sources of drinking water. This study will conduct thorough assessments of both the quantity and quality of groundwater, of pre and post monsoon considering the sustainability of extraction. This is particularly crucial in water-stressed regions.

5.6 Risk Assessement of villages based on Sustainability of Ground Water Sources

Sustainability of sources in a water stressed area such as Mohanpur and Fatehpur blocks of Gaya District is crucial for effective water resource management. Therefore, a detailed risk assessment will be carried out through integration of various datasets as per Standard Operating Procedure (SOP) on "Sustainability of Ground Water Sources" prepared by Ministry of Jal Shakti.

5.7 A Plan for Drinking Water Source Sustainability

The primary goal of this objective is to ensure the long-term sustainability of drinking water sources through a strategic management plan. This plan will prioritize the protection and careful use of groundwater, focusing on both supply- and demand-side management. It will promote water use efficiency, conservation practices, and the adoption of technologies that reduce water consumption. In water-stressed areas, such a plan is crucial to balance the population's needs with groundwater availability, ensuring future generations have access to this essential resource.

5.8: Sustainable management plan: Demand & Supply side interventions

The broad objective to prepare a sustainable management plan for groundwater resources is to ensure the long-term availability and quality of groundwater in the area. The study proposes a comprehensive management intervention on the basis of data generated and collected.

Chapter 6: Data Generation and Acquisition

6.1 Introduction

As per NAQUIM 2.0, the studies proposed to be carried out on 1:10000 or larger scale to create high/ and appropriate data density of hydrogeological parameter to decipher ground water scenario of the area, aquifer disposition and characterisation. As per the indicative data density of different type mentioned in toolkit manual was used to analyse data gap by utilising the tool of ArcGIS.

As per the guidelines of NAQUIM 2.0 toolkit the data generated against the indicated data density for different data type is given as below and presented in figure 14 and 15:

Table 4: Data Generation during NAQUIM 2.0 study

District	Block	Data type	Existing	Generated
Gaya	Mohanpur (343.09 Sq. Km)	☑ **Exploratory drilling** (EW/OW)	EW/OW/Pz: 1	EW/OW/Pz: 3
		☑ **Geophysical data** (VES/TeM/Profiling)	VES: 5 TeM: Nil	VES: 11 TeM: 13
		☑ **Water Level Monitoring** (NHS & Aquifer Mapping)	DW: 01 PZ:01	DW: 58 PZ:3
		☑ **Water Quality**	01	58
		☑ **Infiltration Test**	Nil	2
		☑ **Pumping Test**	Nil	2
	Fatehpur (335.94 Sq. Km)	☑ **Exploratory drilling** (EW/OW)	EW/OW/Pz: 2	EW/OW/Pz: 2
		☑ **Geophysical data** (VES/TeM/Profiling)	VES: 06 TeM: Nil	VES: 05 TeM: 24
		☑ **Water Level Monitoring** (NHS & Aquifer Mapping)	DW: 01 PZ:01	DW: 69 PZ:02
		☑ **Water Quality**	01	69
		☑ **Infiltration Test**	Nil	3
		☑ **Pumping test**	Nil	2

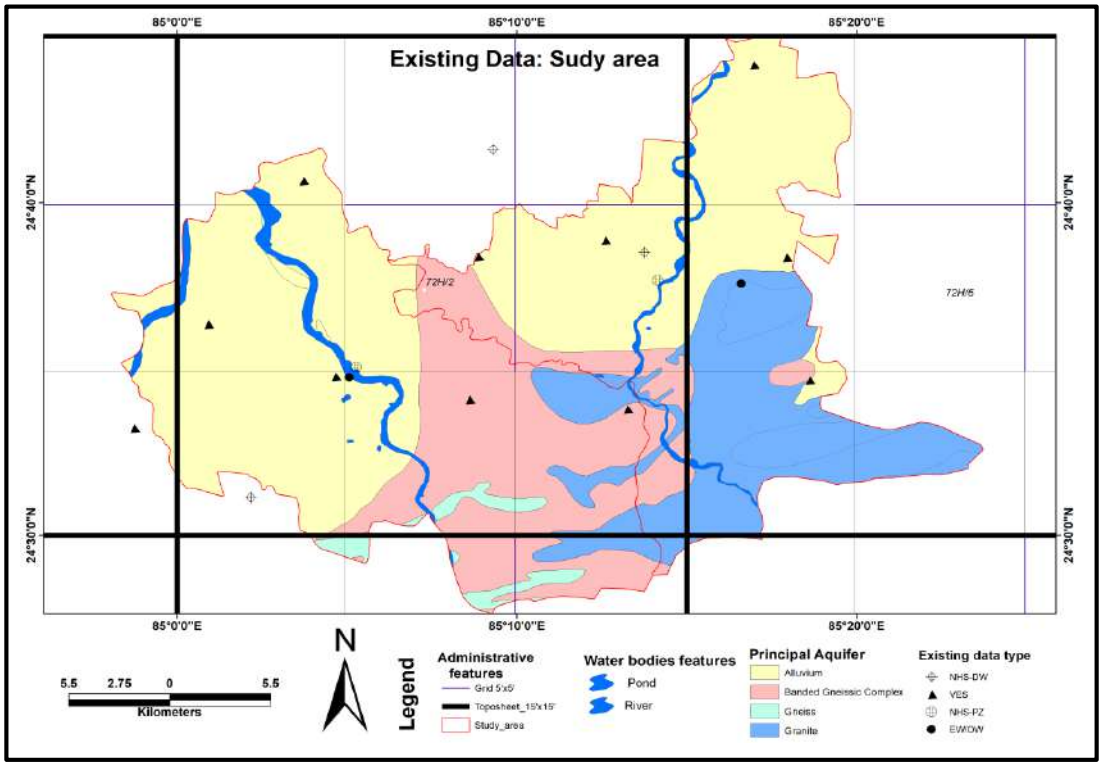


Figure 14: Details of existing data prior to NAQUIM 2.0 study in Mohanpur and Fatehpur block, Gaya district

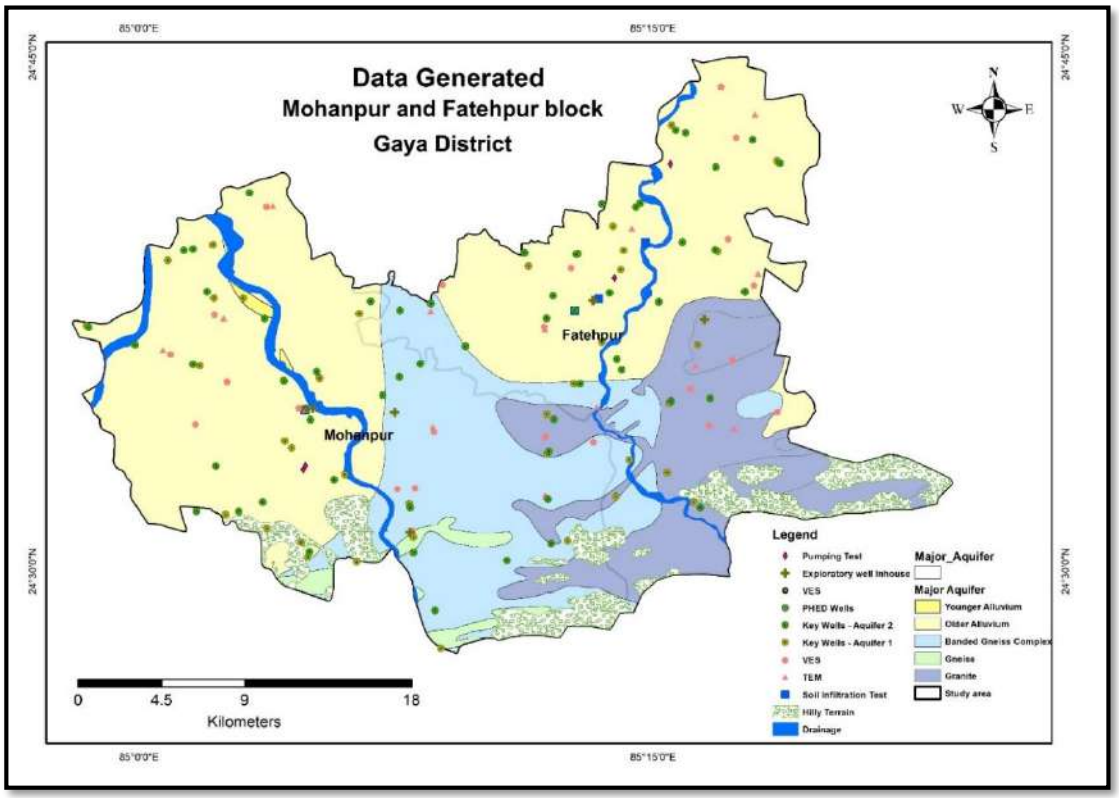


Figure 15: Details of data generated during NAQUIM 2.0 study in Mohanpur and Fatehpur block, Gaya district.

6.2 Exploratory drilling and pumping test:

There were only 03 exploratory wells drilling data from two locations, available with CGWB which was generated during the NAQUIM-1.0 as shown in figure 14 on the scale of 1:50000. As per the toolkit mandate's indicative data density, data gap was identified keeping annual target of inhouse drilling. Total 05 exploratory drilling activity were carried out in the study area. Litholog, drill time log and preliminary yield test at 01 site was conducted. Aquifer parameters were calculated based on pumping tests. The salient details of some of the drilled borewells and piezometers are provided in annexure 1. Moreover, there was not any pumping test data of the study area generated so far prior to the current study. CGWB had constructed 05 nos. of exploratory wells upto the depth of 202.8 m bgl to know the subsurface lithology and aquifer disposition during AAP 2023-24. Due to non-availability of sufficient discharge (≥ 3.0 lps, air compressor), pumping test had not been carried out as drilled exploratory wells had negligible discharge. However, an effort had been made to conduct pumping test in 04 nos. of private/ farmer wells tapping weathered aquifer and large diameter dug wells to derive the hydrogeological properties. Sites are indicated in figure 15.

6.3 Soil InfiltrationTest:

Soil infiltration testing is a vital aspect of hydrological studies, offering insights into how water moves through the soil. A commonly used method for these tests is the double ring infiltrometer technique. This method provides valuable information on soil-water interactions, infiltration dynamics, and hydraulic conductivity. Understanding soil infiltration is essential for effective water resource management, particularly in regions prone to drought or water scarcity. It aids in estimating groundwater recharge rates and designing efficient irrigation systems. Therefore, to know the infiltration rate 05 nos. of test were conducted in the study area covering the range of soil type which are indicated in figure 15.

6.4 Water Level and Quality data

Previously, 04 locations available with CGWB' hydrograph monitoring stations which was used in periodical monitoring of groundwater level. Water sampling is conducted annually from these 02 dug wells during the pre-monsoon period in May. In present study, in order to establish new GW monitoring and sampling stations ($MS_{WL/WQ}$), a grid of 10 sq. km (approx. 3x3km) and village panchayat was considered for identifying the data gap to assess the adequacy of the data. During pre-monsoon and post-monsoon, 132 nos. of well inventory were carried out covering wells tapping shallow aquifer and deeper aquifer and water samples from these wells were also collected for analysis of basic and heavy parameter. The details are presented in figure 15.

6.5 Geophysical data (VES/TeM)

A total 11 VES geophysical data was available with CGWB prior to take up the study. As per the toolkit mandate's indicative data density, data gap analysis was performed to figure out data adequacy in the area. Subsequently, geophysical survey was conducted in the study area using Vertical Electrical Sounding (VES) with Schlumberger & Pole-Dipole methods and Transient Electromagnetic Survey. A total of 27 VES and 37 TeM surveys were carried out in study area (Annexure 8 and 9). The interpretation of geophysical data, combined with available groundwater exploration data, allowed for a refined understanding of the aquifer geometry. The location map of the VES and TEM surveys conducted in the study area is shown in the figure 15.

6.6 Feedback and Sample survey

Under the NAQUIM 2.0 study in Gaya district, a total of 49 farmer feedback forms were collected in the study area.

6.7 Additional data collected from other Agencies

- Data of 17 boreholes constructed under Har Ghar Nal Jal (HGNJ) scheme are collected from PHED, Govt. of Bihar.
- Month wise rainfall data of 10-year are collected from Department of Economics and Statistics, Govt. of Bihar.
- For preparation of management plan 6th MI census data are collected from Minor Irrigation Department, Govt. of Bihar.

Chapter 7: Hydrogeology

The Central Ground Water Board (CGWB) has gathered baseline data on water levels, quality, and geophysical conditions for the district. Utilizing a network of observation wells from the National Hydrograph Network, CGWB monitors groundwater levels and quality. Data from exploratory drilling has helped identify sub-surface geology, water-bearing horizons, and aquifer properties like transmissivity and storativity. Additionally, hydro meteorological data, land use, and cropping patterns have been collected from various government departments to provide a comprehensive understanding of groundwater conditions and usage. In Mohanpur and Fatehpur block of Gaya district, the distribution and movement of groundwater are influenced by factors such as geomorphology, geological structure, and hydraulic properties, resulting in a complex hydrogeological landscape. The area's diverse topography and drainage contribute to this complexity. Based on geological diversity and groundwater potential in various formations, the study area is categorized into two main hydro geological units: (A) Porous Formations and (B) Fissured Formations. These classifications help to understand the varying groundwater characteristics associated with different geological settings within the district. The hydrogeological map of the study area is illustrated in figure 16.

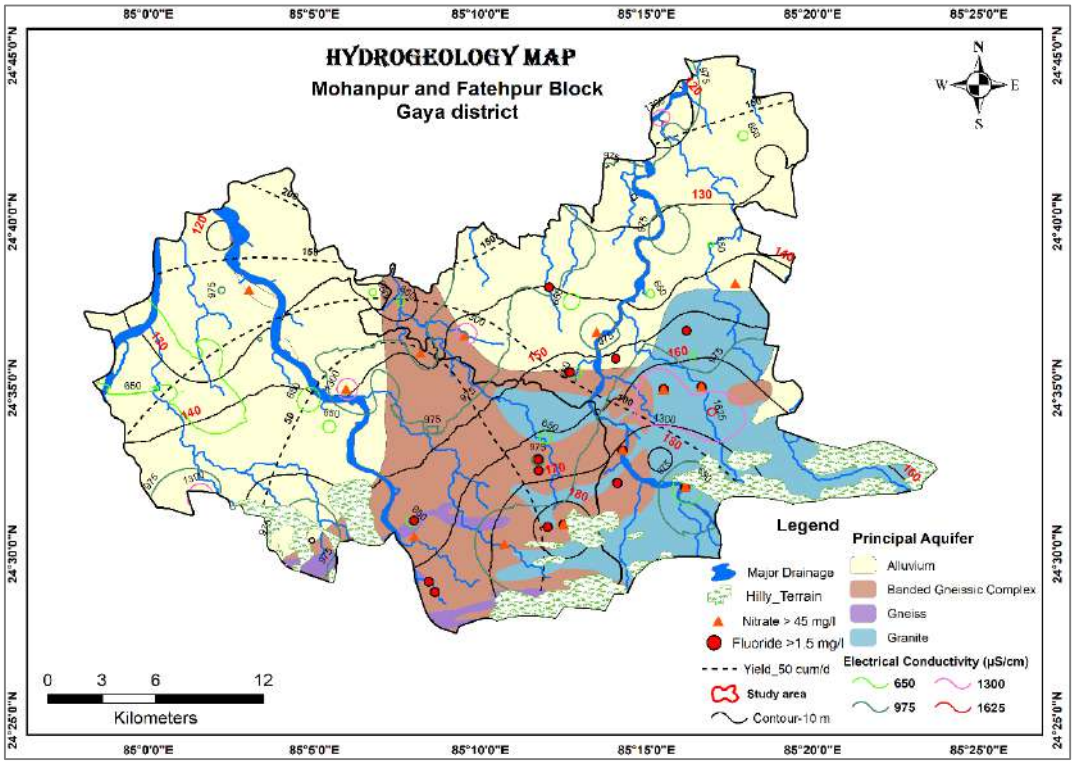


Figure 16: Hydrogeological Map of the Study Area

Data generated so for was analysed and interpreted to decipher the following deliverables:

7.1 Aquifer Dispositions and characterisation

The objective was to characterize the spatial and vertical distribution of aquifers system within geological formations. This involves defining lithological boundaries, mapping stratigraphic layers, and determining the geometry of aquifer units. Well inventory, pumping test, geophysical and drilling data generated & collected from PHED, Gaya was used to delineate aquifer geometry of the area by utilising the tools of RockWorks.

Hydrogeological data revealed the existence of 02 prominent aquifer system in the area till the depth of 200m. Aquifer-I consist of marginal alluvium of coarse to fine grained sand mixed with clay and occasional kanker of tertiary and quaternary period respectively occurred upto the depth of 50 m and thickness ranges from 4.9 to 45.3 m, thickness of the aquifer gradually decreases from south to north. Groundwater occurs under phreatic condition where depth to water level varies from 1.3 m bgl to 9.85 m bgl. Groundwater is generally potable having TDS value ranging from 243 to 1249 ppm during pre and post monsoon. Aquifer-II comprises weathered and fractured formation of granitic gneiss rock type mixed with phyllite and quartzite of Archean period. The depth of aquifer encountered upto 90 m and thickness ranges from 4 to 82 m having more thickness near southern part of the area. Most of the abstraction structure are handpump. Groundwater occurs under phreatic to semiconfined condition where depth to water level varies from 7 m bgl to 35 m bgl. Groundwater is generally potable having TDS value ranging from 241 to 1110 ppm during pre and post monsoon. Well hydraulic data of test conducted in 03 farmer/private well reveals that yield potential lies in the order of 1.44 -25.5 m^3/hr with an average drawdown of 0.98 to 6.22 m and transmissivity is in the order of 72.62-1016.19 m^2/day. Drilling data shows that some deep seated fractures encountered at depth of 90 m and 60 m. However, shallow fractures are common in this area, yielding negligible to very limited discharge. Massive hard rock formation with predominantly granitic gneiss and quartzite is observed below fractured hard rock formation upto the depth of 202.8 mbgl. It has been observed that the heterogeneity of hard rock aquifer being high, the hydrogeological information drawn by inferring the continuity of fracture zones in the second aquifer is tentative. Any additional data from the area in future may change the geometry of aquifer, that can be considered as well. These information is integrated to decipher aquifer disposition by following hydrogeological cross section covering different direction of study area and their characterisation.

7.2 Hydrogeological 2D-cross section

To study the aquifer disposition in detail, various hydrogeological cross section indicating aquifer geometry has been prepared. The aquifer disposition prepared is a regional picture based on data of available exploratory wells drilled by CGWB and PHED. The Location map of the exploratory wells is illustrated in figure 17.

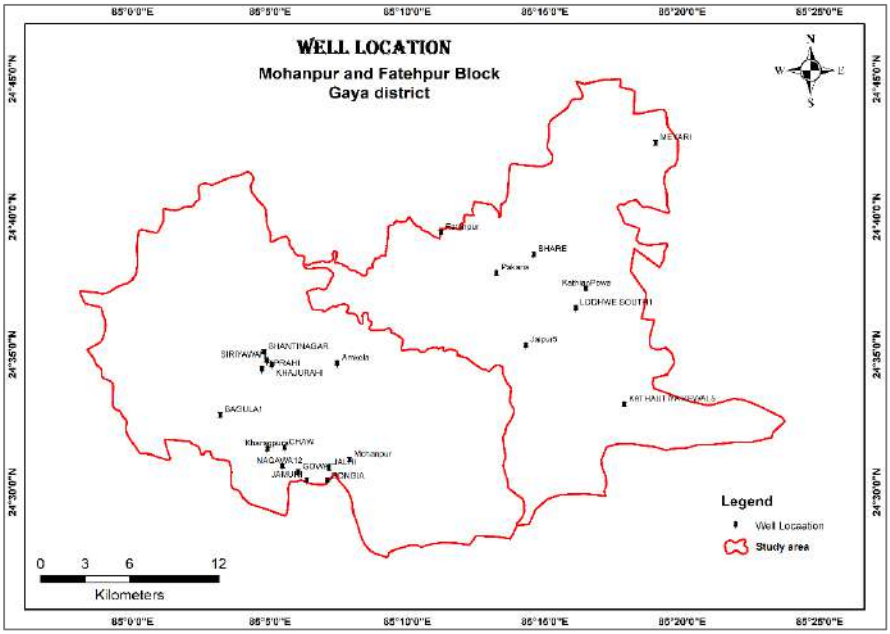


Figure 17: Location Map of exploratory wells in the Study Area

7.2.1. Hydrogeological cross section along A and A'

The cross section is taken along N-S and eastern part of the study area. As shown in figure 18, the alluvium thickness varies from 5-20 m and weathered portion decreases as we move toward north. Fractured hard rock is found in northern part of the study area. The alluvium part demarcates the 1st aquifer and weathered and fractured segment below it constitute the 2nd aquifer.

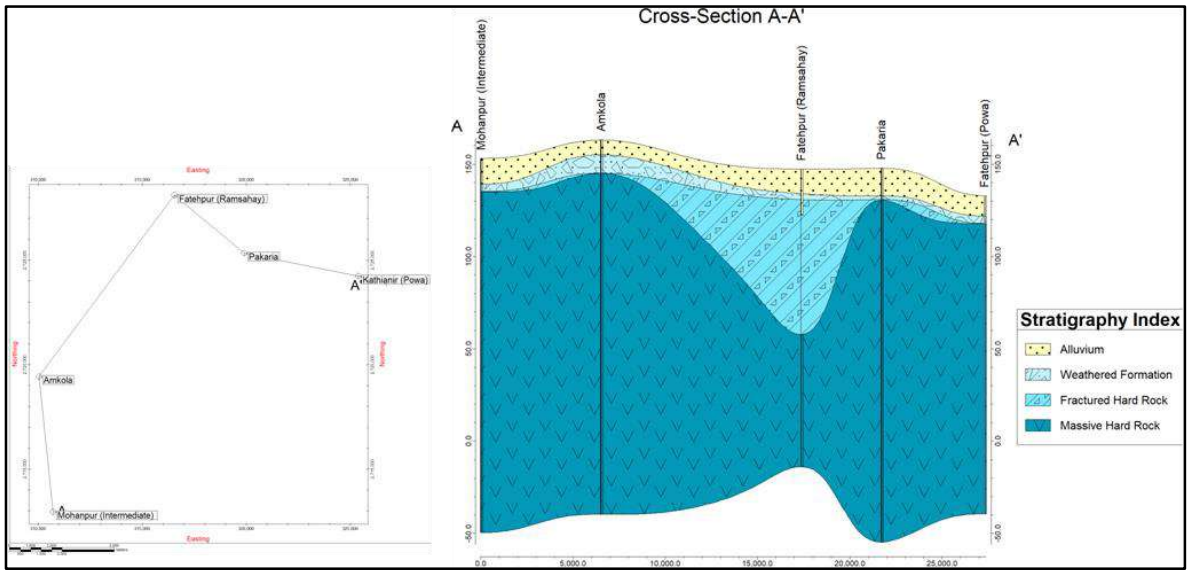


Figure 18:Hydrogeological cross section along A () and A' ().

7.2.2. Hydrogeological cross section along B and B'

The cross section is taken along NE-SW direction of the study area. As shown in figure 19, the alluvium layer is consistently thick, its thickness varies between 10-20 m. But its thickness decreases as we move toward Jalhi from Mohanpur. The alluvium demarcates the 1st aquifer. The weathered and fracture zone below it, demarcates the 2nd aquifer.

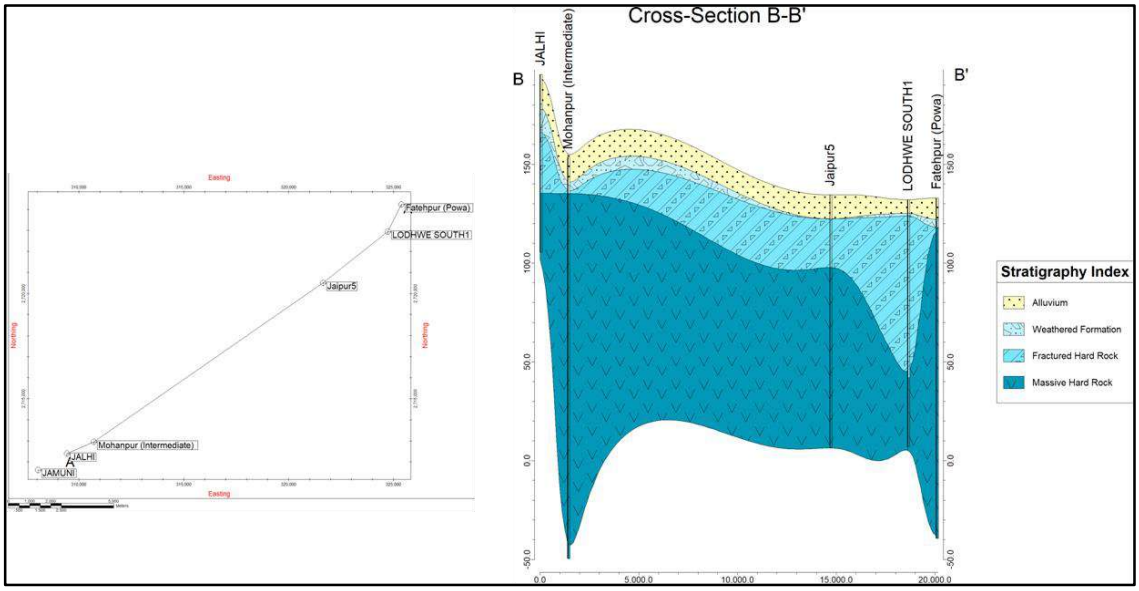


Figure 19: Hydrogeological cross section along B () and B' ().

7.2.3. Hydrogeological Section along C-C'

The cross section is taken along central and southern part of the study area. As shown in figure 20, the alluvium thickness varies in between 5-15m and its (1st Aquifer) thickness decreases as we move towards south in Fatehpur and Mohanpur block. The 2nd aquifer is continuously thick (ranging between 10 to 15 m) as we move northwards while it is sporadically present as we move from west to east in the study area.

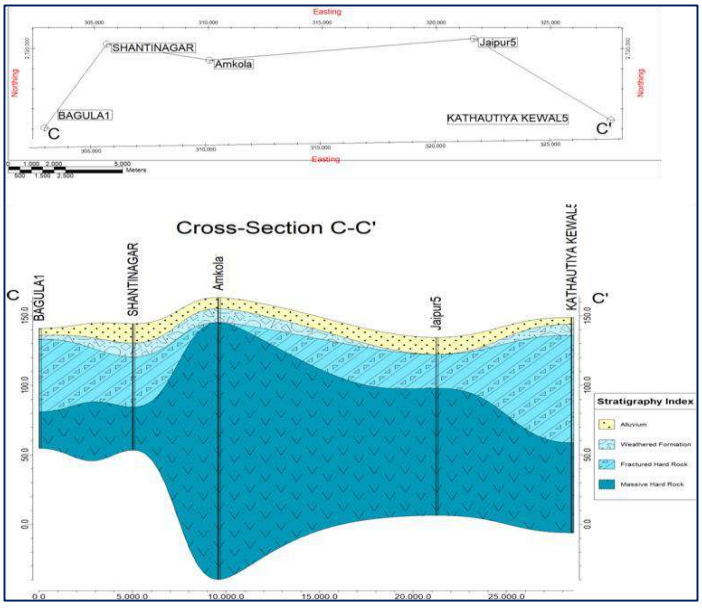


Figure 20: Hydrogeological cross section along C and C'.

7.2.4 Hydrogeological Section along D-D'

The cross section is taken along N-S direction of Fatehpur block. The alluvium thickness varies in between 5-25m and its (1st Aquifer) thickness decreases as we move towards south in Fatehpur block. The 2nd aquifer is continuously thick (70-100m) as shown in figure 21.

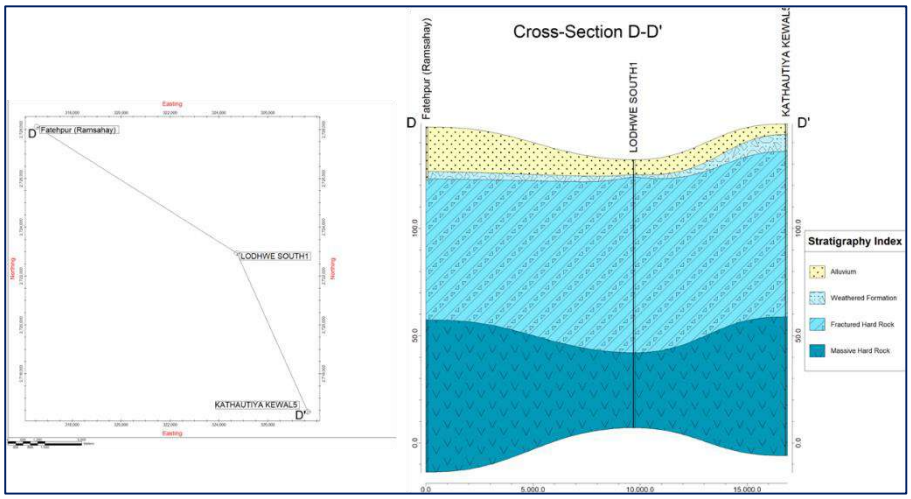


Figure 21: Hydrogeological cross section along D and D'

7.2.5 Hydrogeological Section along E-E'

The cross section is taken along N-S direction of the Mohanpur block. The 1st aquifer (Alluvium) thickness is about 10 m. The 2nd aquifer is very thin in Mohanpur but its thickness increases away from it as shown in figure 22.

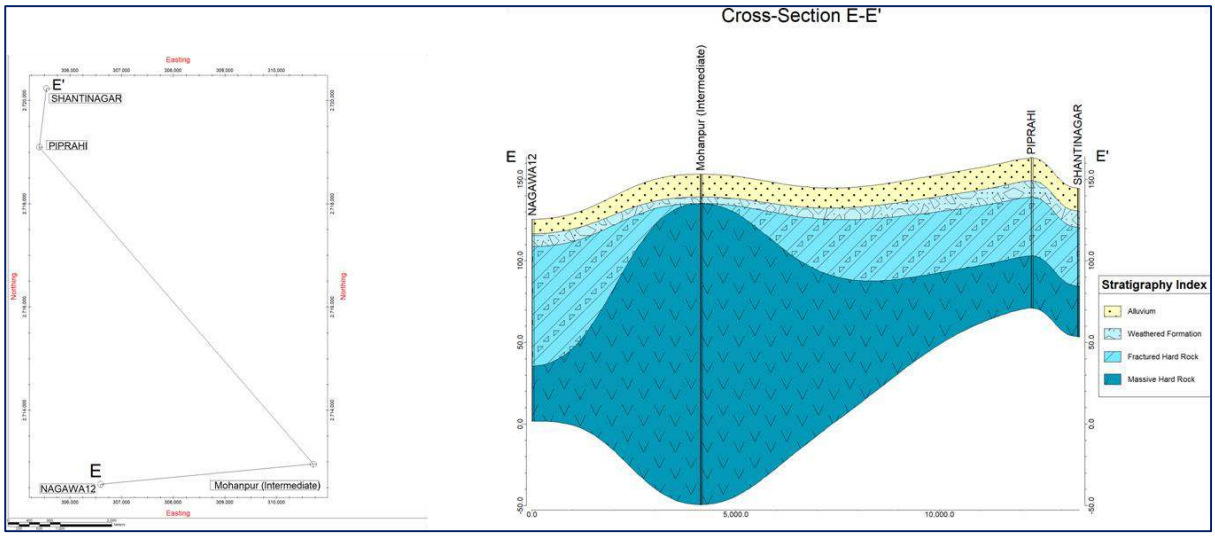


Figure 22: Hydrogeological cross section along E and E'.

7.2.6 Hydrogeological Section along F-F'

The cross section is taken along NE-SW direction, considering the wells in Bagula, Amkola and Pakaria of the Mohanpur and Fatehpur block. The 1st aquifer (Alluvium) thickness is observed to be increasing from SW to NE in the range of 10 to 20 m. The 2nd aquifer is relatively thin in Mohanpur and Fatehpur but its thickness increases in the central part of the study area as shown in figure 23.

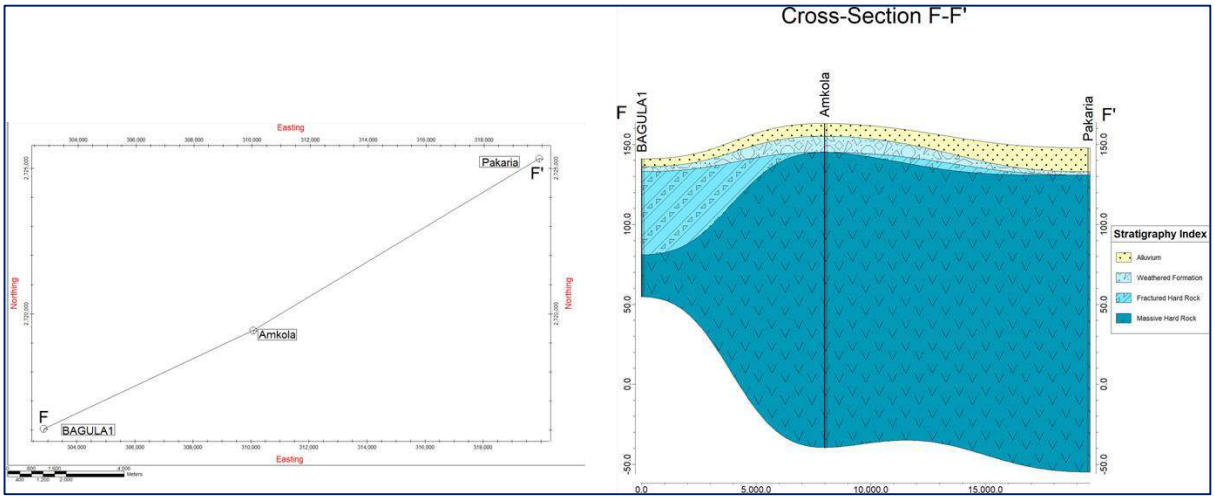


Figure 23: Hydrogeological cross section along F and F'

7.3 Aquifer Disposition of the Study Area

The Mohanpur and Fatehpur blocks of Gaya district have two primary aquifers: alluvial and granitic gneiss. The alluvial aquifers, formed during the Quaternary period, consist of fine to coarse sand, clay, and silt with kankar and gravel. They occur at depths ranging from 0 to 50.29 meters with a thickness of 4.9 to 45.3 meters. The extent of alluvium increases from south to north with maximum thickness being observed in the northern fringes of the study area, showing positive correlation with the depth of bedrock in the area.

The hard rock aquifers occur below the alluvium, and lithologically constitute quartzite, phyllite, and granite gneiss. Hydrogeologically, these are further demarcated as weathered zone and fractured hard rock. Ground water resides in phreatic conditions in weathered zone aquifers with the thickness of aquifer ranging from 1.2 to 33 meters in depth while fractured hard rock aquifers exhibit semi confined conditions with the thickness of aquifer ranging between 3.4 to 82.1 m. While yield of ground water are moderate in weathered zones (2-7.1 lps), fractured sections yield lower volumes (0.0 to 1.3 lps).

The 3D representation of the overall aquifer disposition of the study area is illustrated in figure 24 and tabulated as table 5.

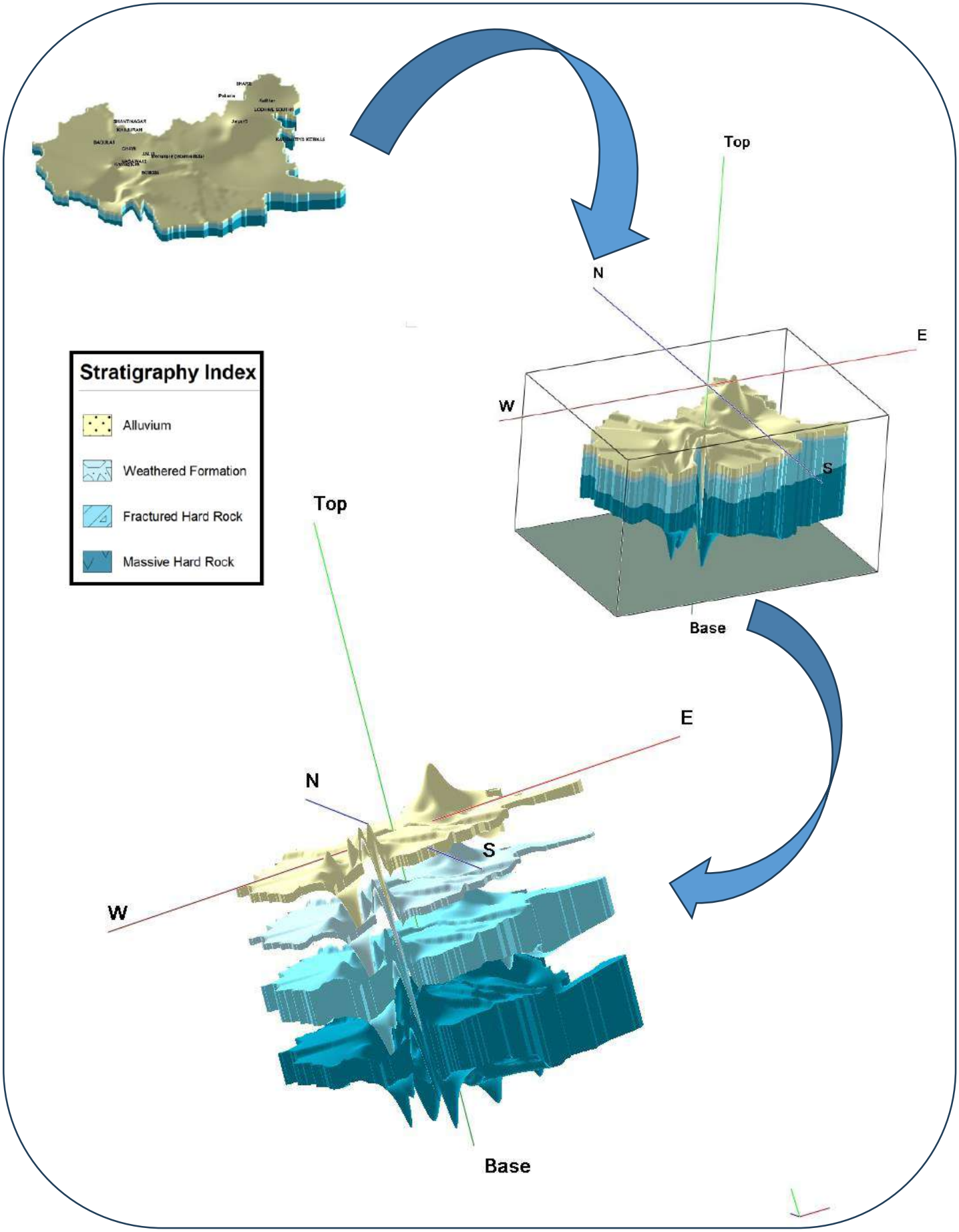


Figure 24: Aquifer Disposition of the Study Area

Table 5: Aquifer Characteristic and Disposition

Aquifer Characterization														
Stratigraphy	**Principal Aquifer**	**Major Aquifer**	**Lithological Characteristics**	**Depth range of occurrence of Aquifer (mbgl)**	**Thickness Range (m)**	**Water Level Range (mbgl)**	**Type of Abstraction Structure**	**Quality**			**Discharge Range (lps)**	**Transmissivity Range (m2/day)**	**Nature of Aquifer**	**Remarks**
								F (mg/l)	**As (mg/l)**	**(TDS) Range (mg/l)**				
Quatenary	Alluvium	Alluvium [AL01/AL 03]	Younger and Older Alluvium with Sand fine to coarse, clay, silt with caliche concretions, Kankar, gravel Greyish to brownish grey .[AL03]	0 to 50.29	4.9 to 45.3	1.3 to 9.85	DW/STW	0.33 to 1.84	BDL	243.75 to 1143.35	12 lps	0.419 to 554.40	Phreatic	Good Quality
Archean - Mesoproterozoic	Granitic Gneiss	Granitic Gneiss [GN 01]	Quartzite, phyllite, biotite gneiss, granite gneiss [GN01]	1.2 to 50.29	1.2 to 33.0	3.66 to 13.7	STW	0.30 to 1.11	BDL	284.7 to 1201.2	2.0 to 7.1	18.97 to 1016.191	Phreatic (Weathered)	Good Quality
				5.79 to 90.0	3.4 to 82.1	7 to 35.05	DTW	0.23 to 1.79	BDL	241.8 to 761.15 (1384)	0.0 to 1.3	0.26 to 4.45	Semi Confined (Fractured)	Good Quality

7.4 Ground Water Regime:

7.4.1 Depth to Water Level: Aquifer-I (Premonsoon, 2023)

During the pre-monsoon period, groundwater levels in the Mohanpur and Fatehpur blocks vary from 1.3 to 13.7 meters below ground level (bgl). On average, most of the study area has groundwater levels ranging from 5 to 10 meters bgl. However, there are variations within the region: the northern parts (In patches) of the study area exhibit higher water levels, typically between 10 and 15 meters bgl, while certain southeastern areas have notably lower water levels, often less than 5 meters bgl. This variability reflects the diverse hydrogeological conditions across the region. The depth to water level map along with relevant statistics is illustrated in figure 25 and table 6.

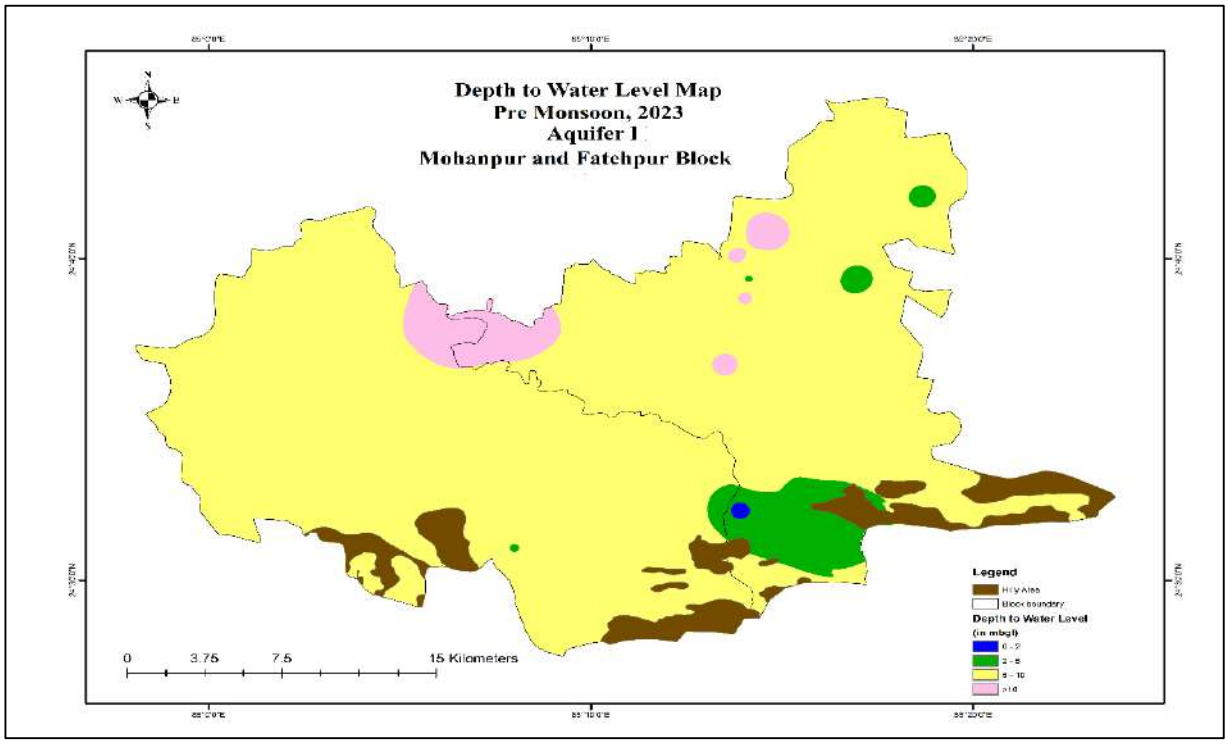


Figure 25:Pre-Monsoon Depth to Water Level Map of Aquifer-1

S. No.	Block Name	No. of wells Analyzed	Depth to Water Level (mbgl)		Number & Percentage of Wells Showing Depth to Water Level (mbgl) in the Range of							
					0-2		2-5		5-10		>10	
			Min	Max	No	%	No	%	No	%	No	%
1	Mohanpur	27	1.3	13.71	1	3.7	2	7.4	23	85.2	1	3.7
2	Fatehpur	32	3.6	12.19	0	0	5	15.6	20	62.5	7	21.9

Table 6: Depth to Water Level data of Study Area during Pre-Monsoon Period

7.4.2 Depth to Water Level: Aquifer-I (Post-monsoon, 2023)

During the post-monsoon period, groundwater levels in the Mohanpur and Fatehpur blocks vary from 2 to 9.15 meters below ground level (bgl). On average, most of the study area has groundwater levels ranging from 5 to 10 meters bgl. However, there are variations within the region: especially the eastern parts of the study area exhibit lower water levels, typically between 2 and 5 meters bgl. This variability reflects the diverse hydrogeological conditions across the region. The depth to water level map along with relevant statistics is illustrated in figure 26 and table 7.

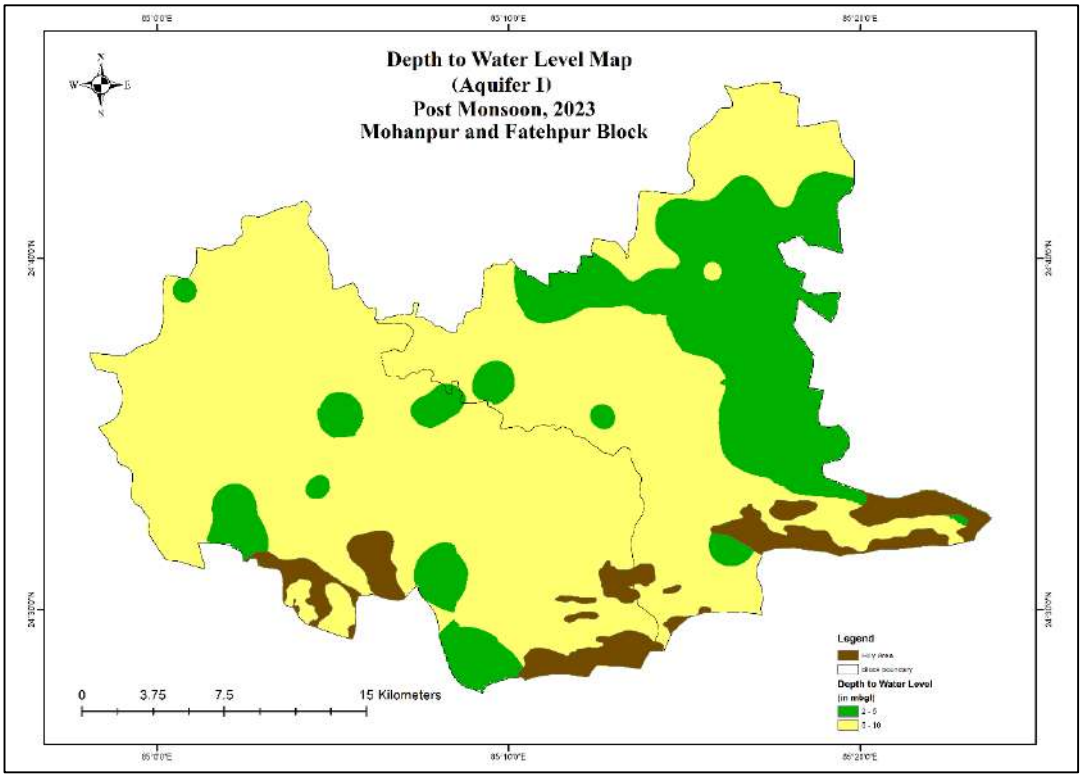


Figure 26:Post-Monsoon Depth to Water Level Map of Aquifer-1

Table 7: Depth to Water Level data of Study Area during Post Monsoon Period

S. No.	Block Name	No. of wells Analyzed	Depth to Water Level (mbgl)		Number & Percentage of Wells Showing Depth to Water Level (mbgl) in the Range of							
					0-2		2-5		5-10		>10	
			Min	Max	No	%	No	%	No	%	No	%
1	Mohanpur	22	3.72	9.15	0	0	8	36.36	14	63.64	0	0
2	Fatehpur	36	2	9.15	0	0	18	50	18	50	0	0

7.4.3 Water Level Fluctuation: Aquifer-I (Premonsoon, 2023):

The seasonal fluctuation of water level ranges between -2.11 to 5.16 m with majority of the study area showing fluctuation in between 0-2 m rise and middle part of the study area shows rise of water level in 2-5 m range. Fall is found in very small area lying in southeast portion shows 0-2 m. The water level fluctuation map along with relevant statistics is illustrated in figure 27.

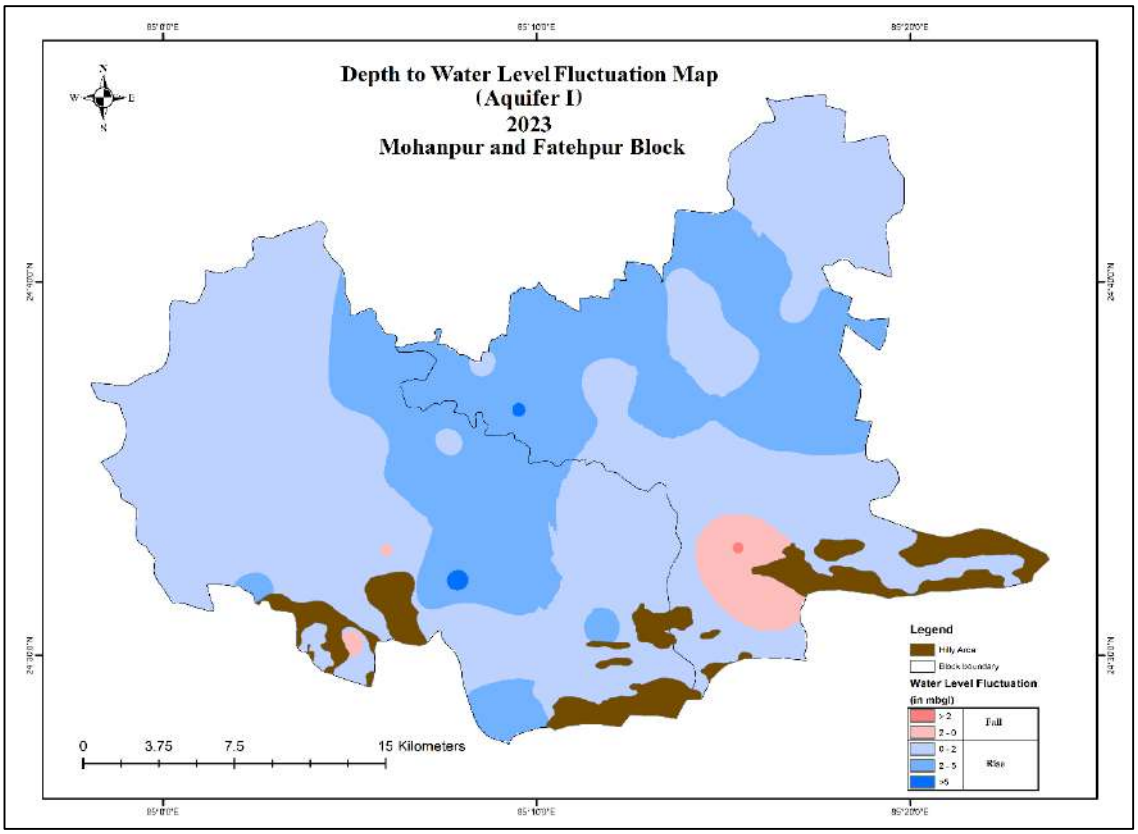


Figure 27: Depth to Water Level Fluctuation Map of Aquifer-1

7.4.4 Depth to Water Level: Aquifer-II (Premonsoon, 2023)

During the pre-monsoon period, groundwater levels in the Mohanpur and Fatehpur blocks vary from 6.09 to 35.05 meters below ground level (bgl). On average, most of the study area has groundwater levels ranging from 10 to 30 meters bgl. However, there are variations within the region: the northern parts (in patches) of the study area exhibit higher water levels, typically between 20 and 30 meters bgl, while certain areas have notably lower water levels, often less than 10 meters bgl. This variability reflects the diverse hydrogeological conditions across the region. The depth to water level map is illustrated in figure 28.

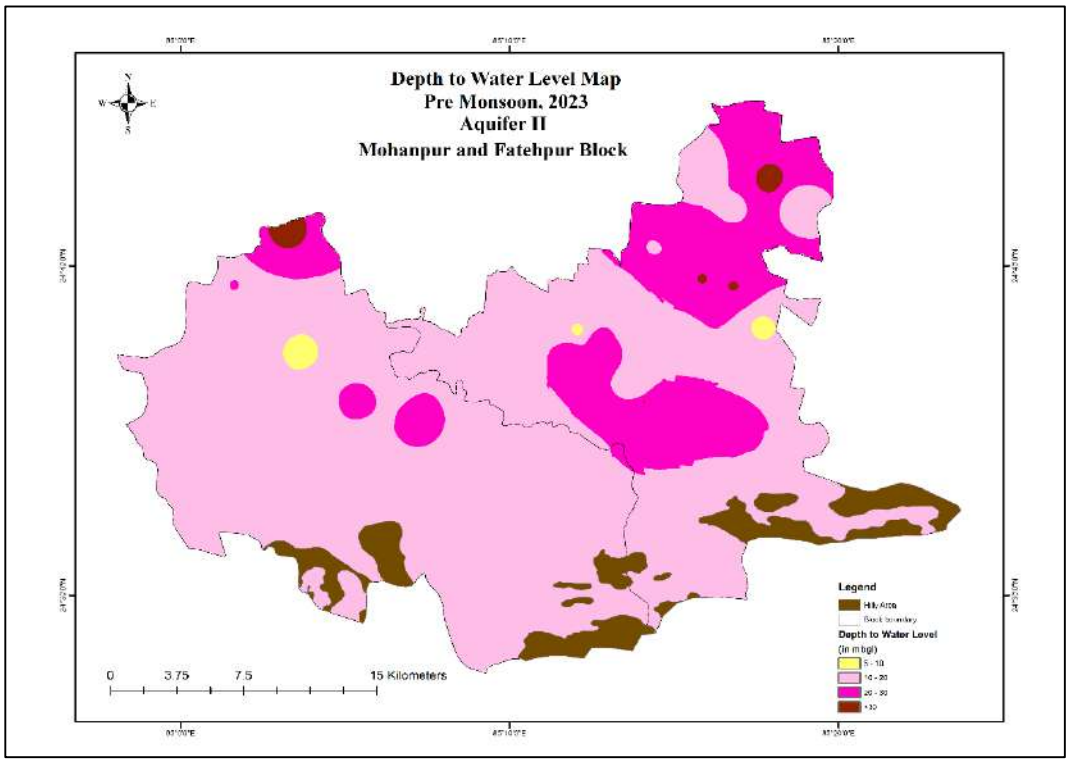


Figure 28:Pre-Monsoon Depth to Water Level Map of Aquifer-II

7.4.5 Post-monsoon Depth to Water Level

During the post-monsoon period, groundwater levels in the Mohanpur and Fatehpur blocks vary from 4.57to 27.43 meters below ground level (bgl). On average, most of the study area has groundwater levels ranging from 10 to 20 meters bgl. However, there are variations within the region: especially the western and northern parts of the study area exhibit higher water levels, typically between20 and 25 meters bgl. This variability reflects the diverse hydrogeological conditions across the region. The depth to water level map is illustrated in figure 29.

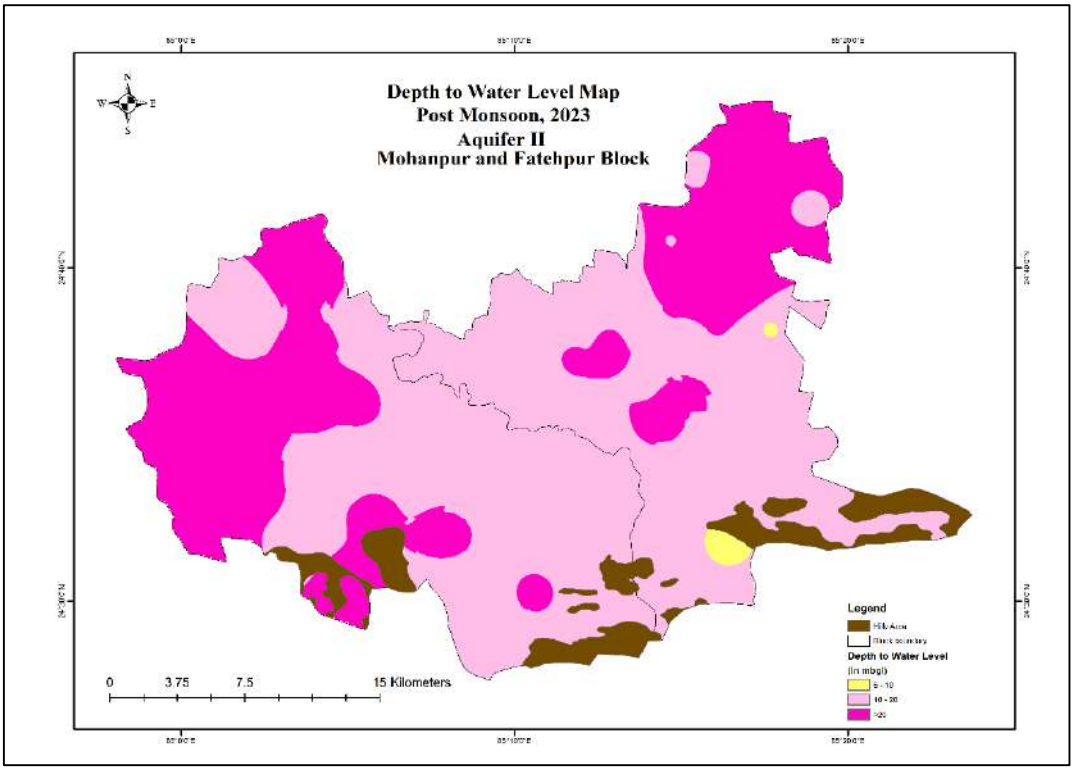


Figure 29:Post-Monsoon Depth to Water Level Map of Aquifer-II

7.4.6 Water Level Fluctuation:

The seasonal fluctuation of water level ranges between -14.34 to 7.62 m with majority of the study area showing fluctuation in between 0-2 m rise. Western part of the study area shows water level fluctuation ranges in between 10-15 m fall. The water level fluctuation map is illustrated in figure 30.

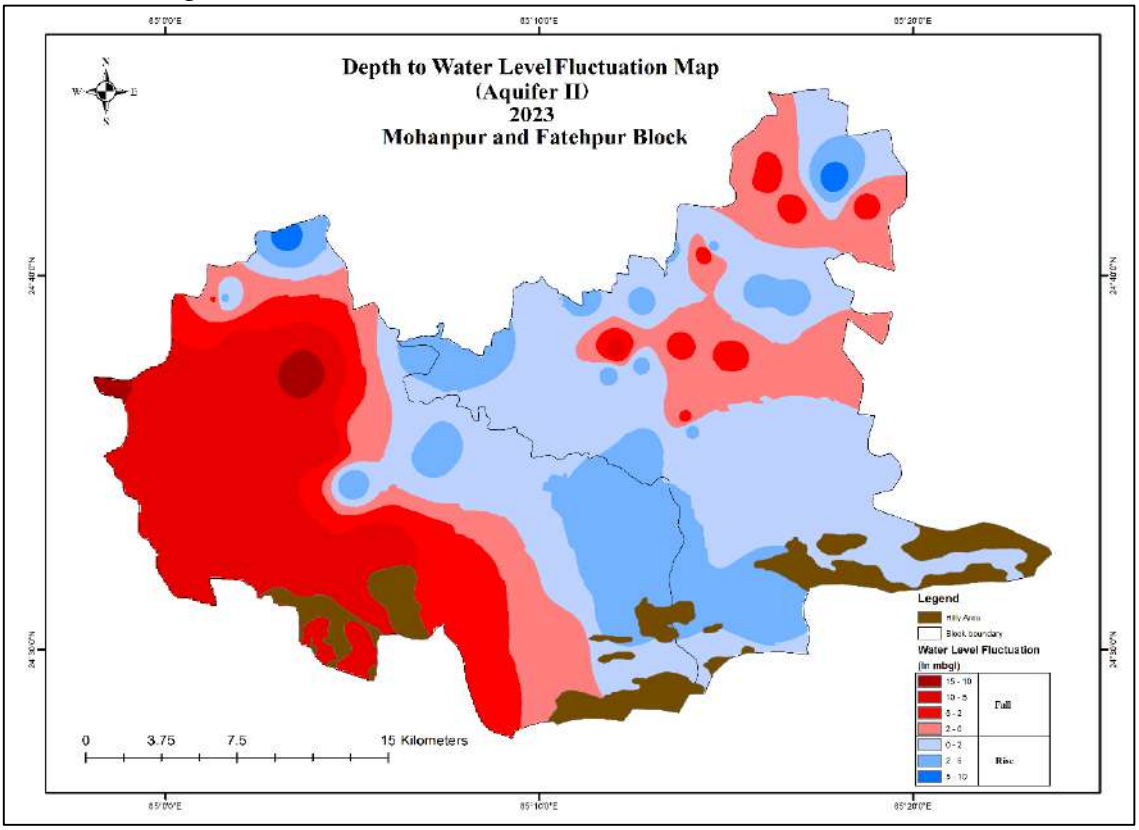


Figure 30: Depth to Water Level Fluctuation Map of Aquifer-II

7.4.7 Long Term Ground Water Level Trend based on Historical Data

The long-term trend for ground water level in Mohanpur and Fatehpur block is computed by utilising historical dataset (from 2013 to 2023) of National Hydrograph Stations (NHS) available with CGWB. It is observed that both blocks in the study area show insignificant rise in ground water level with the monitoring stations in the area showcasing the rise of 4.31 cm per year in Fatehpur block and the rise of 5.28 cm per year in Mohanpur block. The figure 31 and 32 illustrates the long term hydrograph of ground water for Fatehpur and Mohanpur block respectively.

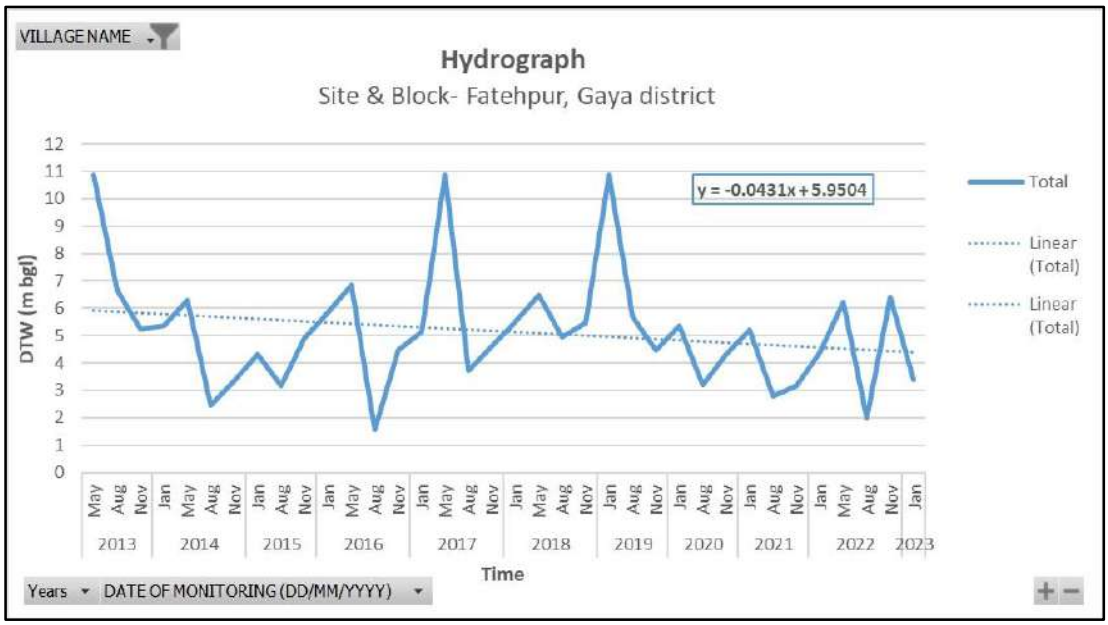


Figure 31: Long Term Hydrograph of Fatehpur Block, Gaya District

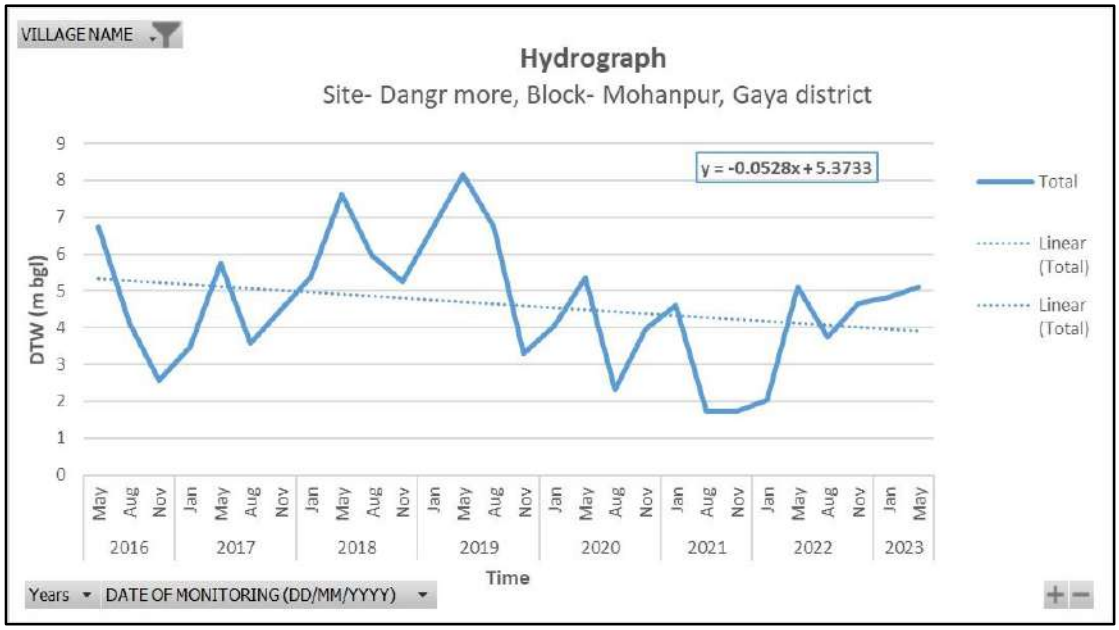


Figure 32: Long Term Hydrograph of Mohanpur block, Gaya District

Chapter 8: Delineation of Recharge Areas

Topographic and hydrogeological data indicate that both lithological and anthropogenic factors strongly influence water level behaviour in the Mohanpur and Fatehpur blocks, where two prominent aquifer systems extend to a depth of 200 meters.

Aquifer-I consists of marginal alluvium, composed of coarse to fine-grained sand mixed with clay and occasional kankar from the Tertiary and Quaternary periods, occurring up to 50 meters deep. The thickness of this aquifer decreases from south to north, with groundwater abstraction mainly through dug wells and shallow borewells. Groundwater in Aquifer-I is found under phreatic conditions, with water levels ranging from 1.3 to 13.7 meters below ground level (bgl) during the pre-monsoon period and 2 to 9.15 meters bgl in the post-monsoon period. Higher water levels are observed in the northern parts of the area, while the southeastern regions show lower levels.

Aquifer-II is composed of weathered and fractured formations of granitic gneiss, phyllite, and quartzites from the Archean to Meso Proterozoic era, extending up to 90 meters deep with thicknesses varying from 4 to 82 meters, particularly pronounced in the southern area. Groundwater in this aquifer is primarily extracted through hand pumps and occurs under phreatic to semi-confined conditions, with water levels ranging from 6.09 to 35.05 meters bgl in the pre-monsoon period and 4.57 to 27.43 meters bgl post-monsoon.

The spatial and seasonal variability of water levels is influenced by the depth of the weathered thickness in Aquifer-II and the alluvial deposits in Aquifer-I. In the southern regions, the thinner aquifer, and the presence of highly weathering-resistant rocks, such as granitic gneiss overlain by alluvium, limit water availability. Conversely, in the northern regions, the marginal alluvium is deeper, potentially extending to significant depths, contributing to higher water levels. Additionally, the study area forms the upper portion of the watershed, which typically acts as a recharge zone, further affecting water level behaviour.

Geochemical Analysis

Geochemical signatures illustrated using Chadha's plot can also be used to identify the groundwater provenance. From the table 8, most of the samples fall in field-I showing Recharge water type in both Pre monsoon and Post monsoon period.

(Pre-Monsoon, 2023) (Post-Monsoon, 2023)

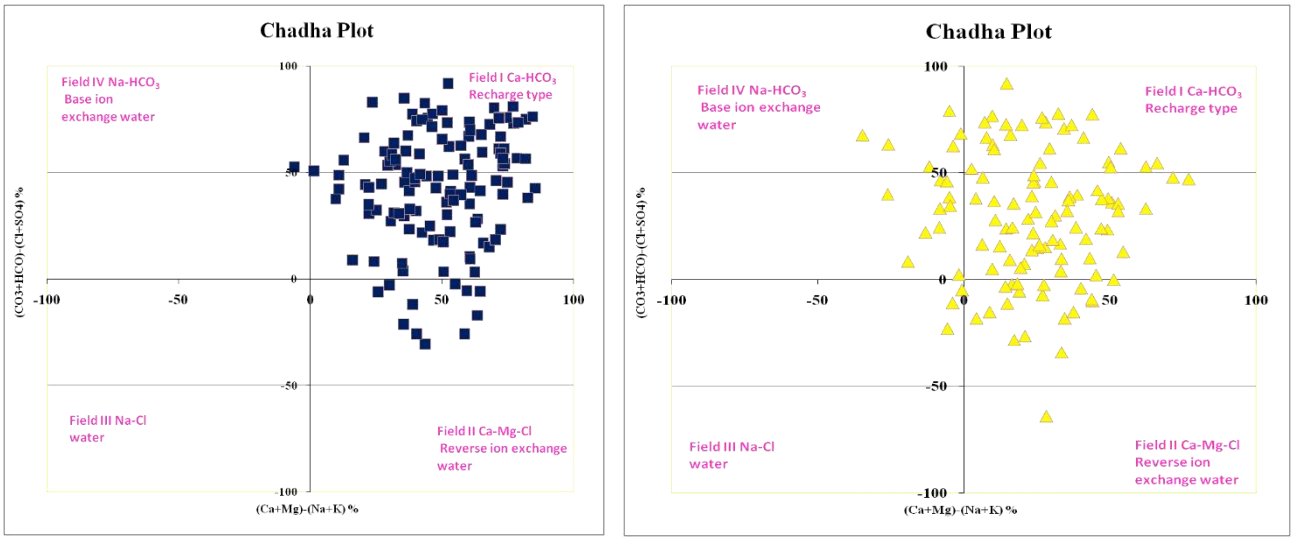


Table 8: Chadha Plot based on Geochemical Data collected during Pre Monsoon and Post Monsoon period

The watershed demarcated in figure 33, it is clearly indicated that the study area falls under the recharge area. The watershed map was prepared by overlaying drainage of the area with the topographic data of the study area. This area has good potential zone for recharge due to presence of adequate weathered zone thickness in the southern part of the study area, bordering the hills and adequate marginal alluvial thickness in the northern fringes of the study area.

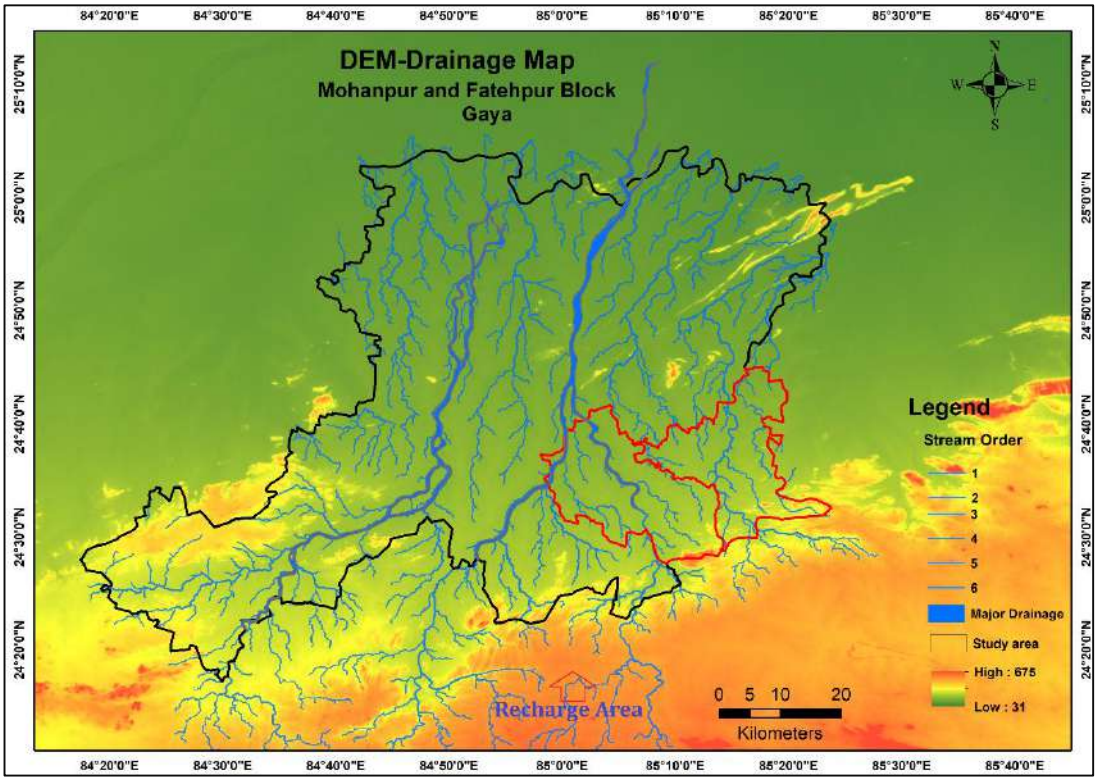


Figure 33: Recharge area Demarcation using DEM and Drainage data

Chapter 9: Assessment of Ground Water Resources

In Bihar, Ground Water Resources is carried out annually at periodical interval jointly by CGWB, MER, Patna and Minor Water Resources Department, Govt. of Bihar based on methodology suggested by Ground Water Estimation Committee, 2015 (GEC-15). This methodology recommends aquifer wise ground water resource assessment of both the Ground water resources components, i.e., Replenishable ground water resources or Dynamic Ground Water Resources and In-storage Resources or Static Resources. The assessment of ground water includes assessment of dynamic and in-storage ground water resources, but the development planning should mainly depend on dynamic resource only as it gets replenished every year. Changes in static or in-storage resources reflect impacts on mining of ground water and such resources may not be replenished annually and may be allowed to be extracted only during exigencies with proper recharge planning in the succeeding excess rainfall years

9.1 Assessments of Dynamic Ground Water Resources

The methodology for ground water resources estimation is based on the principle of water balance as given below –

The methodology for ground water resources estimation is based on the principle ofwater balance as given below –

Inflow – Outflow = Change in Storage (of an aquifer)

The equation can be further elaborated as

$$\Delta S = RRF + RSTR + RC + RSWI + RGWI + RTP + RWCS \pm VF \pm LF - GE - T - E - B$$

Where,

ΔS – Change is storage,
RRF – Rainfall recharge,
RSTR- Recharge from stream channels
RC – Recharge from canals,
RSWI – Recharge from surface water irrigation
RGWI- Recharge from ground water irrigation,
RTP- Recharge from Tanks & Ponds
RWCS – Recharge from water conservation structures,
VF – Vertical flow across theaquifer system
LF- Lateral flow along the aquifer system (through flow),
GE- GroundWater Extraction,
T- Transpiration,
E- Evaporation,
B-Base flow

9.2 Dyanamic ground water resources in Mohanpur Block

The Mohanpur block receives a total annual ground water recharge of 7,729.48 ham, primarily from rainfall and other sources during monsoon and non-monsoon periods. With natural discharges accounting for 772.95 ham, the annual extractable ground water resource is 6,956.53 ham. The block uses 559.0413 ham for irrigation, 4 ham for industrial purposes, and 634.112675 ham for domestic use, totaling an extraction of 1,197.16 ham. For 2025, the domestic water allocation is projected at 677.84 ham, leaving a net ground water availability of 5,715.64 ham for future use. The stage of ground water extraction in Mohanpur stands at 17.21%, categorizing it as safe. These characteristics are tabulated as table 9.

9.3 Dyanamic ground water resources in Fatehpur Block

The Fatehpur block, with a total geographical area of 33,594 hectares and 32,914 hectares recharge worthy, has a slightly lower total annual ground water recharge of 7,666.91 ham. The natural discharges here amount to 766.7 ham, resulting in an annual extractable ground water resource of 6,900.21 ham. Fatehpur uses 1,091.7297 ham for irrigation, 1.5 ham for industrial purposes, and 746.466245 ham for domestic use, summing up to a total extraction of 1,839.69 ham. The projected domestic allocation for 2025 is 797.94 ham, with a net ground water availability of 5,009.05 ham for future use. The stage of ground water extraction in Fatehpur is higher at 26.66%, categorizing it as safe. These characteristics are tabulated as table 9.

9.4 Comparison of Ground Water Resource Assessment [From GWRA 2017 to 2023]

9.4.1 Total Annual Ground Water Recharge

In Mohanpur, the total annual groundwater recharge has ranged from 63.21 hectare meter (Ham) to 78.62 Ham over the years from 2017 to 2023. This range demonstrates a degree of variability but generally indicates a stable recharge pattern. In Fatehpur, the recharge figures have fluctuated between 61.33 Ham and 80.57 Ham during the same period, reflecting similar stability with some variability.

9.4.2 Annual Extractable Ground Water Resource

Mohanpur's annual extractable groundwater resource has fluctuated between 56.89 Ham and 70.76 Ham over the years from 2017 to 2023. This range highlights a moderate to high availability of groundwater that can be used. In Fatehpur, the extractable groundwater

resource has been between 58.27 Ham and 72.52 Ham, showing a consistent capacity for groundwater extraction over the years from 2017 to 2023.

9.4.3 Annual Ground Water Draft

The annual groundwater draft in Mohanpur has varied significantly, from 5.59 Ham to a 23.01 Ham over the years from 2017 to 2023. This wide range reflects differences in groundwater use across the years. Whereas, in Fatehpur, the draft has ranged from 10.92 Ham to 23.0 Ham, over the years from 2017 to 2023, indicating varying levels of groundwater extraction.

Table 9: Ground Water Resource Assessment for the blocks falling in the study area.

Block	Assessments Year (GWRA-2017,2020,2022 &2023)	Total Annual Ground Water Recharge (Mcm)	Total Natural Discharges (Mcm)	Annual Extractable Ground Water Resource (Mcm)	Annual Ground Water Draft (Mcm)				Annual GW Allocation for Domestic Use as on 2025 (Mcm)	Net Ground Water Availability for future use (Mcm)	Stage of Ground Water Extraction (%)	Categorization (Over-Exploited/Critical/Semi critical/Safe/Saline)
					Irrigation	Industrial	Domestic	Total Extraction				
Mohanpur	GWRA-2017	78.62	6.32	70.76	23.01	1.34	3.88	11.87	3.29	39.2	16.77	Safe
	GWRA-2020	73.62	7.36	66.26	13.3	0.81	3.45	17.56	3.87	48.27	26.5	Safe
	GWRA-2022	63.21	7.86	56.89	5.59	0.04	6.24	17.69	6.78	58.89	31	Safe
	GWRA-2023	77.29	7.73	69.57	5.59	0.04	6.34	11.97	6.78	57.16	17.21	Safe
Fatehpur	GWRA-2017	80.57	3.07	72.52	13.55	0.84	3.29	18.28	3.88	30.04	25.2	Safe
	GWRA-2020	65.21	6.52	58.69	23	1.35	4.06	28.41	4.56	29.78	48.41	Safe
	GWRA-2022	61.33	8.06	58.27	10.92	0.02	7.34	28.23	7.98	53.6	48	Safe
	GWRA-2023	76.67	7.67	69	10.92	0.02	7.46	18.4	7.98	50.09	26.66	Safe

Chapter 10: Geophysical Investigations

10.1 Introduction: -

As part of NAQUIM 2.0 studies, Mohanpur and Fatehpur blocks of Gaya district in Bihar were taken up under the category "Water Stressed Area" in AAP 2023-24. Geophysical investigations were carried out covering the four blocks as part of the study. A total of 37 TEM (Transient Electromagnetic Survey) at 13 locations and 27 VES (16 under AAP 2023-24 and 11 existing) (Fig 1) covering the whole study area were conducted with an objective to delineate aquifer geometry, investigate the depth to bedrock. The findings of the study are discussed below.

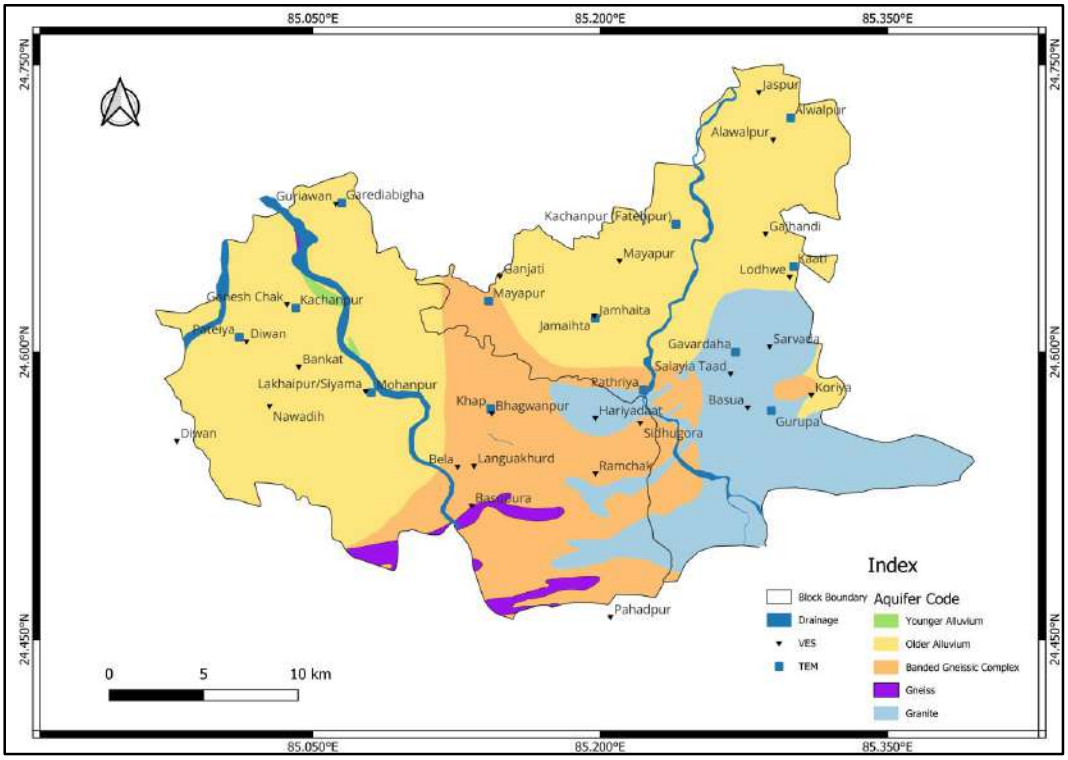


Figure 34: Map showing the locations of Geophysical studies in the Study Area

10.2 VES Survey in Gaya District: -

A total of 27 VES were conducted spanning the whole study area. Out of 27 VES, 16 VES were carried out in AAP 2023-24. The data were acquired using the instrument *Aquameter CRM Auto C*. The maximum spreading (AB/2) was 400.0 m, and the obtained apparent resistivity values were plotted against AB/2 in double logarithmic paper of moduli 62.5 mm. The data were interpreted using the software *IX1d.* Equivalence of layer parameters were kept in mind during interpretation and final models for each sounding was selected such that it satisfies local hydrogeological conditions. An attempt was made to identify the probable fracture zones with the help of curve break technique. A few representative VES curves along

with interpreted models are shown below. The interpreted results of VES survey are attached in Annexure.

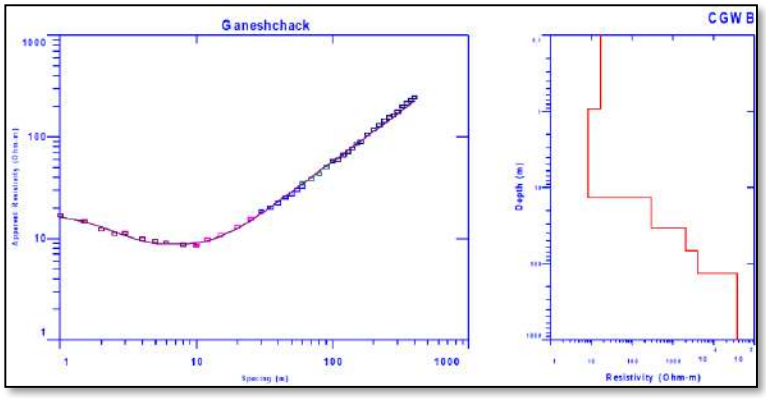


Figure 35: Interpreted Model of Vertical Electrical Sounding (VES) carried out at Ganeshchak, Gaya District, Bihar

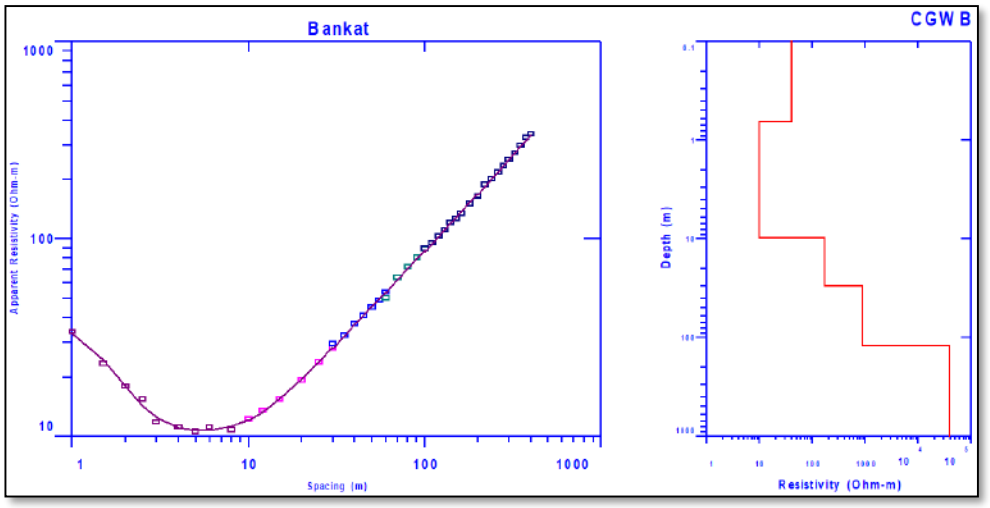


Figure 36: Interpreted Model of Vertical Electrical Sounding (VES) carried out at Bankat, Gaya District, Bihar

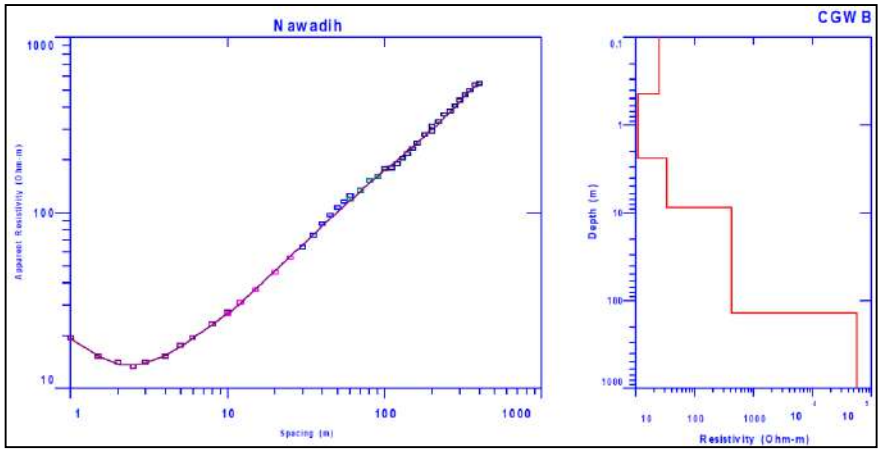


Figure 37: Interpreted Model of Vertical Electrical Sounding (VES) carried out at Bankat, Gaya District, Bihar

10.3 Transient Electromagnetic (TeM) Survey in study area -

37 TEM soundings at 13 locations were carried out using the instrument *Monex Geoscope*. Coincident loop configuration was used to acquire the data. The dimension of both transmission and receiver loop was set to be 40 x 40 m^2. Utmost care was taken during acquisition of data and potential sources of noise such as transmission line, heavy electrical accessories, and anthropogenic structures were avoided, and the obtained data was inverted using the software *Terra Tem Plot*. Final interpretation was carried out using the software *IX1d*. Equivalence of layer parameters is an observed phenomenon in TEM interpretation. Local hydrogeological conditions were kept in mind during the interpretation process.

10.3.1 Findings of TEM Survey at Gaya District, Bihar: -

The obtained apparent conductivity section along with interpreted resistivity profiles of some of the locations of study area are shown below.

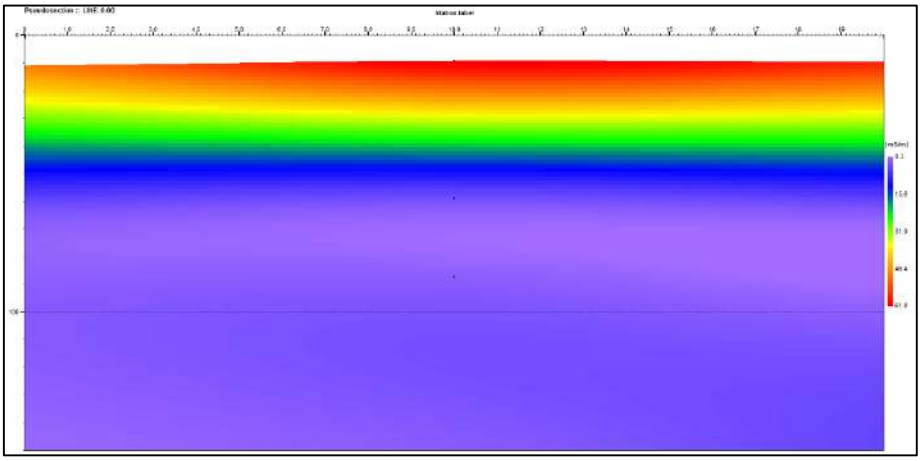


Figure 38: Apparent conductivity pseudo section of Gurpa, Fatehpur Block Gaya District, Bihar

It shows the apparent conductivity pseudo section of Gurpa, Fatehpur Block, Gaya District, Bihar where apparent conductivity decreases downwards. Three distinct layers may be identified from the figure which may be inferred as Weathered Zone, Saprolite Zone and Massive bedrock.

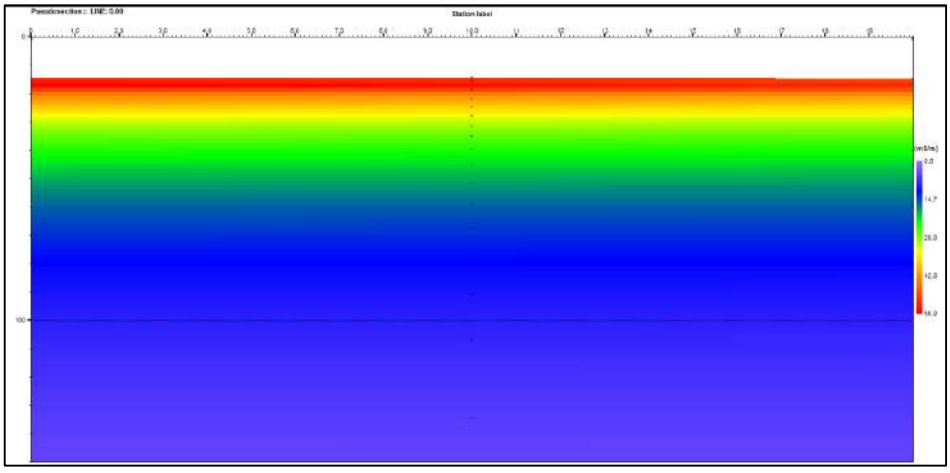


Figure 39: Apparent conductivity pseudo section of Jamhaita, Fatehpur Block, Gaya District, Bihar

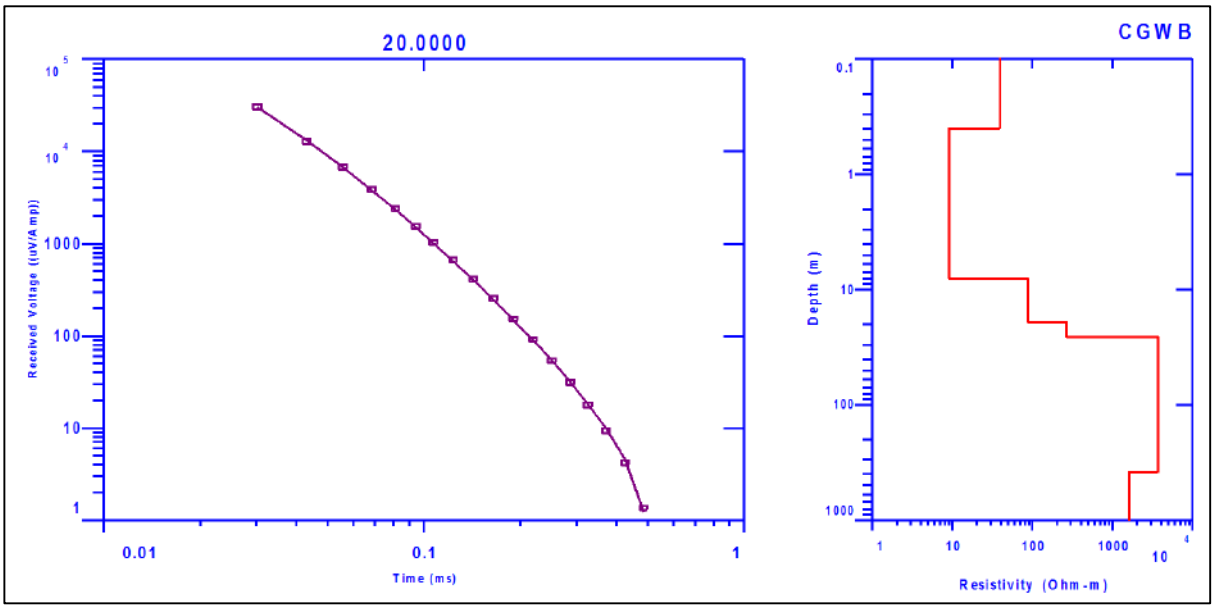


Figure 40: Voltage decay curve and interpreted model at Jamhaita, Fatehpur Block, Gaya District, Bihar.

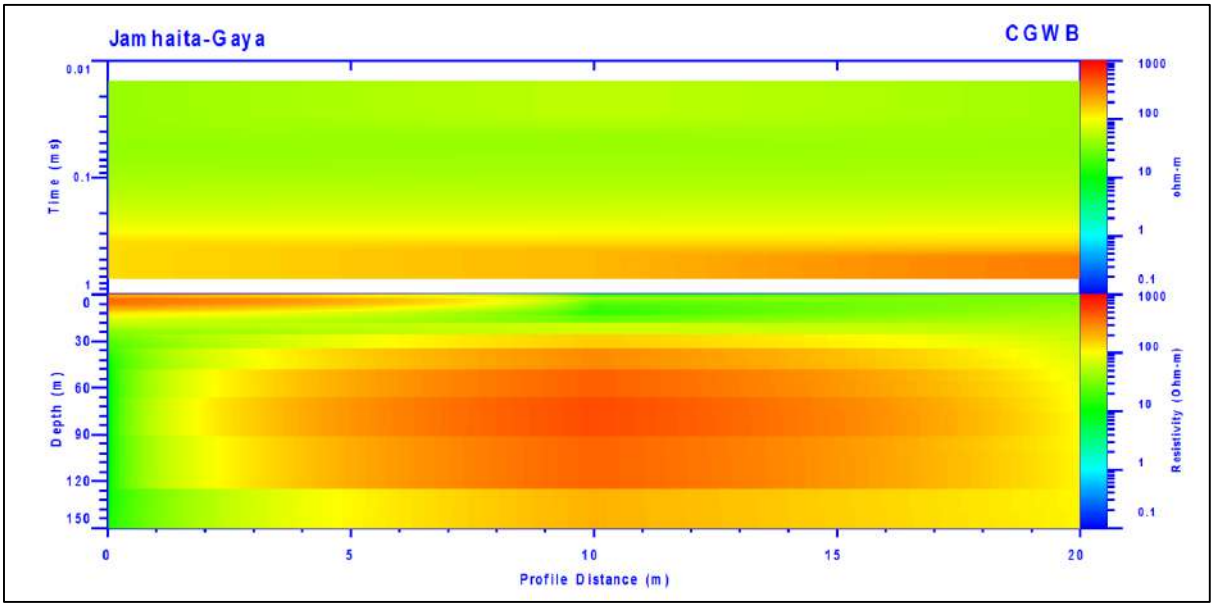


Figure 41: Interpreted Resistivity Profile of Jamhaita, Fatehpur Block, Gaya District, Bihar

Figure 38-41 shows the findings of TEM survey at Jamhaita, Fatehpur Block, Gaya District, Bihar. Figure 38 represents the apparent conductivity pseudo section which depicts decrease of apparent conductivity with increasing depth. Figure 39 represents the voltage decay curve and interpreted model of the area. The voltage decays beyond noise level at around 0.5 ms. Six geoelectrical layers were interpreted in the study area. The resistivity and thickness of the layers are 39.2 Ω-m, 8.9Ω-m, 87.4 Ω-m, 267 Ω-m, 3636Ω-m, 1586Ω-m and 0.4 m, 7.5m, 11.4 m, 6.5 m, 360.76 m respectively. The depth to bed rock has been inferred to be 26.0 mbgl.

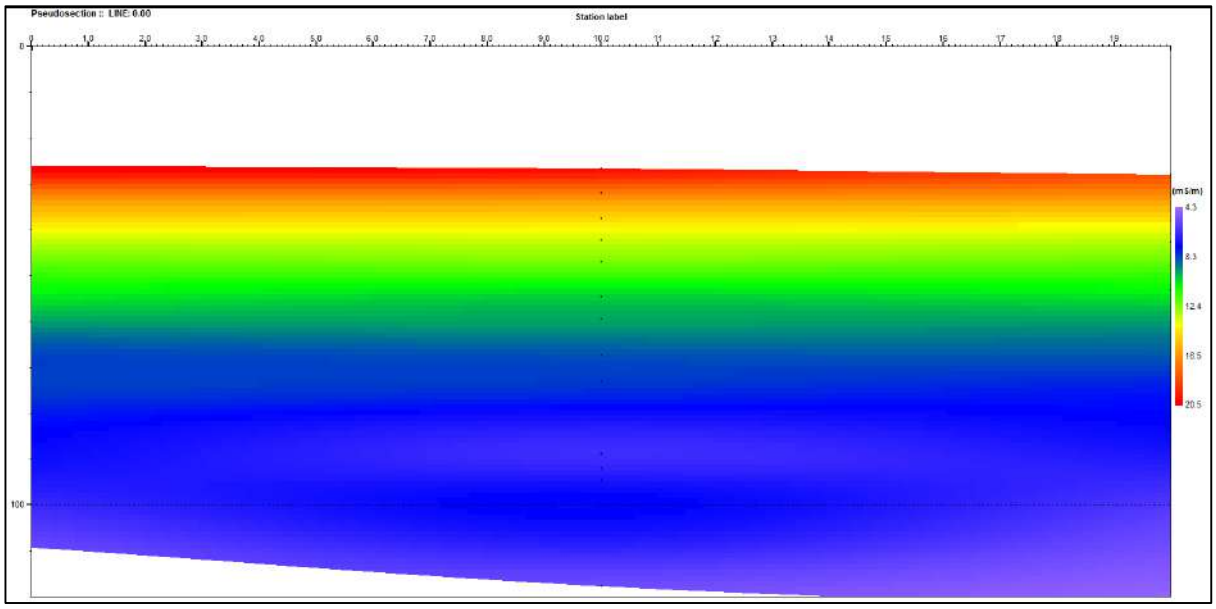


Figure 42: Apparent Conductivity pseudo section of Kaati, Fatehpur Block, Gaya District

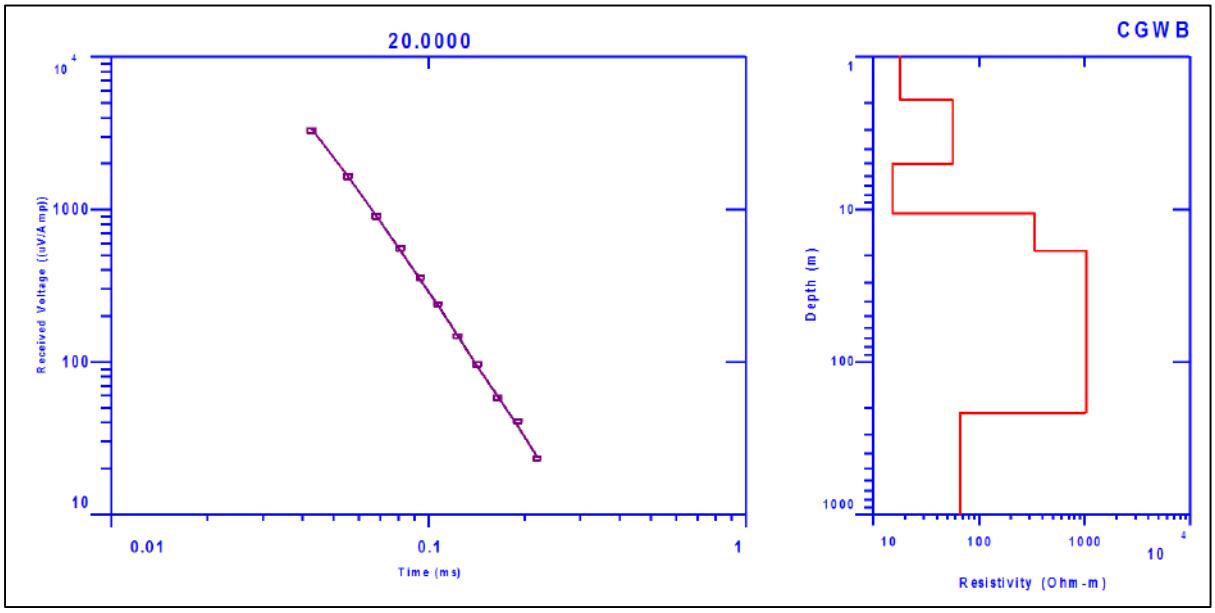


Figure 43: Voltage decay curve and interpreted model at Kaati, Fatehpur Block, Gaya District, Bihar

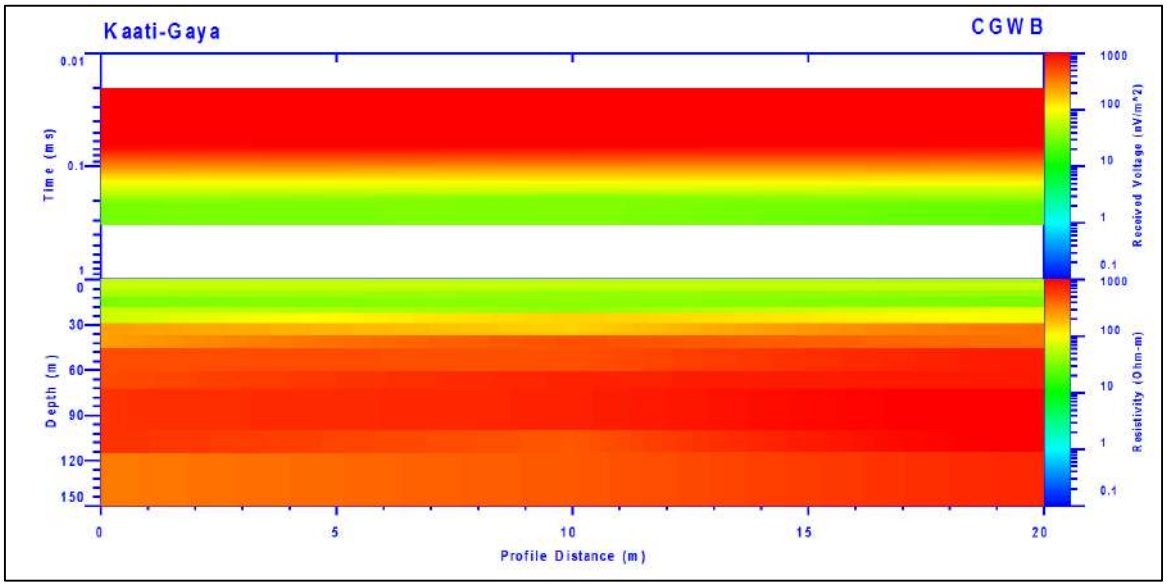


Figure 44: Interpreted Resistivity Profile of Kaati, Fatehpur Block, Gaya District, Bihar

Figure 42-44 shows the findings of TEM survey at Kaati, Fatehpur Block, Gaya District, Bihar. Figure 42 represents the apparent conductivity pseudo section which depicts decrease of apparent conductivity with increasing depth. Figure 43 represents the voltage decay curve and interpreted model of the area. The voltage decays beyond noise level at around 0.2 ms indicating resistive nature of the subsurface. Six geoelectrical layers were interpreted in the study area. The resistivity and thickness of the layers are 20.0 Ω-m, 55.2 Ω-m, 13.7 Ω-m, 267 Ω-m, 340.0 Ω-m, 1151.3 Ω-m and 2 m, 2.8 m, 5.2 m, 7.9 m, 188.0 m respectively. The depth to bed rock has been inferred to be 10.0 mbgl.

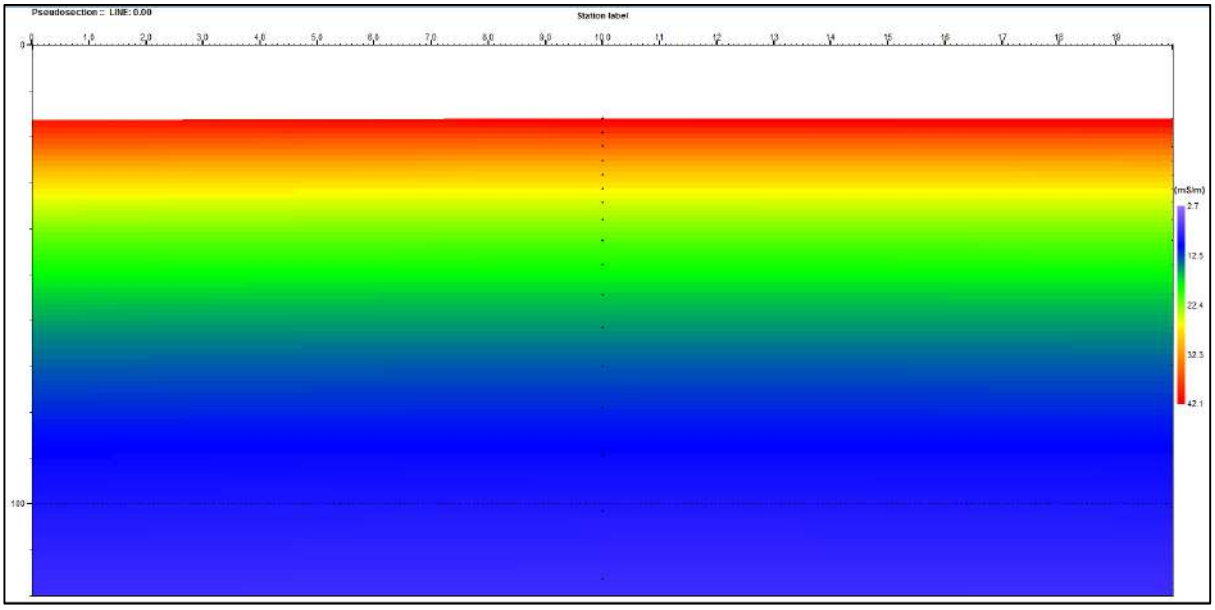


Figure 45: Apparent Conductivity pseudo section of Mayapur, Fatehpur Block, Gaya District

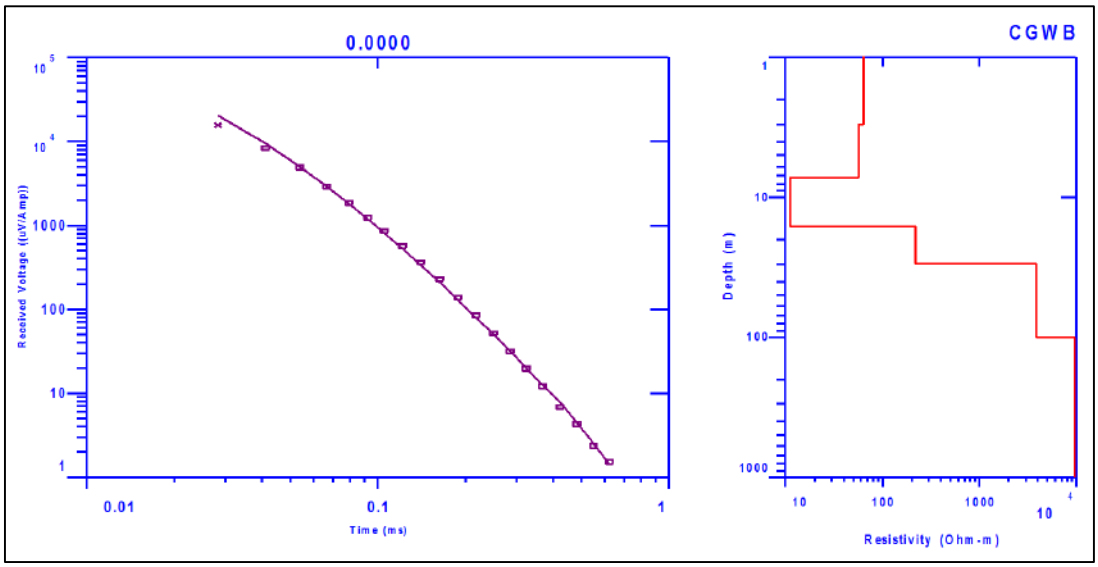


Figure 46: Voltage decay curve and interpreted model at Mayapur, Fatehpur Block, Gaya District, Bihar

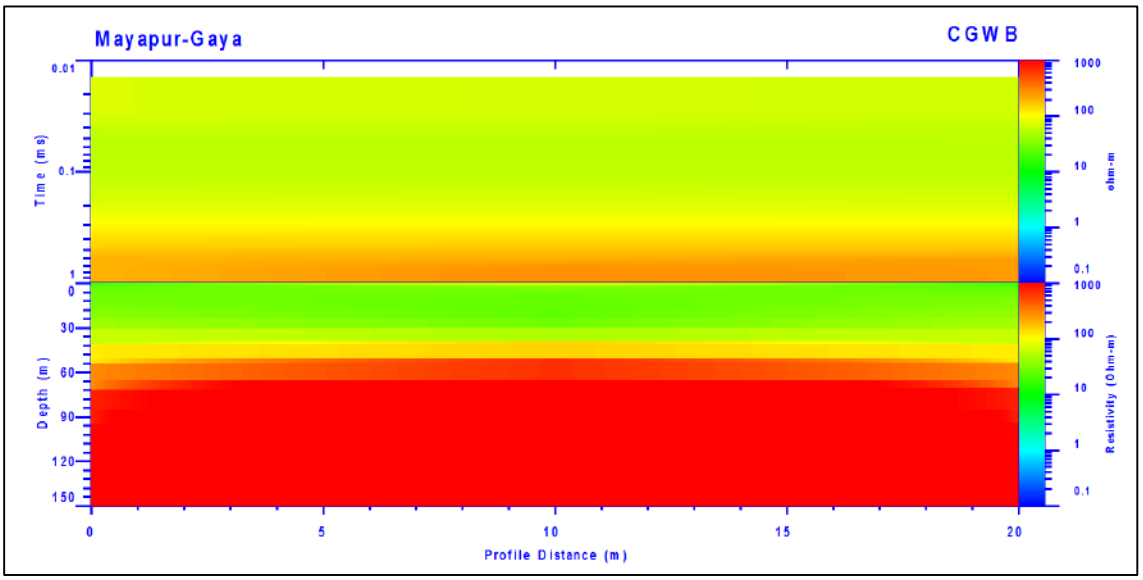


Figure 47: Interpreted Resistivity Profile of Mayapur, Fatehpur Block, Gaya District, Bihar

Figure 45-47 shows the findings of TEM survey at Mayapur, Fatehpur Block, Gaya District, Bihar. Figure 45 represents the apparent conductivity pseudo section which depicts decrease of apparent conductivity with increasing depth. Figure 16 represents the voltage decay curve and interpreted model of the area. The voltage decays beyond noise level at around 0.6 ms indicating presence of conductive layer above massive bedrock beneath the surface. Six geoelectrical layers were interpreted in the study area. The resistivity and thickness of the layers are 64.2 Ω-m, 56.7 Ω-m, 11.2 Ω-m, 219 Ω-m, 3866 Ω-m, 9567 Ω-m and 3 m, 4.3 m, 8.9 m, 13.6 m, 70.3 m respectively. The depth to bed rock has been inferred to be 30.0 mbgl.

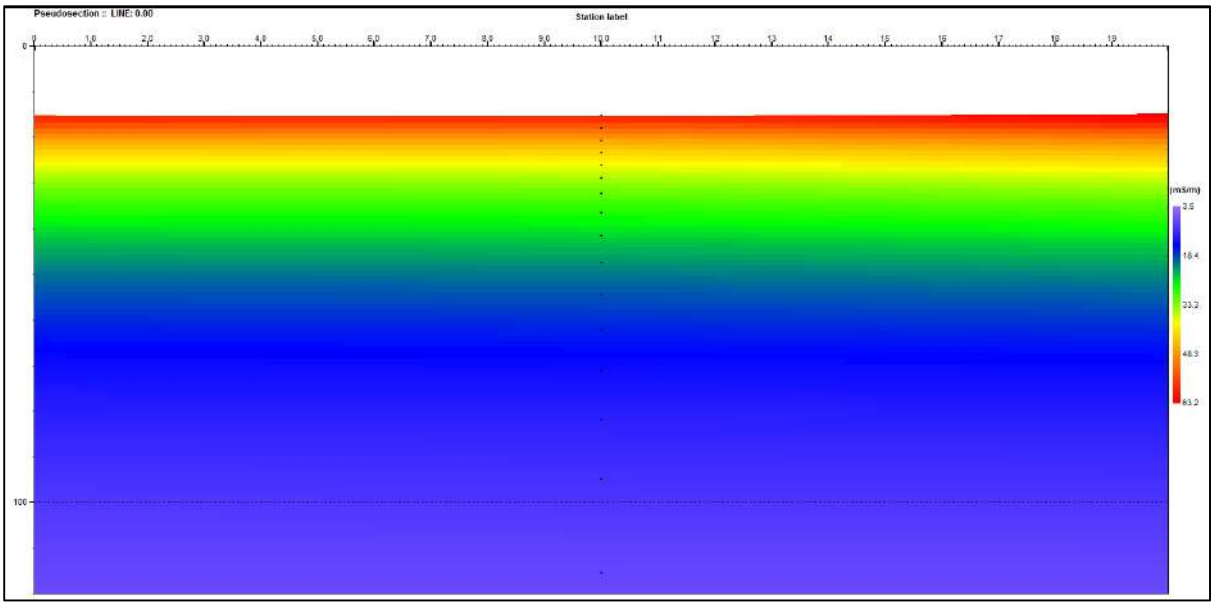


Figure 48: Apparent Conductivity pseudo section of Pathriya, Fatehpur Block, Gaya District, Bihar

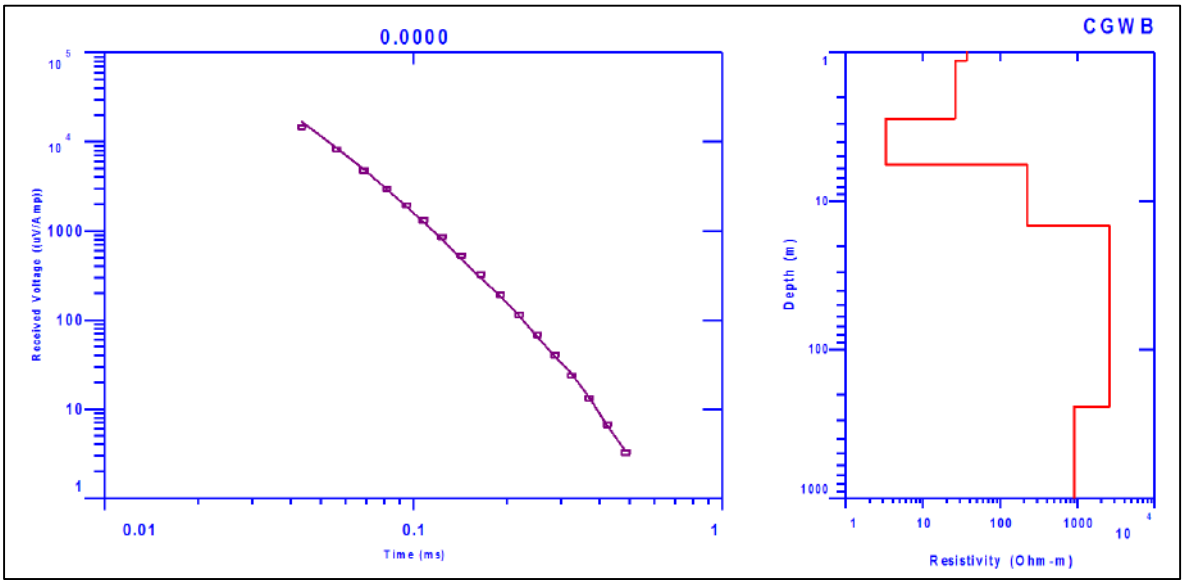


Figure 49: Voltage decay curve and interpreted model at Pathriya, Fatehpur Block, Gaya District, Bihar.

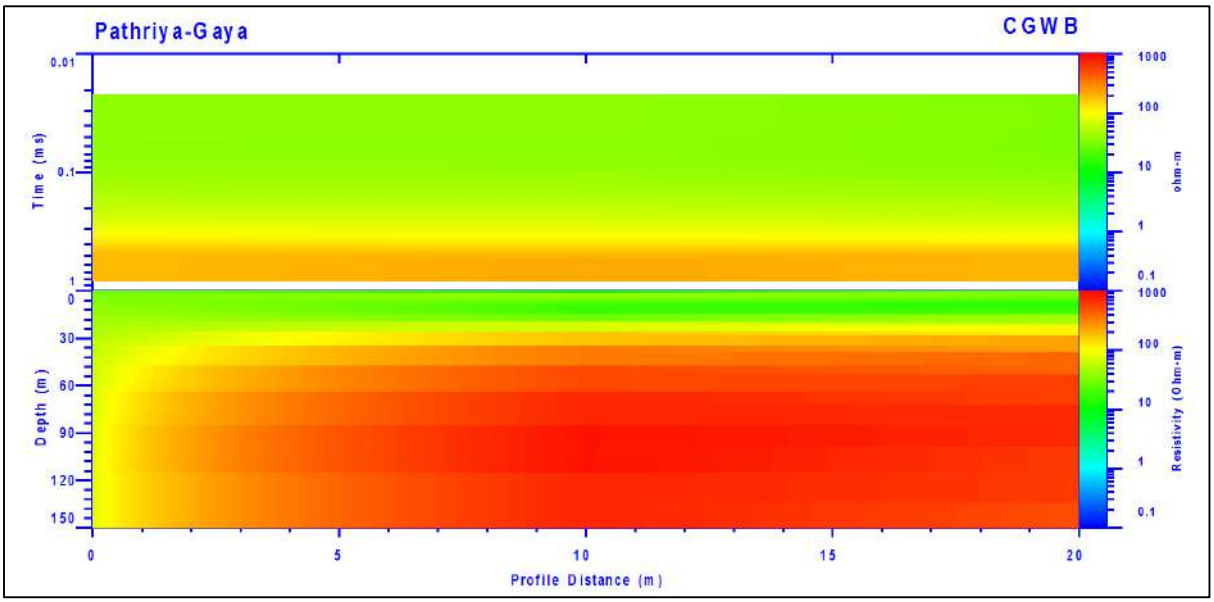


Figure 50: Interpreted Resistivity Profile of Pathriya, Fatehpur Block, Gaya District, Bihar

Figure 48-50 shows the findings of TEM survey at Pathriya, Fatehpur Block, Gaya District, Bihar. Figure 48 represents the apparent conductivity pseudo section which depicts decrease of apparent conductivity with increasing depth. Figure 19 represents the voltage decay curve and interpreted model of the area. The voltage decays beyond noise level at around 0.6 ms indicating presence of conductive layer above massive bedrock beneath the surface. Six geoelectrical layers were interpreted in the study area. The resistivity and thickness of the layers are 36.4 Ω-m, 26.2 Ω-m, 3.3 Ω-m, 219.3 Ω-m, 2596 Ω-m, 902.3 Ω-m and 1 m, 1.7 m, 3.0 m, 9.0 m, 230.0 m respectively. The depth to bed rock has been inferred to be 15.0 mbgl.

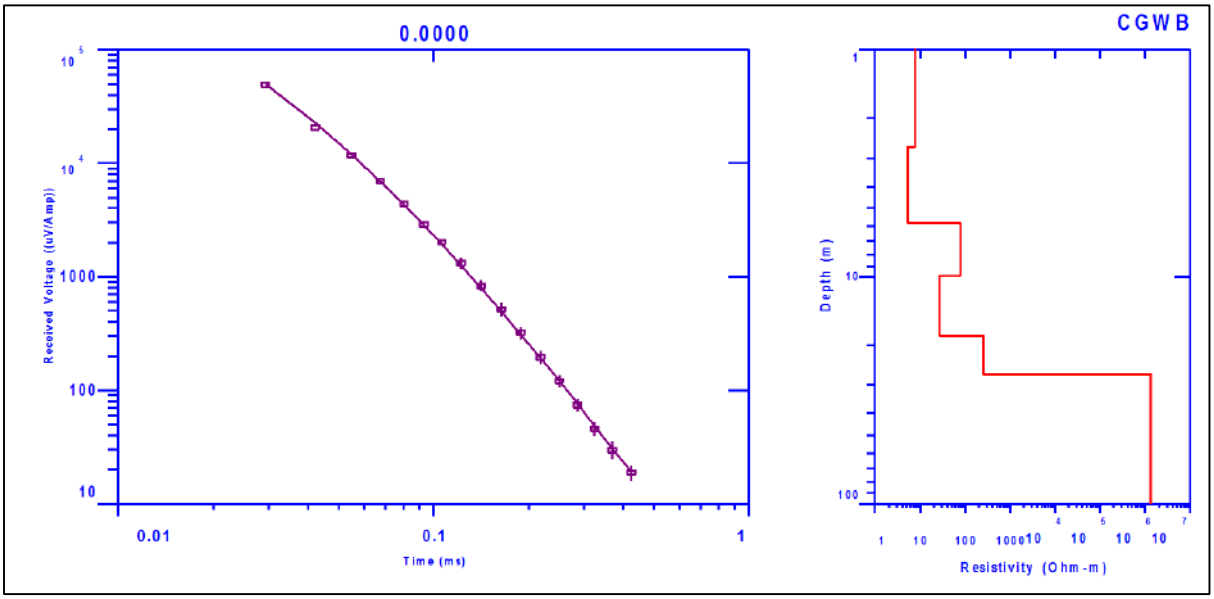


Figure 51: Voltage decay curve and interpreted model at Kanchanpur, Mohanpur Block, Gaya District, Bihar

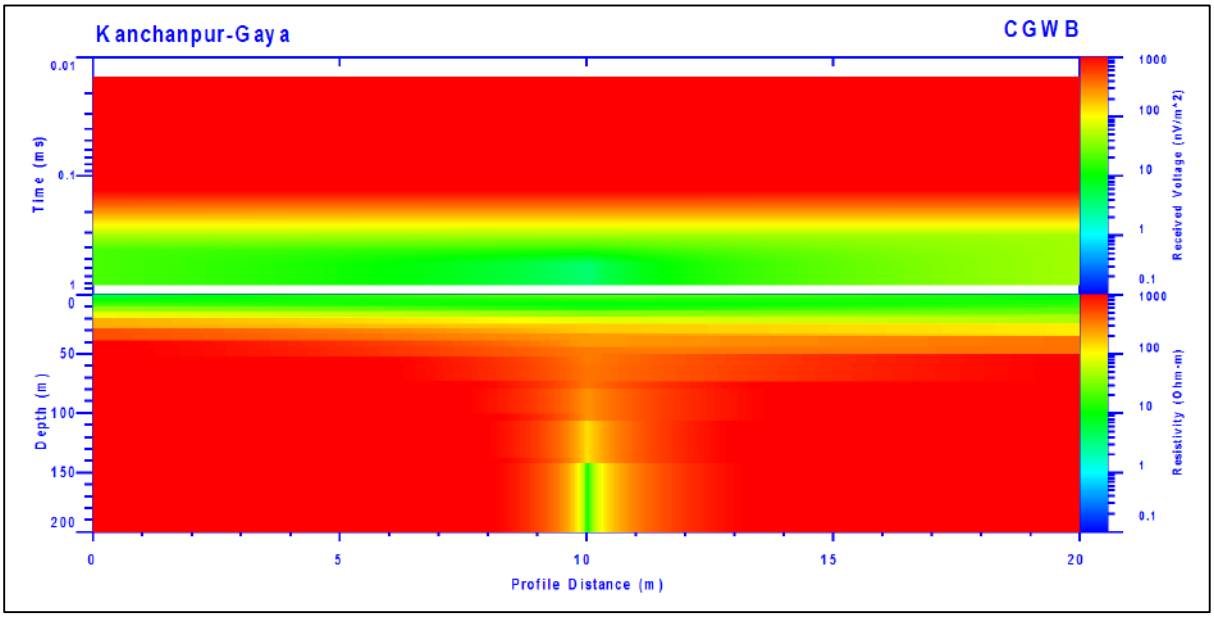


Figure 52: Interpreted Resistivity Profile of Kanchanpur, Mohanpur Block, Gaya District, Bihar

Figure 51-52 shows the findings of TEM survey at Kanchanpur, Mohanpur Block, Gaya District, Bihar. Figure 51 represents the voltage decay curve and interpreted model of the area. The voltage decays beyond noise level at around 0.5 ms indicating presence of massive bedrock beneath the surface. Six geoelectrical layers were interpreted in the study area. The resistivity and thickness of the layers are 6.9 Ω-m, 5.0 Ω-m, 81.8 Ω-m, 33.2 Ω-m, 259 Ω-m, VH (Very High) and 2.7 m, 2.9 m, 4.2 m, 7.9 m, 8.9 m respectively. The depth to bed rock has been inferred to be 23.0 mbgl.

10.4 VES-TEM-Borehole Correlation

The VES at Lakhaipur and TEM at Mohanpur lies closer to the borehole at Mohanpur High School and VES and TEM at Jamhaita lies around 1 km SW of the borehole at Ram Sahay High School. Therefore, an attempt was made to correlate the layer parameters with the lithounits.

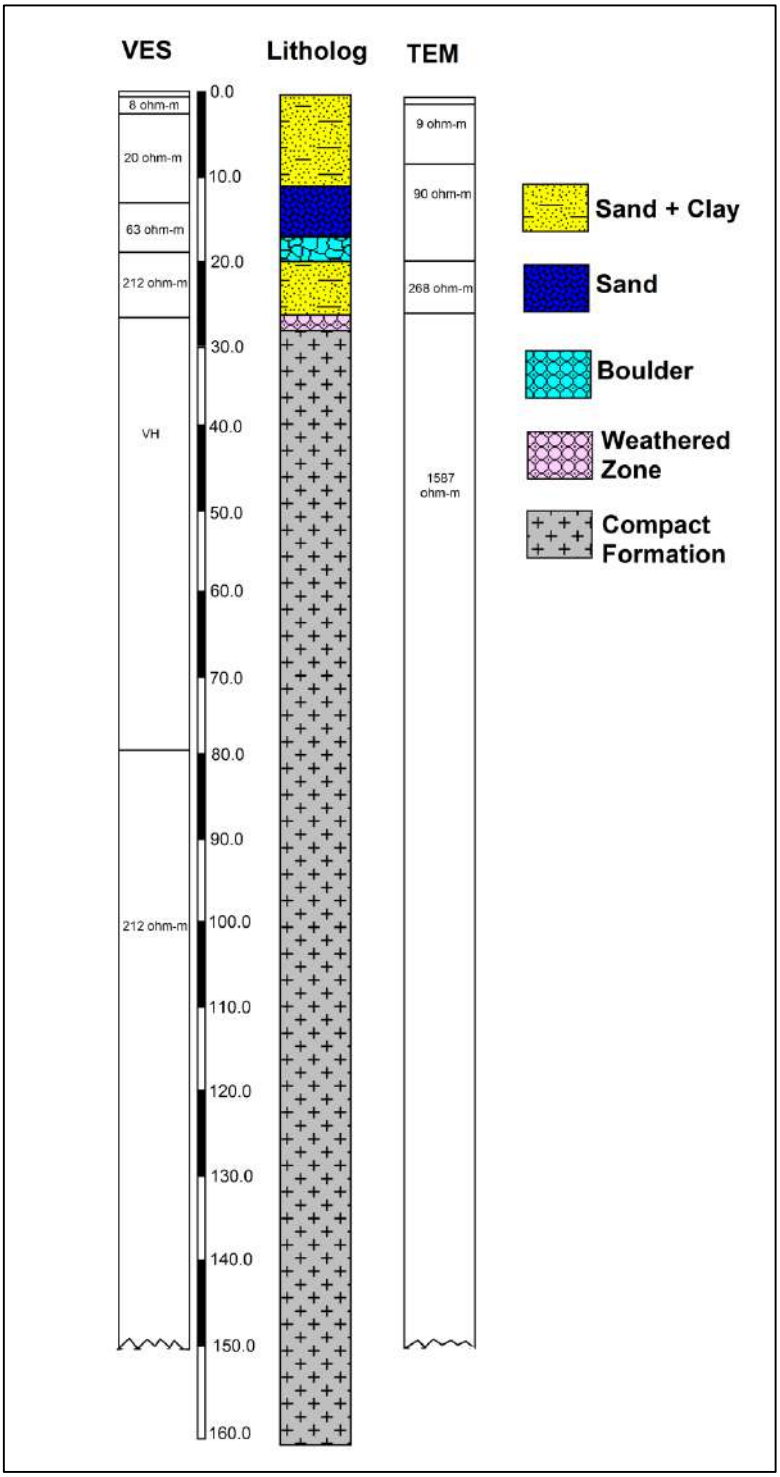


Figure 53: Litholog-VES-TEM correlation at Jamhaita, Fatehpur Block, Gaya District, Bihar

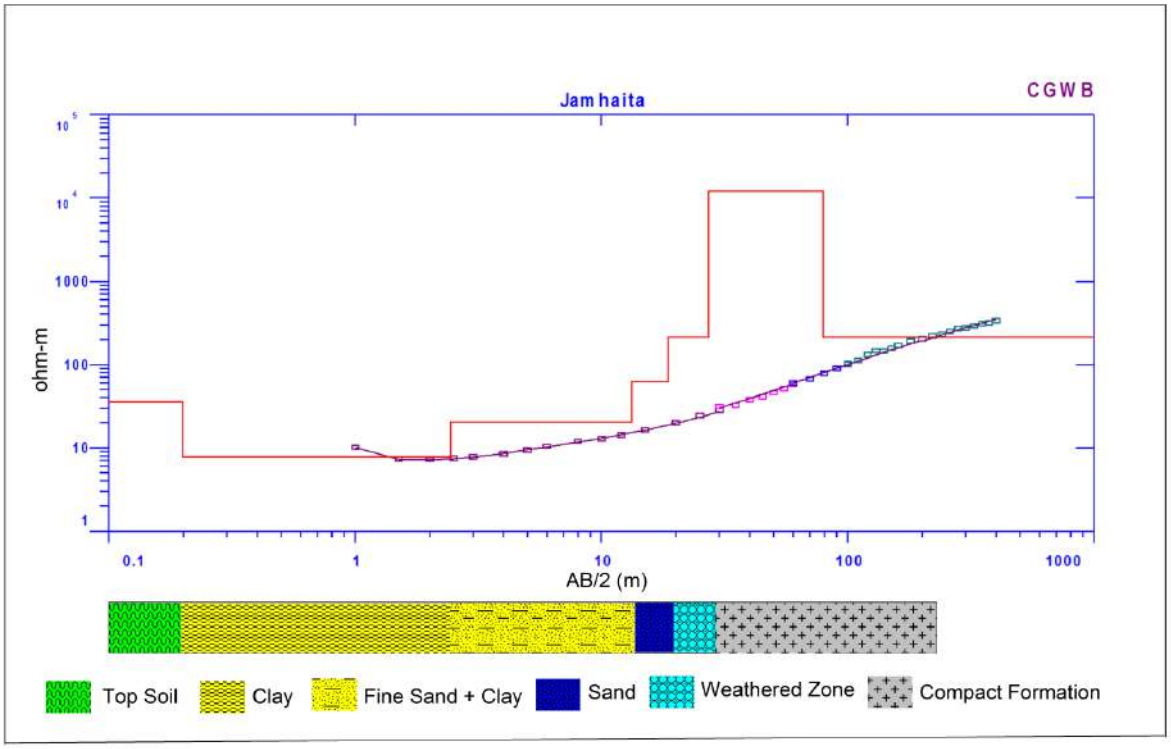


Figure 54: VES curve and interpreted model at Jamhaita, Fatehpur Block, Gaya District, Bihar

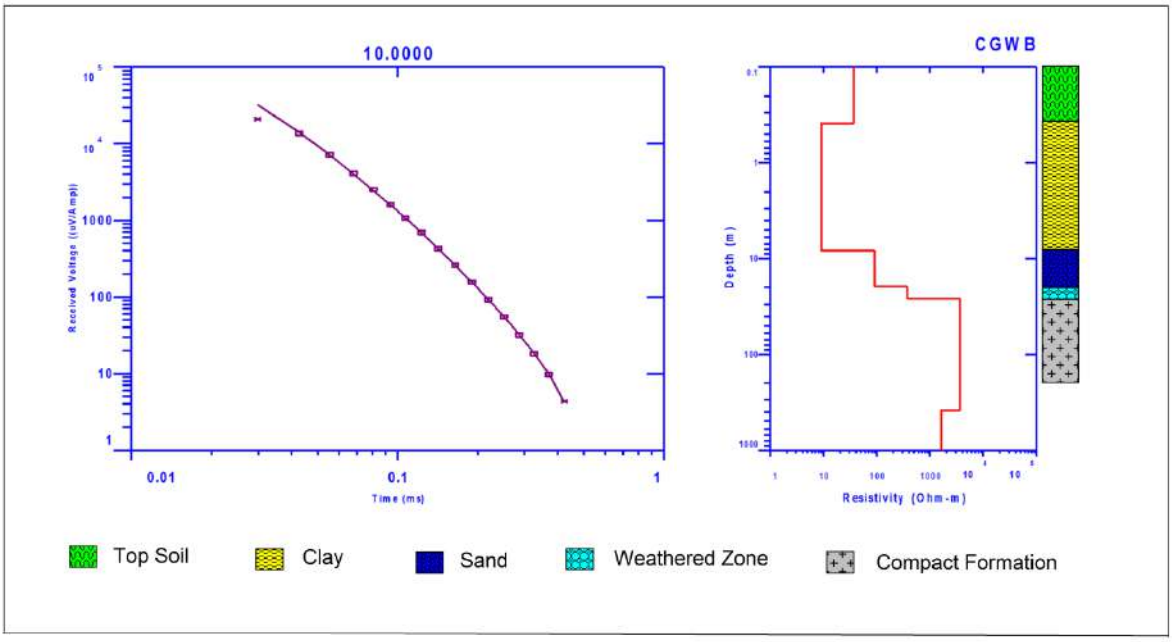


Figure 55: Voltage decay curve and interpreted layer at Jamhaita, Fatehpur Block, Gaya District, Bihar

The exploratory well at Ram Sahay High school was drilled upto a depth of 161 mbgl. The casing was lowered upto a depth of 27 m. Massive Gneissic formation was encounterd from 27 mbgl. Above the massive formation formation, five different lithounits were encountered. From the GL to 10.6 mbgl, clay with little sand content was encountered, which was followed by a 6.1 m thick sand layer. The sand layer was followed by a boulder3.1 m thick boulder layer. Underneath the boulder bed, a sandy clay layer of thickness 3.0 m was

encounterd. From 25.9 mbgl to 28.9 mbgl weathered formation was encountered. Beneath the weathered formation, massive granite gneiss was encountered upto the depth 161 mbgl.

The VES and TEM site at Jamhaita is situated approximately 1 km SW of the borehole. The interpretation of the VES curve gives 7 geoelectric layers. The resistivity of the top layer was found to be 35.8 Ω-m having thickness 0.2 m. The resistivity and thickness of the second layer was found out to be 7.8 Ω-m and 2.2 m respectively. The lower value of resistivity indicates presence of clay. Underneath this layer, a 10.8 m thick layer with resistivity 20.5 Ω-m was interpreted. The gradual increase in resistivity might be due to a layer having presence of both sand and clay in different proportions. The fourth geoelectric layer has resistivity and thickness 63 Ω-m and 5.3 m respectively. This layer was followed by an 8.5 m thick layer with resistivity 212 Ω-m. This resistivity value might indicate presence of weathered zone. The sixth geoelectric layer has resistivity and thickness 11976 Ω-m and 52.3 m respectively. This layer having very high resistivity may be inferred to be compact formation. The last layer shows resistivity value of 212.2 Ω-m. This might be due to change in compactness and presence of weak zone having groundwater potential.

The interpretation of TEM sounding gives five geoelectric layers. The first layer is a 0.4 m thick layer with resistivity 37 Ω-m. The second layer shows resistivity and thickness vale of 9 Ω-m and 7.7 m respectively. This layer is followed by two layers having resistivity 90 Ω-m and 267 Ω-m having thicknesses 11 m and 6 m respectively. The gradual increase in resistivity indicates increase of grain size (presence of sand and weathered formation). The last layer shows resistivity 3662 Ω-m which may be inferred as massive formation.

Therefore, it can be concluded that VES and TEM data are in coherence with the local lithological formation.

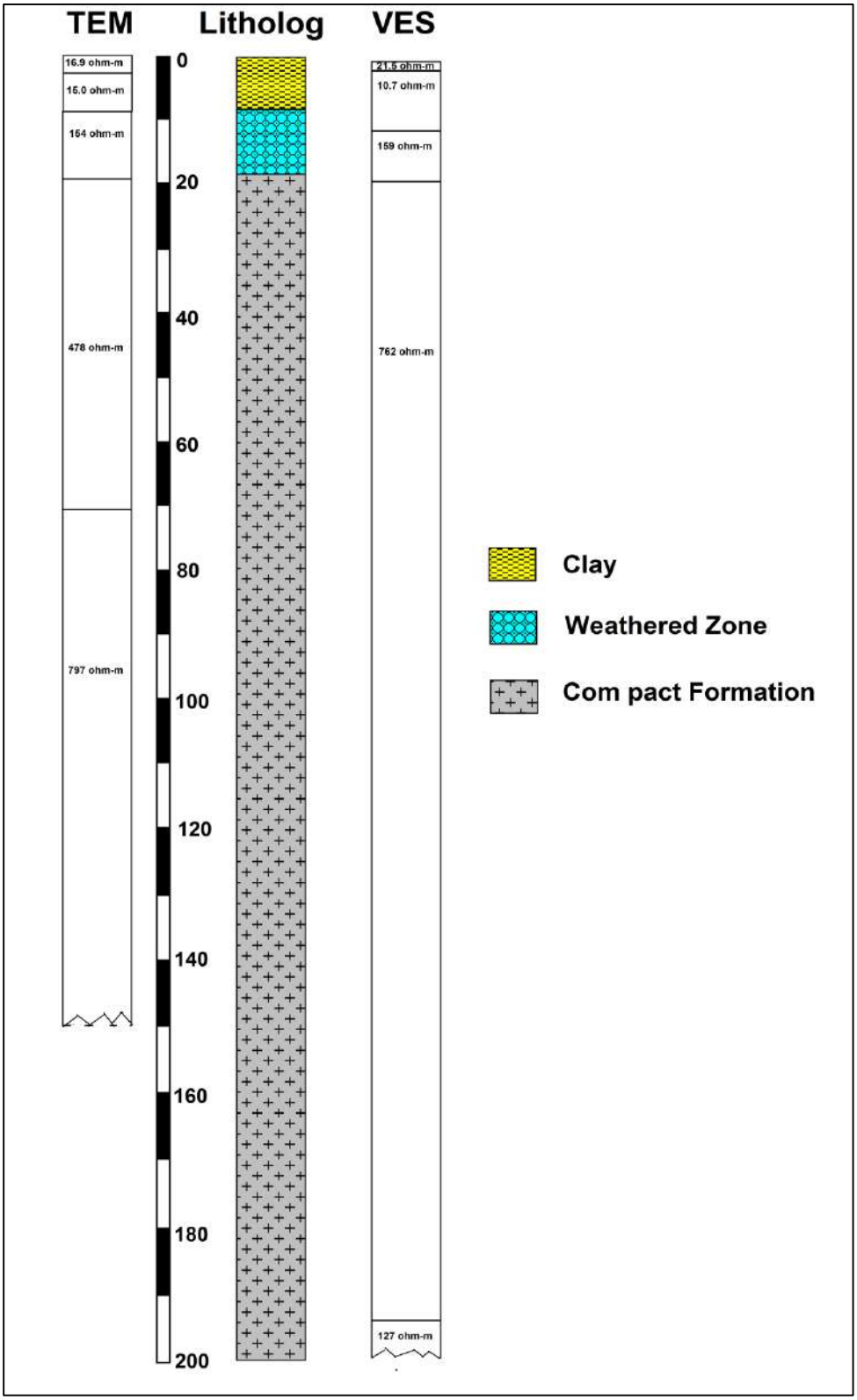


Figure 56: Litholog-VES-TEM correlation at Mohanpur, Fatehpur Block, Gaya District, Bihar

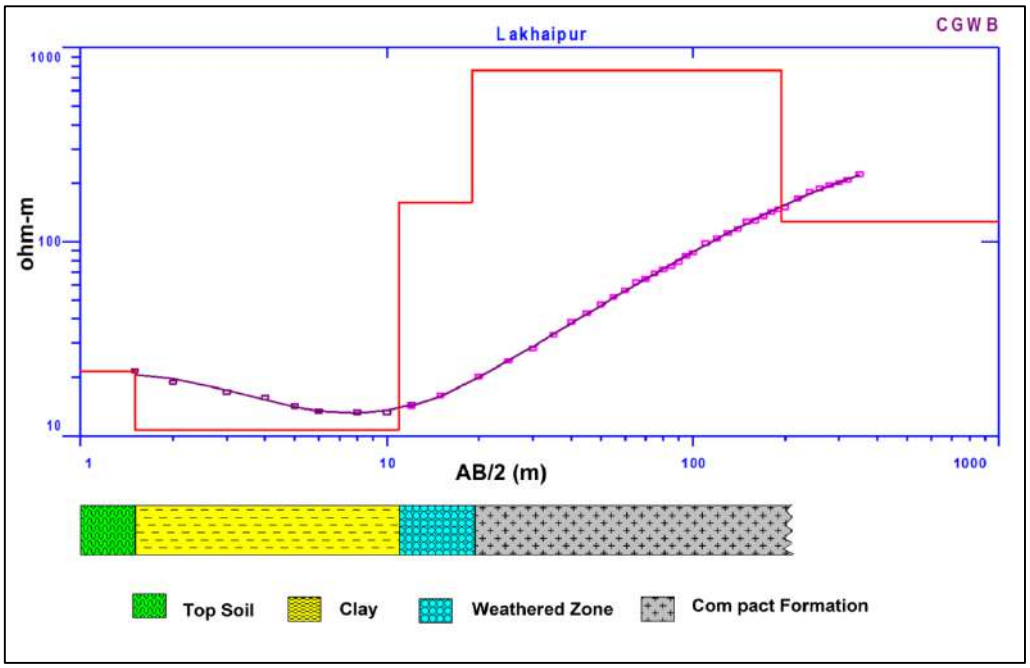


Figure 57: VES curve and interpreted model at Mohanpur, Mohanpur Block, Gaya District, Bihar

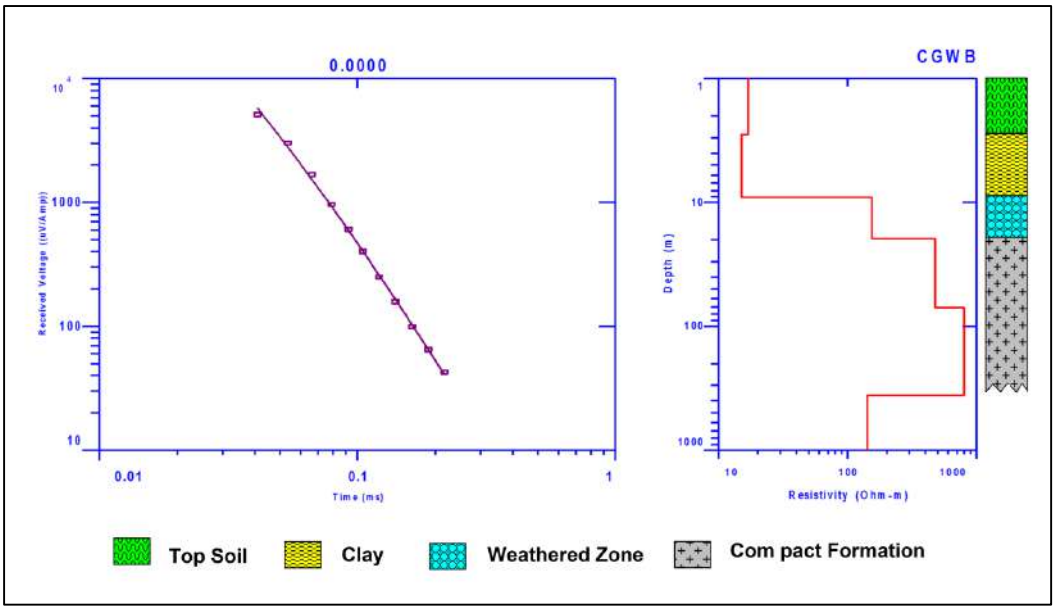


Figure 58: Voltage decay curve and interpreted layer at Mohanpur, Mohanpur Block, Gaya District, Bihar

A well was drilled upto depth of 201 mbgl at +2 school, Mohanpur. The casing was lowered upto depth of 19 mbgl. The first lithounit was a prominent clay layer with thickness 7.6 m. It was followed by weathered formation having thickness 10.6 m. Massive formation (Granite Gneiss) was encountered at a depth of 19 mbgl. No fracture was encountered during drilling of the well.

The VES site at Lakhaipur is situated approximately 50 m from the well. The interpretation of the VES curve gives five geoelectric layers. The top layer has resistivity 21.6 Ω-m and thickness 1.2 m. The second layer is a 9.4 m thick layer having resistivity value 10.7

Ω-m. This layer indicated presence of clay. The third layer has been interpreted to have resistivity 159 Ω-m and thickness 8 m. This layer corresponds to weathered formation. Underneath this layer, a layer having resistivity and thickness 762 Ω-m and 175 m was interpreted. It indicates presence of massive bedrock. The last layer has comparatively lower resistivity value of 127 Ω-m. This might be due to decrease in compactness of the bedrock.

The TEM survey was carried out adjacent to the borewell. Interpretation of TEM sounding gives six geoelectrical layers. The layer parameters (resistivity and thicknesses) are 16.9 Ω-m, 15.0 Ω-m, 154 Ω-m, 478 Ω-m and 796 Ω-m and 2.8 m, 6.2 m, 10.5 m, 51.3 m respectively. The second layer represents clay layer whereas the third layer corresponds to weathered zone. The fourth and fifth layer indicates presence of massive bedrock.

Based on the above parametric correlation, following resistivity ranges have been fixed for the study area.

10.5 Geoelectric Cross Section: -

Based on the inferred lithology three geoelectric sections were constructed to understand the lithological disposition upto a depth of 150.0 m. The profile directions are shown in the following figure 59.

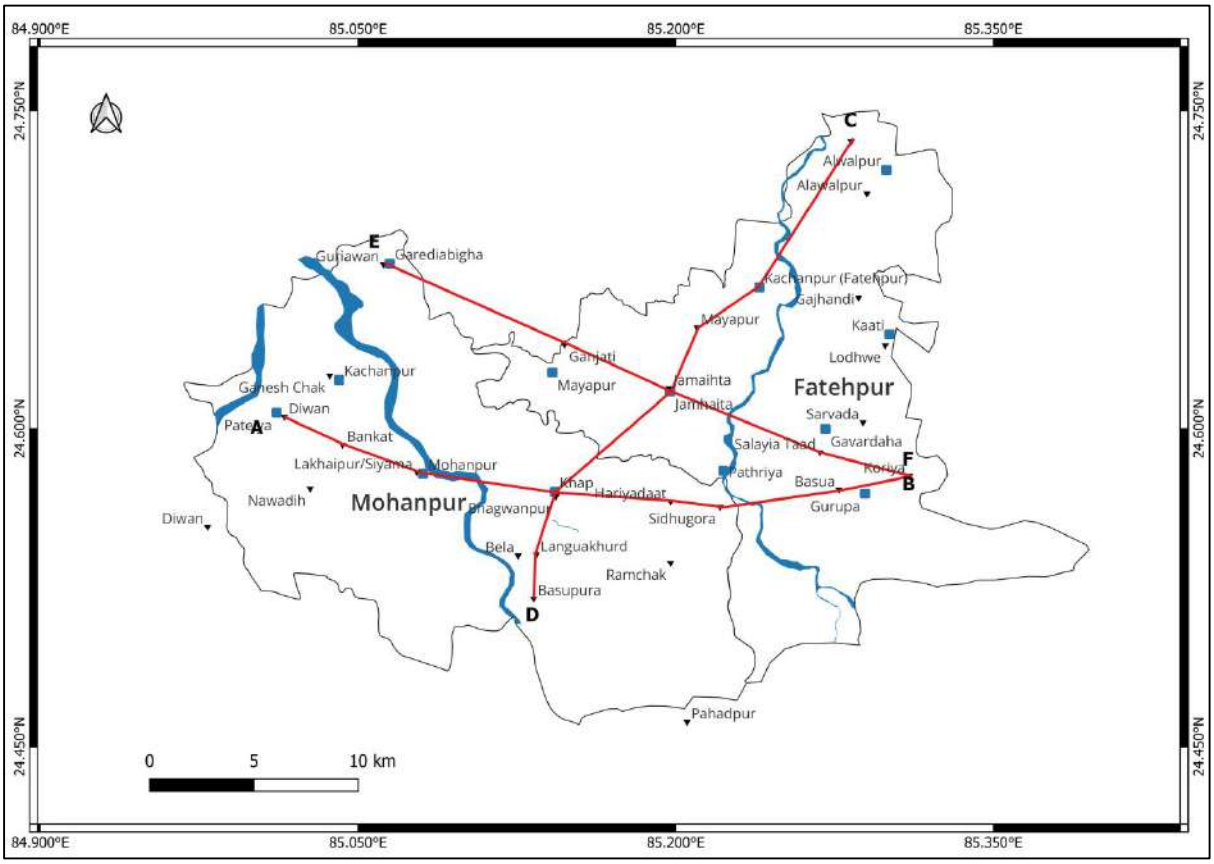


Figure 59: Map showing profile directions

10.5.1 Geoelectric Section A-B

Geoelectric section AB traverses Diwan of Mohanpur block to Koriya of Fatehpur block covering a distance of … km. The profile extends from West to East direction.

The depth to bed rock varies from 4.0 mbgl at Basua to 30.0 mbgl at Bankat. The western part of the profile has comparatively higher depth to bedrock than that of the Eastern part. The bedrock is overlain by top soil and weathered zone at all the locations which may act as shallow aquifer. At Bankat and Bhagwanpur, a geoelectric layer with resistivity 9.0 Ω-m and 5.3 Ω-m respectively has been interpreted, which may be inferred as highly weathered layer or clay layer. At Diwan, a less compact layer has been inferred at a depth of 45-150 m, which may be a groundwater promising zone. Similarly, at Basua, an approximately 23 m thick layer with comparatively lower resistivity value has been inferred which may be a ground water potential zone.

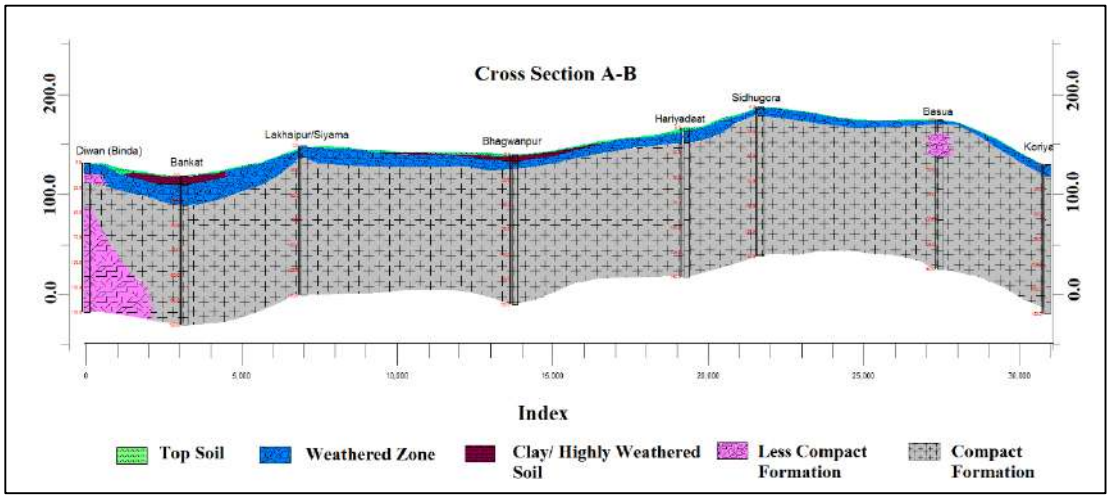


Figure 60:Cross Section along A-B

10.5.2 Geoelectric Section C-D

The Geoelectric section CD extends from Jaspur to Basupura area and traverses in NE-SW direction. The elevation gradually increases as one traverses across the profile.

The maximum depth to bedrock has been found to be 3.5 mbgl at Basupura to 30 mbgl at Mayapur. Above the massive layer alluvial sediments as well as weathered materials are present. A layer with lower resistivity (<25 Ω-m) has been inferred at all places. This layer may be inferred as clay layer or highly weathered material. In Jaspur area, the top soil layer is underlined by a 4 m thick layer having resistivity 23 Ω-m, which may be a layer containing higher degree of weathered material. This geoelectric layer is underlain by a layer with

resistivity 46 Ω-m having thickness 8 m upto the depth 15.5 mbgl. This sand layer is present at all the locations except Bhagwanpur where the highly weathered layer is followed by a 5.0 m thick layer with resistivity 90.0 Ω-m, which may be inferred as weathered zone. The weathered zone has been inferred along Mayapur to Bhagwanpur, whose thickness are 9.0 m, 12.0 m and 5.0 m respectively. The layer overlying the massive formation may act as shallow aquifer in the area.

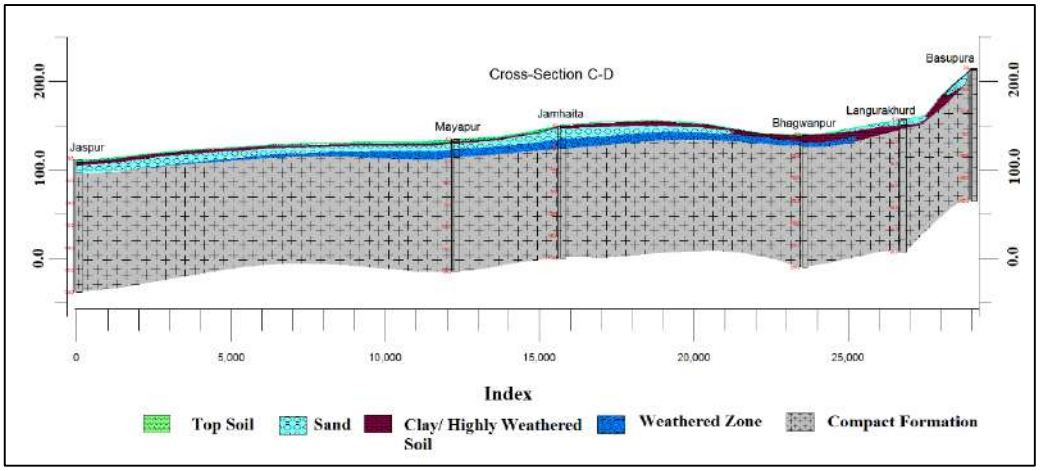


Figure 61:Cross Section along C-D

10.5.3 Geoelectric Section E-F: -

The geoelectric section EF traverses from Guriawan toKoriya in NW-SE direction. The depth to bed rock varies from 11.6 mbgl to 26.0 mbgl along the profile. The weathered zone has been inferred at all the places whose thickness varies from 18.0 m at Guriawan to 8.0 m at Ganjati. The weathered zone thickness at Salaiya Taad, Koriya and Jamhaita are 17.0 m, 10.0 m and 12.0 m respectively.

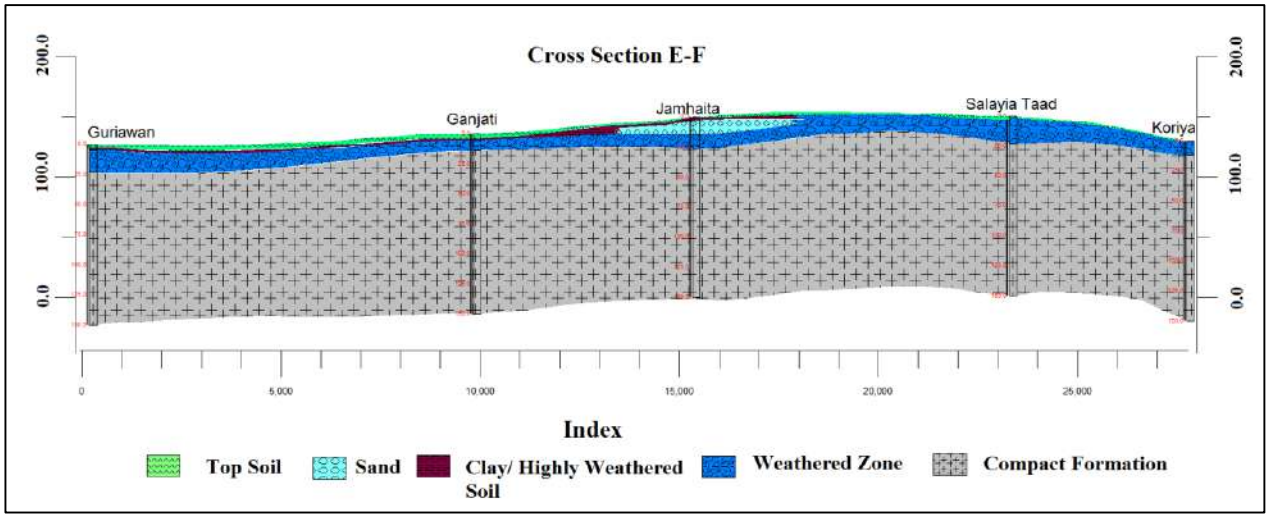


Figure 62:Cross Section along E-F

Chapter 11: Hydrochemistry

11.1 Introduction

Groundwater quality of an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities. Quality of ground water is as much demanding as its quantity. Suitability of ground water for drinking and rrigational purpose is important for its safe and effective use. The concentration of the major ions and other dissolved ions in ground water are function of the availability of the constituents in the aquifer matrices and their solubility. Rocks, through which water circulate, are composed of minerals and amorphous solids, which in turn are composed of chemical elements that greatly affect the ground water quality.

11.2 Objective

Water quality assessment is vital for ensuring the safety and sustainability of water sources across various sectors, including drinking water, irrigation, and industrial processes. It safeguards public health by identifying contaminants like bacteria, viruses, heavy metals, and chemicals in drinking water.

11.3 Material And Methods

Ground water samples are collected at various points from the study area, from different abstraction structure viz. Dug wells and Shallow tube wells and Deep tube wells in order to identify potential contamination sources. The collected data is then compared to established water quality standards and guidelines to determine compliance. This systematic evaluation enables authorities and water management agencies to make informed decisions and take necessary actions to ensure the provision of safe and reliable drinking water to the public.

11.4 Results And Discussion

In order to assess ground water quality of the study area under NAQUIM 2.0, the chemical analysis of groundwater was conducted in the Mohanpur and Fatehpur blocks of Gaya district, Bihar, during both pre and post-monsoon periods. For the basic hydrochemical analysis, 127 samples were collected during pre-monsoon and 113 samples during post-monsoon. These samples were analyzed for parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^{+}), potassium (K^{+}), alkalinity, chloride (Cl^{-}), sulfate (SO_4^{2-}), nitrate (NO_3^{-}), and fluoride (F^{-}), following standard procedures prescribed by the American Public Health

Association (APHA). The quality of the water was evaluated against the standards set by the Bureau of Indian Standards (BIS IS 10500:2012) for drinking water.

11.4.1 Assessment of Groundwater quality (Basic Parameters)

[A] pH:

The pH levels of groundwater samples collected during both the pre-monsoon and post-monsoon periods of 2023 were found to be within the safe range of 7.67 to 8.49, with an average pH value of 8.02 for pre-monsoon samples and 8.08 for post-monsoon samples. Most of these samples were alkaline, indicating that the water is generally suitable for drinking purposes. These consistent pH levels indicate a balanced acid-base environment, crucial for maintaining water quality.

[B] EC (Electrical Conductivity):

The electrical conductivity (EC) of groundwater, indicating the presence of dissolved ionic salts, was measured in both pre-monsoon and post-monsoon samples. Pre-monsoon EC values ranged from 372 to 2130 µS/cm with an average of 787 µS/cm, while post-monsoon values ranged from 372 to 1922 µS/cm, averaging 911 µS/cm.

[C] TDS (Total Dissolved Solids):

Total dissolved solids (TDS), which result from natural rock/soil interactions and human activities, ranged from 242 to 1384 mg/L during pre-monsoon with an average of 512 mg/L, and from 242 to 1249 mg/L during post-monsoon with an average of 592.3 mg/L. The broader range of TDS during the post-monsoon period (242 - 1249 mg/L) indicates potential dilution effects from increased water flow during the monsoon, impacting the EC of water sources. These TDS levels generally fall within the acceptable limit of 500 mg/L for drinking water, although some exceed this threshold, remaining within the permissible limit of 2000 mg/L when no alternative source is available.

[D] Chloride (Cl^-):

Chloride, a common constituent in natural water, is primarily derived from halite (NaCl) and igneous rocks. Its high solubility in water makes it difficult to remove naturally, resulting in variable concentrations. According to BIS 2012 standards, the acceptable limit for chloride in drinking water is 250 mg/L, with a permissible limit of 1000 mg/L in the absence of an alternative source. In the pre-monsoon sample analysis, chloride levels in groundwater

samples ranged from 7.1 to 376 mg/L, with an average of 67 mg/L. During Post-monsoon period, chloride concentrations ranged from 7.1 to 287 mg/L, averaging 87 mg/L. In both periods, all samples were within the maximum permissible limit.

[E] Sulfate ($SO4^{2-}$):

The acceptable limit for sulfate in drinking water, according to BIS (2012), is 200 mg/L, with a permissible limit of 400 mg/L if no alternative source is available, provided that magnesium concentrations do not exceed 30 mg/L. Sulfate in groundwater primarily originates from the oxidation of sulfide ores, gypsum, and anhydrite. In the pre-monsoon sample analysis, sulfate concentrations in groundwater samples ranged from 0.46 to 97.21 mg/L, with an average of 25.5 mg/L. In the post-monsoon sample analysis, sulfate levels ranged from 1.85 to 145.6 mg/L, with an average of 39.1 mg/L. Both sets of samples were within the prescribed limits. These values remain well below the permissible limit of 200 mg/L, indicating a low sulfate presence and stable water quality.

[F] Nitrate ($NO3^{-}$):

The acceptable limit for nitrate in drinking water, as prescribed by BIS (2012), is 45 mg/L, with no recommended relaxation beyond this value if no alternative source is available. In the pre-monsoon period, nitrate concentrations in groundwater samples ranged from 0 to 39.02 mg/L, with an average of 13.4 mg/L. During the post-monsoon period, nitrate levels ranged from 0.11 to 69 mg/L, with an average of 20.2 mg/L. In both periods, most samples remained within the acceptable limit. The variability suggests potential agricultural runoff or other sources contributing to nitrate levels, emphasizing the need for ongoing monitoring.

[G] Total Hardness (TH) and Calcium (Ca^{2+}):

The total hardness (TH) of groundwater, influenced by geological interactions, ranged from 135 to 730 mg/L during pre-monsoon and 100 to 690 mg/L during post-monsoon, with averages of 288 mg/L and 275.6 mg/L, respectively. These values exceed the BIS acceptable limit of 200 mg/L but remain within the permissible limit of 600 mg/L. Calcium concentrations ranged from 20 to 186 mg/L during pre-monsoon and 16 to 160 mg/L during post-monsoon, with averages of 63 mg/L and 57 mg/L, staying within the BIS limits of 75 mg/L to 200 mg/L.

[H] Magnesium (Mg^{2+}):

Magnesium levels, sourced from minerals like olivine and dolomite, ranged from 3.64 to 70.5 mg/L during pre-monsoon and 2.43 to 85.05 mg/L during post-monsoon, with averages

of 31.6 mg/L during pre-monsoon and 32.5 mg/L during post-monsoon, generally aligning with the BIS limits of 30 mg/L to 100 mg/L. The wider range of values during the post-monsoon period suggests dilution effects in magnesium concentration.

[I] Fluoride (F^-):

The acceptable limit for fluoride in drinking water, according to BIS (2012), is 1.0 mg/L, with a permissible limit of 1.5 mg/L in the absence of an alternative source. Elevated fluoride levels can cause dental and skeletal fluorosis. In the pre-monsoon groundwater samples, fluoride concentrations ranged from 0.23 to 1.84 mg/L, averaging 0.88 mg/L, with 14 samples exceeding the permissible limit. Post-monsoon groundwater samples showed fluoride levels ranging from 0 to 2.05 mg/L, with an average of 1.07 mg/L, and 19 samples exceeded the permissible limit. Despite most samples being within acceptable levels, some exceeded the safe threshold, indicating potential health risks.

[J] Sodium (Na^+):

Sodium levels in groundwater were observed to range from 6.23 to 160.3 mg/L during pre-monsoon and 12 to 188 mg/L during post-monsoon, with averages of 45 mg/L and 75 mg/L, respectively. These values are well within the acceptable limits set by BIS, indicating that sodium concentrations in the groundwater do not pose a significant risk.

[K] Potassium (K^+):

Potassium levels ranged from 0.24 to 36.7 mg/L during pre-monsoon and 0.14 to 48.3 mg/L during post-monsoon, with averages of 5.8 mg/L and 13.3 mg/L, respectively. The relatively low concentration of potassium suggests that it is not a major contributor to groundwater contamination in the study area.

[L] Alkalinity:

Alkalinity, which reflects water's capacity to neutralize acid, is primarily due to dissolved species like bicarbonates, carbonates, carbon dioxide, and hydroxide ions. In the pre-monsoon groundwater samples, no carbonate alkalinity was detected, with bicarbonate concentrations ranging from 128 to 610 mg/L, averaging 317 mg/L. In the post-monsoon groundwater samples, some carbonate alkalinity was observed, ranging from 0 to 27 mg/L, with an average of 3.21 mg/L. The bicarbonate levels in the post-monsoon period ranged from 85.4 to 738 mg/L, averaging 327 mg/L.

11.4.1.1 Assessment of Groundwater quality (Heavy Metal Parameters)

In addition to the basic analysis, heavy metal concentrations were also evaluated using ICP-MS on 75 samples collected during the pre-monsoon period and 45 samples during the post-monsoon period. The samples were tested for the presence of heavy metals such as chromium (Cr), iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), arsenic (As), lead (Pb), and uranium (U).

11.4.2 Conclusion

The chemical analysis of groundwater from the study area in both pre-monsoon and post-monsoon 2023 periods reveals important insights into water quality.

Basic Parameters

- The pH levels were consistently within the safe range of 7.41 to 8.49, indicating the water is generally alkaline and suitable for drinking.
- Electrical conductivity (EC) values and total dissolved solids (TDS) showed some variability, with TDS levels mostly within acceptable limits, though some exceeded the threshold during the post-monsoon period.
- Chloride and sulfate concentrations remained within permissible limits, reflecting stable water quality.
- Nitrate levels varied but generally stayed within acceptable limits, with higher levels noted post-monsoon, likely due to agricultural runoff.
- Total hardness (TH) exceeded acceptable limits but remained within permissible levels, while calcium and magnesium concentrations were within prescribed limits, albeit with some variation post-monsoon.
- Fluoride levels, however, exceeded the permissible limit in several samples, posing potential health risks.
- Alkalinity levels remained stable, with some carbonate alkalinity observed post-monsoon.

Heavy Metal Parameters

- The analysis revealed that concentrations of copper, zinc, arsenic, and lead were within permissible limits in all samples.
- Uranium levels exceeded the permissible limit of 0.03 mg/L in 10 samples during pre-monsoon and in 2 samples during post-monsoon, with the highest concentrations found in shallow tube wells of Khajurahi and Dhanichak in Mohanpur block.

- Iron concentrations were above the permissible limit of 1.0 mg/L in 9 samples during pre-monsoon and 3 samples during post-monsoon, with the highest levels recorded in shallow tubewells in Hardiaspur, Mohanpur block.
- Manganese concentrations also exceeded the permissible limit of 0.3 mg/L in 10 locations during pre-monsoon and 2 locations during post-monsoon, particularly in Dug wells of Jogia and Dundhi, both in Mohanpur block.
- Overall, the groundwater quality in the study area is largely within safe limits, though certain parameters, particularly fluoride, warrant close monitoring. These findings highlight significant concerns about groundwater quality in certain areas, particularly regarding the elevated levels of uranium, iron, and manganese, which pose potential health risks if the water is consumed without proper treatment.

11.5 Classification of ground water type

11.5.1 Piper Plot:

It was observed that majority of the water samples collected during pre & post monsoon from the area are of Ca-Mg-HCO_3 type, followed by mixed type and Na-K-Cl-SO_4 type water. The study suggested that the aquifer is dominated by alkaline earth metals over alkali metals (figure 63).

11.5.2 USSL diagram

US Salinity plot showed that most of the groundwater samples of pre & post monsoon were in the C2-S1 category followed by C3-S1 category (figure…). The C2-S1 category suggests that the groundwater has less sodium content and can be used for irrigation purpose (figure 65).

11.5.3 Wilcox diagram

The Wilcox plot indicated that most of the samples were in the category of excellent to good and good to permissible range (figure 64).

Pre-monsoon, 2023 **Post-monsoon, 2023**

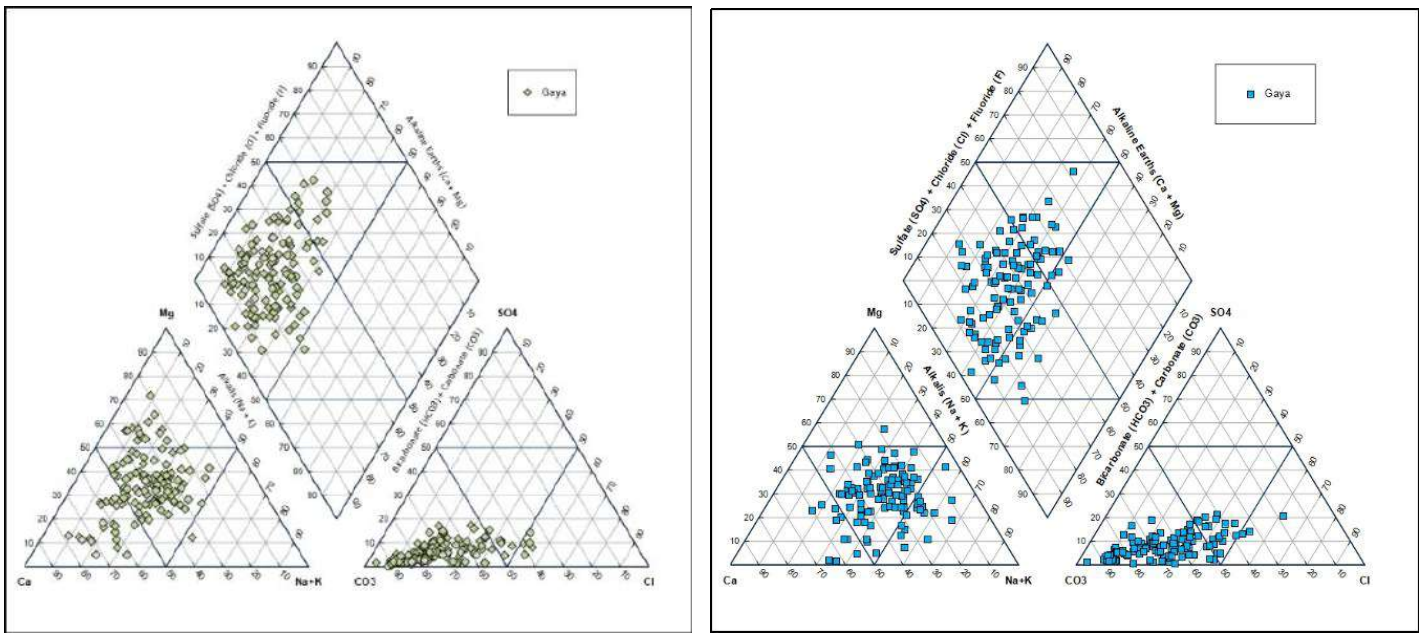


Figure 63: Piper Plot

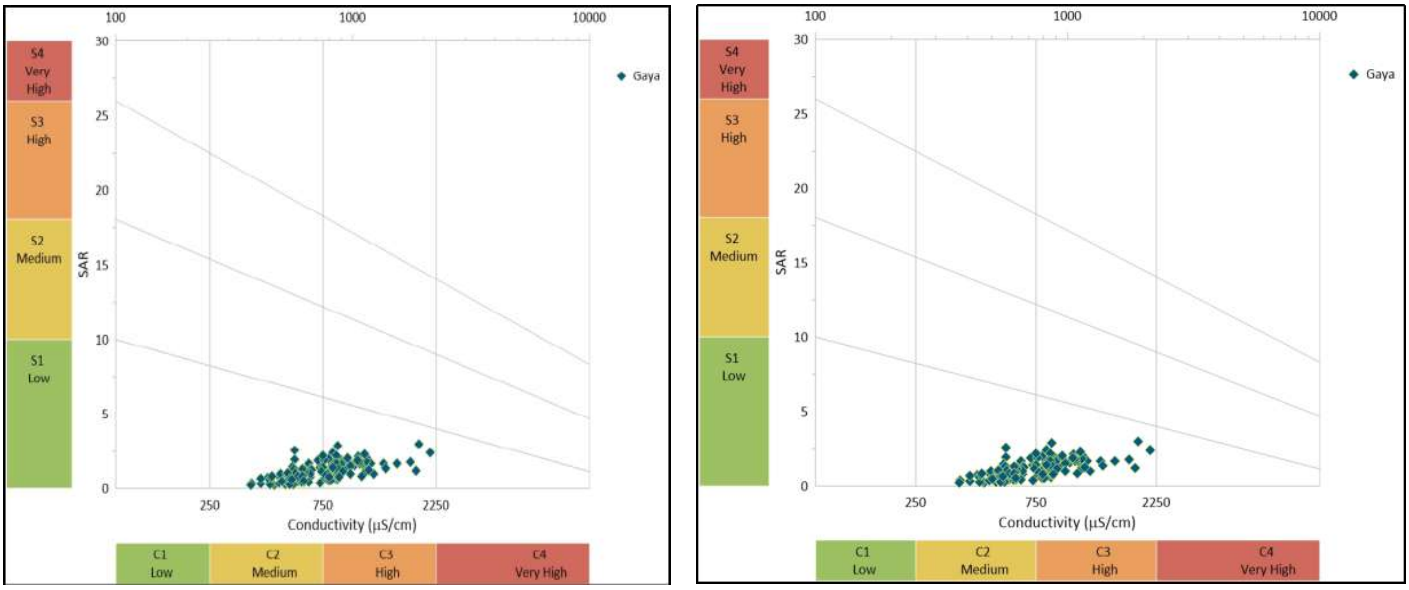


Figure 65: USSL Plot

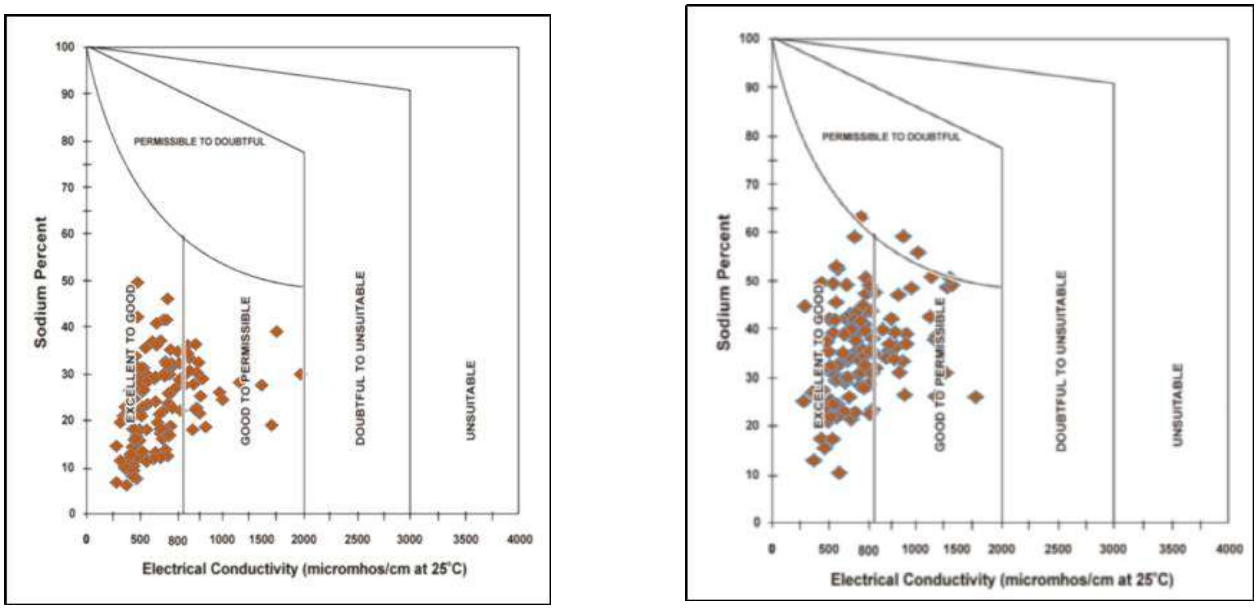


Figure 64: Wilcox Plot

Table 10: Statistical result of the studied chemical parameters in the Study Area

Parameter	Aquifer	Pre-Monsoon			Post-Monsoon			BIS 2012, acceptable limit	Samples Above Permissible limit			
		Min	Max	Avg.	Min	Max	Avg.		Premonsoon		Postmonsoon	
									No of Samples	%	No of Samples	%
pH	Aquifer-I	7.67	8.31	8.025	7.41	8.48	8.0	6.5-8.5	Nil		Nil	
	Aquifer-II	7.81	8.25	8.005873	7.59	8.49	8.1		Nil		Nil	
EC	Aquifer-I	375	1848	771.4688	453	1922	941.9					

Parameter	Aquifer	Pre-Monsoon			Post-Monsoon			BIS 2012, acceptable limit	Samples Above Permissible limit			
		Min	Max	Avg.	Min	Max	Avg.		Premonsoon		Postmonsoon	
									No of Samples	%	No of Samples	%
	Aquifer-II	372	2130	803.9206	372	1708	882.2					
TDS (mg/L)	Aquifer-I	243.75	1201.2	501.4547	294.45	1249.3	612.2	500	26	41	38	67
	Aquifer-II	241.8	1384.5	522.5484	241.8	1110.2	573.4		32	51	32	57
HCO3- (mg/L)	Aquifer-I	128.1	500.2	311.3859	122	640.5	331.8	200	62	97	34	60
	Aquifer-II	128.1	610	322.0413	85.4	738.1	323.7		60	95	35	62
Cl- (mg/L)	Aquifer-I	7.1	333.7	65.45313	7.1	287.55	95.9	250	3	5	3	5
	Aquifer-II	10.65	376.3	69.25317	21.3	223.65	77.9		1	2	Nil	
NO3- (mg/L)	Aquifer-I	0.32	32.61	12.76766	0.14	69	19.8	45	Nil		4	7
	Aquifer-II	0	39.02	14.13825	0.11	69	20.6		Nil		7	12
SO42- (mg/L)	Aquifer-I	0.46	89.17	24.41703	2.24	117	39.9	200	Nil		Nil	
	Aquifer-II	1.12	97.21	26.54921	1.85	145.6	38.0		Nil		Nil	
F- (mg/L)	Aquifer-I	0.3	1.84	0.870313	0	1.85	1.0	1	16	25	30	53
	Aquifer-II	0.23	1.79	0.9	0.04	2.05	1.2		16	25	36	64
Ca2+ (mg/L)	Aquifer-I	20	186	62.09375	125	690	57.6	75	18	0	8	14
	Aquifer-II	22	172	64.57143	16	160	55.7		23	37	3	5
Mg2+ (mg/L)	Aquifer-I	6.075	64.395	31.38117	2.43	75.33	34.1	30	32	50	7	12
	Aquifer-II	3.645	70.47	31.76357	2.43	85.05	31.2		37	59	14	25
Na+ (mg/L)	Aquifer-I	10.02	102.32	43.36938	21.51	174.61	77.6					
	Aquifer-II	6.23	160.31	46.43667	11.71	188.24	72.1					
K+ (mg/L)	Aquifer-I	0.34	32.41	5.634063	1.02	48.3	13.7					
	Aquifer-II	0.24	36.74	5.97127	0.14	44.07	13.1					
TH (mg/L)	Aquifer-I	135	730	284.375	125	690	284.3	200	54	84	47	83
	Aquifer-II	160	720	292.1429	100	560	267.5		52	83	46	81

11.6 Ground Water Quality Management Interventions including demarcation of safer aquifers

The groundwater quality assessment reveals variable levels of dissolved solids, with pH values indicating a slightly alkaline nature, suitable for drinking and irrigation purposes. However, Total Dissolved Solids (TDS) and Electrical Conductivity (EC) values exceed permissible limits in some areas which may impact drinking water quality. Ion concentrations,

such as Bicarbonate, Chloride, Nitrate, Sulfate, and Fluoride, also vary, with some areas exceeding permissible limits. Total Hardness values indicate moderate to high levels.

The water quality is suitable for drinking and agricultural use except in a few patches where fluoride and nitrate has been found above the permissible limit. 16.8% samples (13 locations) shows fluoride concentration beyond permissible limit and varies from 1.51 mg/l to 2.05 mg/l. and 12.38% samples (14 locations) shows nitrate concentration above permissible limit of 45 mg/l and ranges from 48 to 69 mg/l.

11.6.1 Distribution of Fluoride contamination in groundwater:

Ground water flow direction in general is towards the direction of flow direction of river water from south to north. The fig 66 illustrates the distribution of fluoride in the study area during Pre-Monsoon and Post Monsoon respectively. It is observed that both in pre monsoon and post monsoon period, the samples having fluoride concentration > 1.5 mg/l are mainly concentrated in the marginal alluvium and weathered zone surrounding the hilly regions, throughout the eastern and western extent of the study area. The samples having concentration between 1 to 1.5 mg/l are spread across the major drainage in the eastern part of the study area during pre-monsoon period, while this concentration range (1 to 1.5 mg/l) is observed in vicinity of entire major drainage pattern of the study area, showing a wider distribution during post monsoon. This indicates that there is movement of fluoride contamination from the hilly regions to the plain areas along the rivers (figure 66).

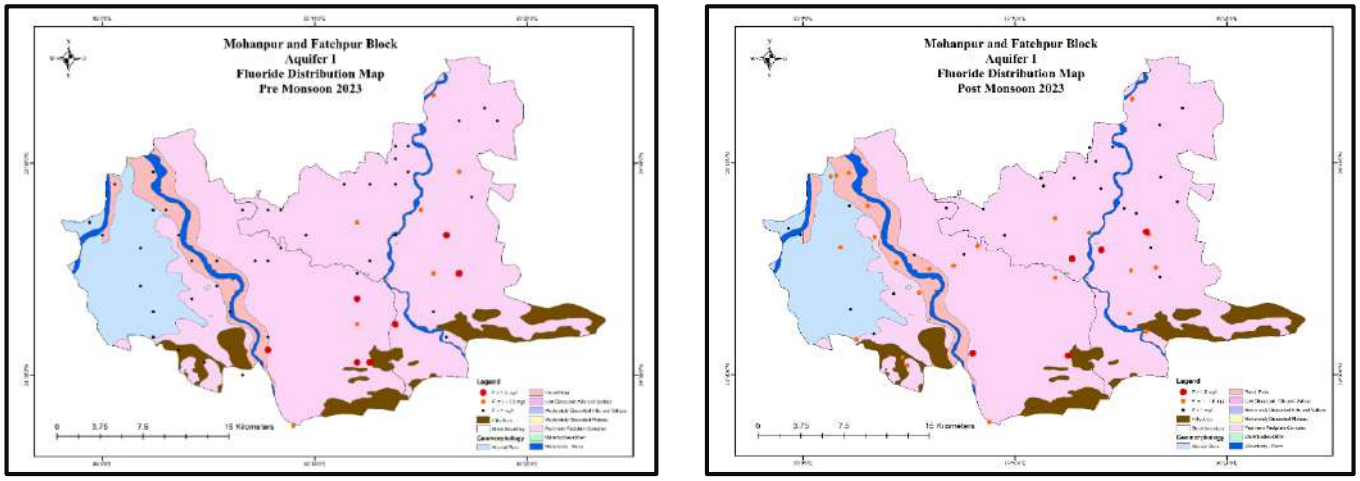


Figure 66: Fluoride Distribution during Pre-Monsoon and Post Monsoon period

11.6.1 Vertical distribution of Fluoride in Groundwater:

The variation of fluoride with depth is not so significant indicating that the major source of fluoride in groundwater is geogenic in nature. Depth versus fluoride plot shows that fluoride concentration beyond permissible limit (> 1.5 mg/l) in groundwater observed at all sampling depth (figure 67).

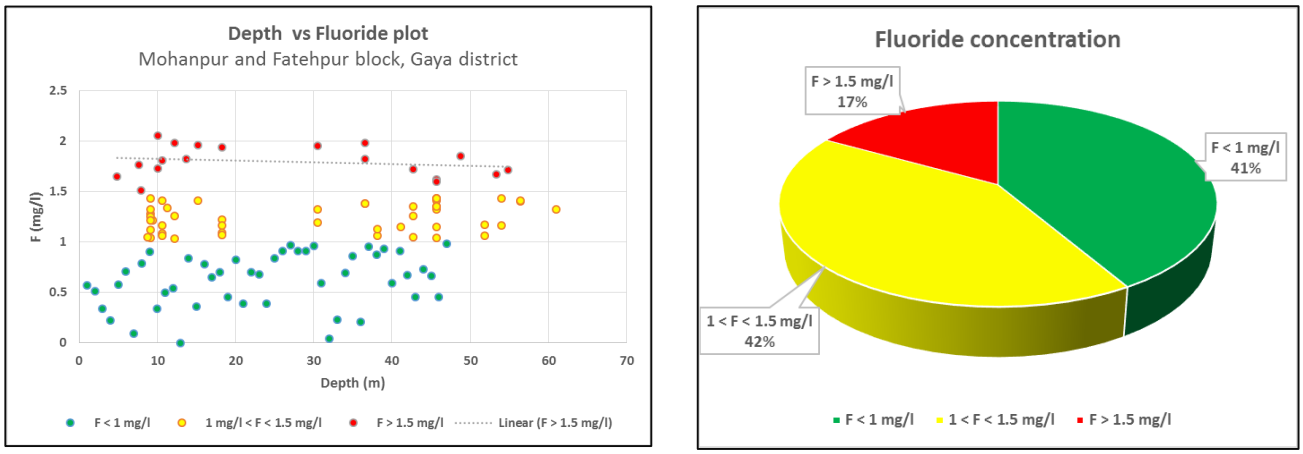


Figure 67: Graphical Representation of Fluoride Concentration in the Study Area

11.6.2 Management interventions

- High yielding wells with low fluoride concentrations should be identified. These high yielding wells containing low fluoride concentrations should be used to provide drinking water to communities with enriched fluoride wells.
- There should be construction of multi-village piped water supply schemes with conventional treatment, using surface water.
- Reducing the concentration of fluoride in water and the duration of continuous exposure are necessary to control population health risk of dental and skeletal fluorosis.
- In areas of high concentration of Fluiride, Public should be made aware about the adverse health effects of consumption of fluoride contaminated water.
- In endemic fluorosis areas, even if the water fluoride level is well controlled, health education and health promotion strategies are still necessary, and their importance must be highly valued.
- Drilling of exploratory wells in fluoride affected areas by individuals should be regulated and supervised by authorities.
- Regular monitoring and management strategies are essential to ensure sustainable groundwater resources, including water treatment technologies, efficient irrigation practices, watershed management, and public awareness on water conservation and quality.

Chapter 12: Management Strategies

Haphazard and high dependence on groundwater coupled with absence of augmentation measures has led to stress to Phreatic aquifer in major part of the study area and resultant in raising questions on sustainability of existing groundwater structures, food and drinking water security. Groundwater has been contributing more to agricultural wealth than surface irrigation since ages. Tube wells are now the largest source of irrigation in the country. An indiscriminate development of ground water may lead to either of the following problems i) the depletion of water level ii) water quality deterioration iii) water logging problem. Thus, management of ground water resources could be developed/augmented in a judicious way to allow aquifer to sustain yield of water at economical rate, in adequate quantity and of suitable quality is an important aspect of ground water management of an area. At present groundwater development in the area is mainly restricted to (a) Domestic, drinking and industrial water supply and (b) irrigation uses. Tube wells and dug cum bored wells are being used for raising crops like wheat, mustard etc. The gross ground water draft for the area has been estimated as 3036.85 ham where extraction for irrigation accounts 1650.71 ham (54.4 %).

12.1 Management plan

The uneven distribution of groundwater availability and its utilization indicates that a single management strategy cannot be adopted and requires integrated hydrogeological aspects along with socio-economic conditions to develop appropriate management strategy. The study suggests notable measures for sustainable groundwater management, which involves a combination of various measures given below.

12.1.1 Supply side intervention

Artificial recharge of groundwater is a highly efficient, scientifically validated, and cost-effective method not only to address the challenges but also enhances water quality and ensures the long-term sustainability of wells in affected areas. However, considering the low storage potential of hard rock aquifer in the area the ground water development plan should also be coupled with ground water augmentation plan, so that there is no stress on ground water regime of the area. Information of depth to bed rock (figure 69) has also been prepared combining hydrogeological and geophysical studies reveal that thickness increases towards northward side. This provides an insight idea for proposing artificial recharge to groundwater in the area particularly in hard rock terrain.

The supply-side management plan for the study area has been developed using fundamental hydrogeological principles. Sub-surface storage is determined by multiplying the total area by the specific yield, accounting for variable lithology, and the thickness of the unsaturated zone, which is calculated by subtracting 3 meters from the post-monsoon water level. The volume of groundwater recharge from committed harvesting and conservation structures is subtracted from the sub-surface storage to determine the available storage potential. To fully saturate the sub-surface storage, the surface water requirement is obtained by multiplying the available storage potential by a factor of 1.66. A runoff coefficient of 0.22 is used for the study area (as per GWRA, 2023) calculate the total surface water runoff, with 40% of this runoff considered non-committed and considered 60% for feasible & available for sustaining proposed artificial recharge structures. The distribution of non-committed runoff is allocated as follows: 50% to percolation tanks, 25% to gully plug/check dams and 15% to nala bunds. The remaining 10% of runoff is designated for restoring/ renovating existing village water conservation structures. A detailed of the proposed artificial recharge structures is presented in the Table 11. An artificial recharge to groundwater with proposed conservation structure are shown in figure 68.

A financial outlay plan has been developed, estimating the costs for various artificial recharge structures as follows: Rs. 15 lakhs per percolation tank, Rs. 20 lakhs per check dam/gully plug, Rs. 5 lakhs per nala bund, and Rs. 2 lakhs per renovation of village existing water conservation structures. The total estimated cost to implement the supply-side management strategy is Rs. 56.20 crores. Detailed financial allocations are presented in Table 12 for the study area.

12.1.2 Demand Side Intervention

Groundwater is a critical resource, and managing its sustainable use is vital for maintaining the balance between demand and supply. To achieve a sustainable groundwater balance, it is essential to focus on demand side interventions. One of the key concepts in this context is real water savings, which emphasizes interventions that can reduce groundwater withdrawal while optimizing water use efficiency. The main demand-side interventions that can help achieve this goal are discussed below.

To generate additional irrigation potential in the study area, additional abstraction structures such as large diameter dug wells upto the depth of 10 m may be promoted for irrigation purposes along with domestic usage. These structures can act as water storage

structures at the time of water scarcity and contribute to ground water recharge from return flow of ground water irrigation which will create additional irrigation potential in the area.

It has been observed that alluvium and weathered zone aquifer is the main water bearing horizon for utilization in the study area. Hence, efforts should be made to tap this lithology sustainably by construction of farm ponds in central part of the study area to utilize the top clayey soil as the reservoir for water resources and by accelerating recharge in the aquifers underneath by promoting construction of recharge well in these ponds wherever the depth to bedrock is thicker, as in northern part of the study area.

In the areas with shallow depth to bedrock, revival and maintainance of traditional water conservation structures such as Ahar and Pynes should be prioritized since the underlying hard rock will act as a confining layer to minimize water loss during conveyance. Agriculture should have concentrated along these ahars so that they get assured water availability for irrigation all year long. Along with this, as a conservation measure, farmers should be encouraged and educated to adopt modern irrigation techniques like drip irrigation etc as per the suitability of the area.

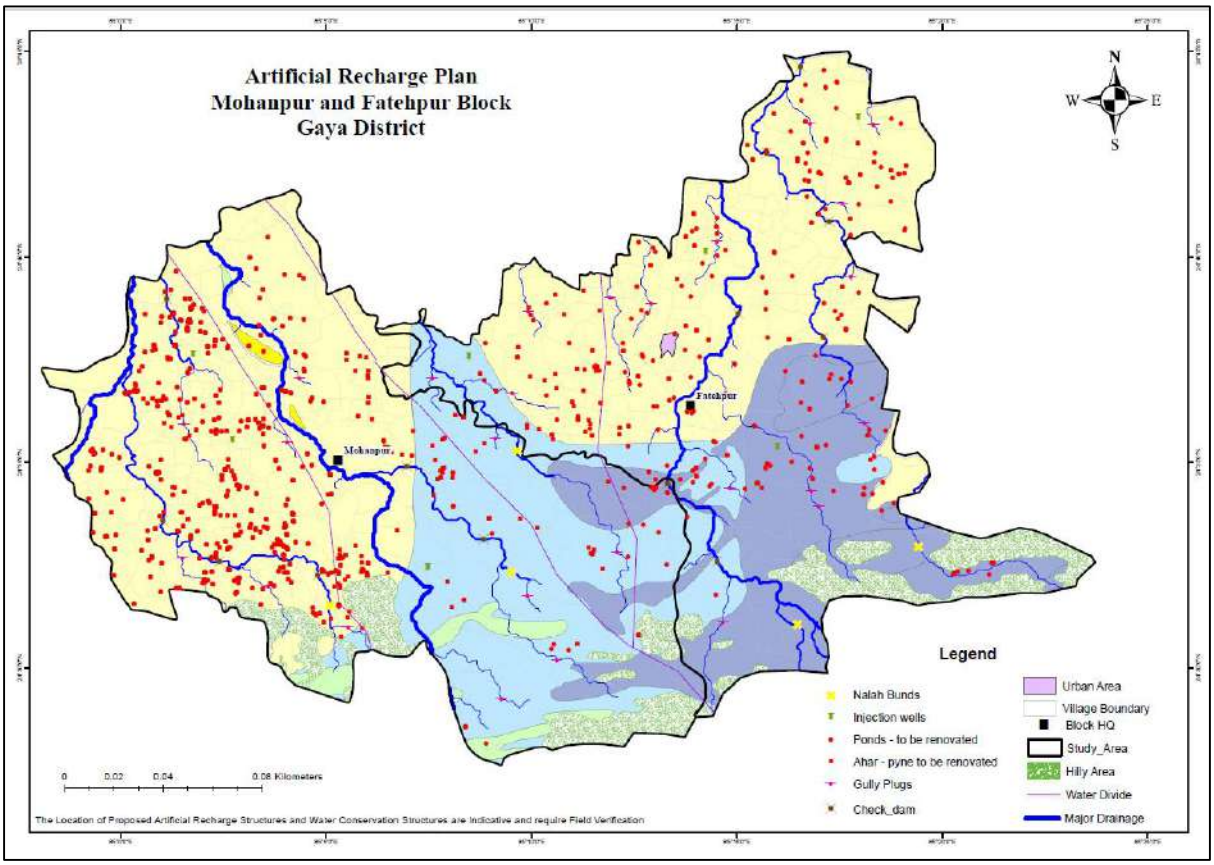


Figure 68: An artificial recharge plan to ground water in study area.

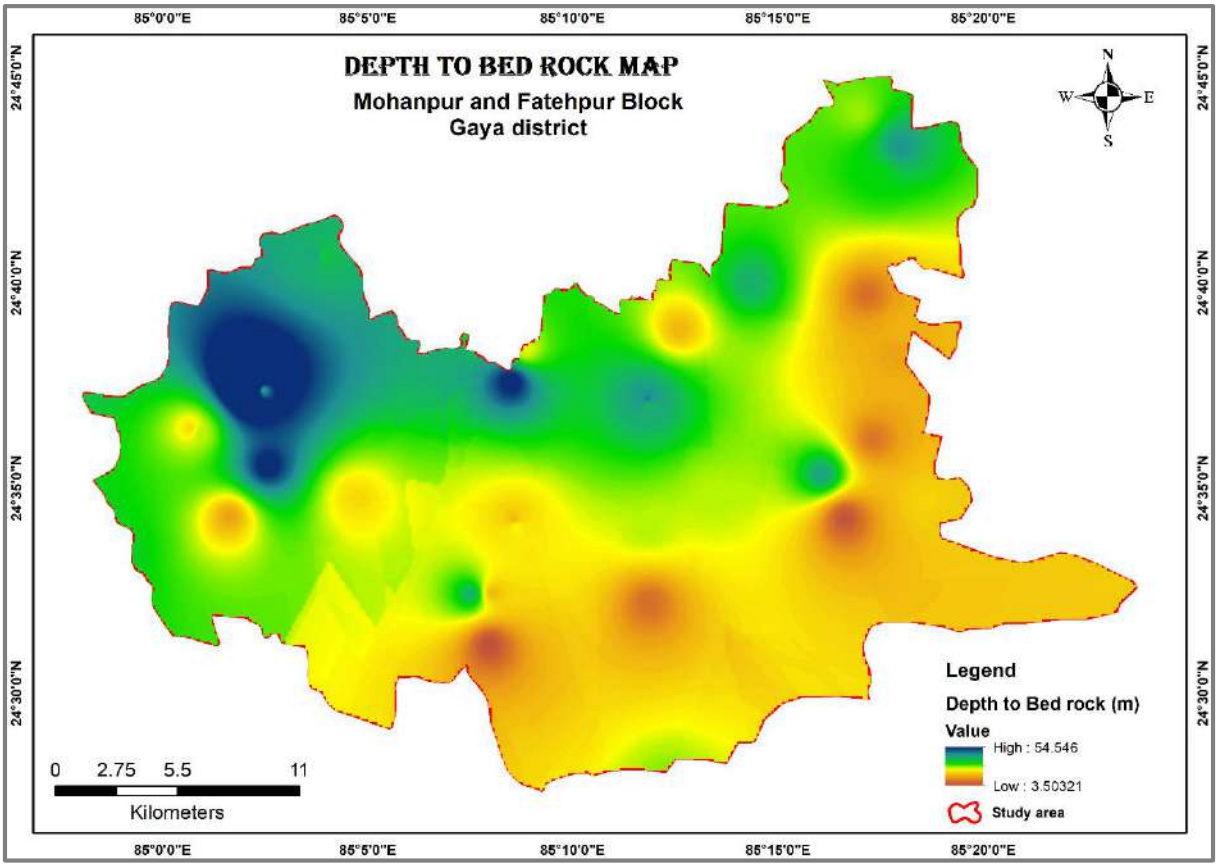


Figure 69: Depth to Bedrock Map for the Study Area

Table 11: Ground Water Management– Supply Side intervention.

District	Block	Geographical Area (Sq. Km)	Recharge worthy area (Sq. Km)	Post monsoon wl (m bgl)	Available depth for recharge (DTW-3m) unsaturated zone thickness	Sp.yield	Rainfall (m)	Volume of unsaturated zone available for recharge (MCM)	Available subsurface space for AR (MCM)	Source Water required at 60% efficiency (MCM)	Source water available i.e (Runoff) (MCM)	Total Non-committed surplus runoff available (MCM)	Feasible runoff available for recharge/ harvested
Gaya	Mohanpur	343.09	336.29	6.03	3.03	0.01	0.852	1018.96	10.19	16.91	63.05	25.22	15.13
	Fatehpur	335.94	329.14	5.68	2.68	0.01	0.954	882.10	8.82	14.64	69.09	27.64	16.58
		679.03	**665.43**					**1901.05**	**19.01**	**31.56**	**132.14**	**52.86**	**31.71**

Table 12: Ground Water Management– Supply Side intervention: Proposed structures with financial outlay.

Proposed Percolation tank			Proposed Gully plug/Check Dam			Proposed Nala bund			Renovation of existing water bodies/structure			Total Cost
Total volume of available Water for Recharge through Percolation Tank (mcm)	Number of Percolation Tank	Cost of Percolation Tank (lakhs)	Total volume of available Water for Recharge through Gully plug/Check Dam (mcm)	Number of Gully plug/Check dam	Cost of Gully plug/ chek cdam RS (lakhs)	Total volume of available Water for Recharge through NB (mcm)	Number of Nala Bund	Cost of Nala bund (lakhs)	Total volume of Avilable Water for village pond/existing structure (mcm)	Renovation of existing structure	Cost of renovation of existing water bodies/structure (lakh)	In Cr
7.57	56	840	4	74	1480	2.27	64	320	2	50	100	27
8.29	61	915	4	81	1620	2.49	71	355	2	40	80	29
15.86	**117.00**	**1755.00**	**7.93**	**155.00**	**3100.00**	**4.76**	**135.00**	**675.00**	**3**	**90**	**180.00**	**56**

12.1.3 Risk Assessment as per SoP of source sustainability:

Sustaining groundwater sources need large scale water conservation measures and recharge in the area where drinking water facility is dependent on ground water scheme. As per toolkit of NAQUIM2.0, Standard Operating Procedure on "Sustainability of Ground Water Sources" was used for risk assessment of the villages falling in study area. To assess the risk potential a step by sequential approach was adopted while using key parameter like normal rainfall, slope, well yield and its availability throughout year & quality [as per BIS 10500 water quality standards] and depth to water level of the study area (figure 70).

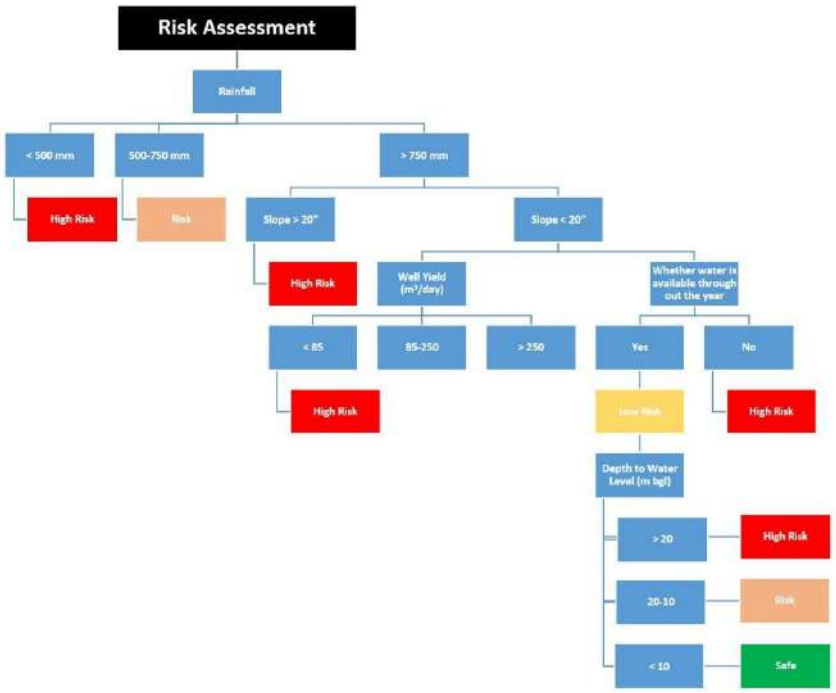


Figure 70: Risk Assessment Methodology based on SOP - "Sustainability of Ground Water Sources"

The evaluation of village risk levels involved multiple steps, beginning with an examination of precipitation patterns. Assessment categorised into three categorizing based on rainfall viz. 500 mm, between 500-750 mm, and exceeding 750 mm. Area receiving less than 500 mm of rainfall were designated as high-risk. For areas with rainfall above 500 mm, further assessment considered the region's topography. Regardless of rainfall, villages on slopes steeper than 20% were classified as high-risk, while those on gentler slopes underwent additional evaluation. Well discharge rates also factored into the risk assessment. Villages with well discharge rates below 1 litre per second (LPS) were deemed high-risk. For discharge rates of 1-3 lps or higher, the Depth to Water Level (DTWL) was examined for risk assessment. In cases where DTWL data was unavailable, villages remained in the high-risk category. When DTWL information was available, it allowed for more nuanced risk classification. Villages

with DTWL exceeding 20 m maintained their high-risk status, while those with DTWL between 10-20 m were categorized as moderate risk. Villages having DTWL of less than 10 m were considered safe.

To evaluate risk in the target region, rainfall data at the block level was utilized for villages within each block. The area under investigation receives precipitation exceeding 750 mm and is classified in the third category, with the assessment conducted accordingly.

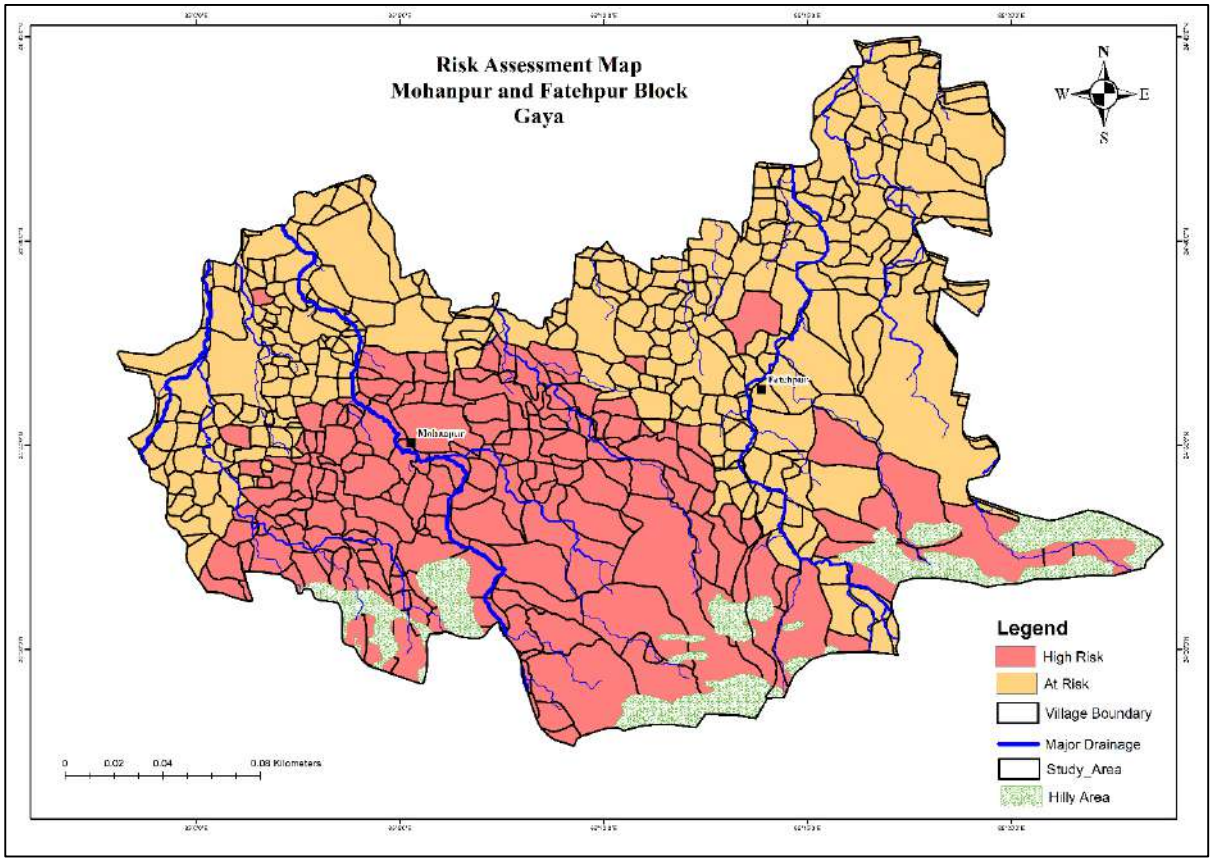


Figure 71: Risk Assessment Map of the Study Area

As shown in figure 71, an investigation into the sustainability of groundwater sources for drinking water, encompassing 483 villages in the study region, indicated that none of the villages qualified for the Safe category due to insufficient discharge (< 3 lps) in groundwater extraction structures across the area, this is associated with the limited potential of the existing weathered and fractures aquifer in the underlying granitic gneissic hard rocks. Combining all the factors such as topographic, well productivity, water level fluctuations before and after monsoons, and additional hydrogeological survey & collected information during study and the approach provided in SoP of sustainability of ground water sources shows that 295 villages were falls under Risk Category; whereas 188 villages (38.92%) were labelled as High-Risk for

maintaining a sustainable drinking water supply from groundwater. The high-risk zones are predominantly located in the southern part of the study area, near hilly regions and places with shallow bedrock.

The results indicate that efforts in water conservation and artificial recharge should focus on replenishing the marginal alluvium and underlying weathered zone to establish source sustainability in the study area. The categorization of villages in the study area based on risk assessment is tabulated as table 13.

Table 13: Categorization of villages in the study area, based on Risk Assessment

Category	Villages	Percentage (%)
High Risk	**188**	**(38.92 %)**
Risk	**295**	**(61.08 %)**
Safe	**0**	**(0 %)**

12.1.4 A plan for drinking water source sustainability.

The study of groundwater sustainability for drinking water sources is crucial for guaranteeing long-term access to clean and sufficient water, especially for rural populations. As water scarcity becomes an increasingly pressing issue, sustainable groundwater management is necessary to protect these vital resources. A sustainable approach involves assessing various factors influencing groundwater resources, including recharge rates, extraction levels, and the impact of climate change. Implementing rainwater harvesting techniques, promoting efficient irrigation practices, and engaging communities in water management can significantly contribute to sustaining groundwater supplies. In rural areas, where water infrastructure may be lacking, community involvement is pivotal. It is vital to educate residents about conservation methods, the importance of maintaining water sources, and the significant role they play in protecting these resources for future generations. Collaborating with local governance can also enhance the effectiveness of water management initiatives. Ultimately, the goal of this study is to create a framework that not only supplies drinking water in adequate quantities but also ensures that it maintains the necessary quality parameters over time. Sustainable groundwater practices will lead to improved health outcomes, increased agricultural productivity, and enhanced overall well-being for rural communities. This comprehensive approach signifies a major step toward enhancing the quality of life in rural areas by ensuring access to essential water resources. The objectives of Jal Jeevan Mission are highlighted in figure 72.

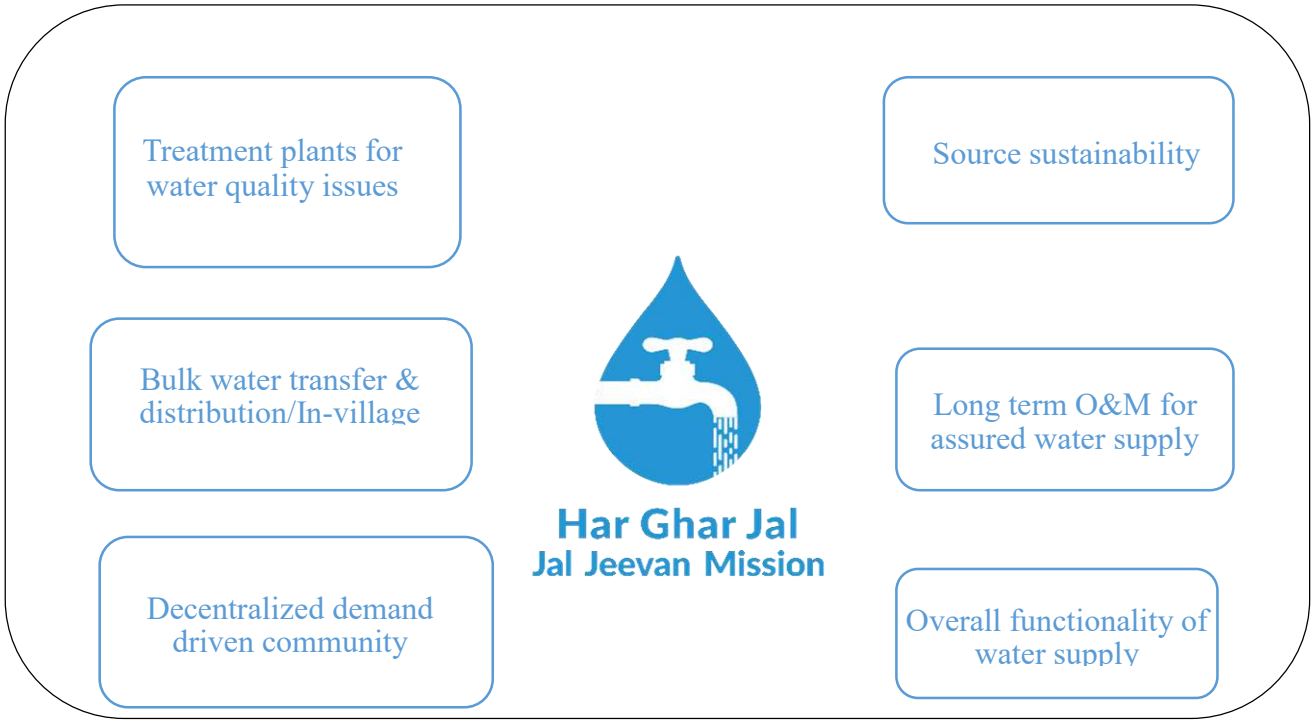


Figure 72: Objectives of Jal Jeevan Mission

Status of Tap Water Supply / "Har Ghar Nal Yojana" (HGNY) Status

The "Har Ghar Nal Yojana" (HGNY) is a key initiative launched by the Government of Bihar with the objective of providing piped drinking water to every rural household. The program is part of a broader effort to ensure that, by 2024, all rural households have access to clean and safe drinking water directly through tap connections.

The success of "Har Ghar Nal Yojana" is integral to improving the quality of life in rural Bihar by ensuring universal access to clean drinking water, fostering sustainable water use, improving public health, and encouraging community ownership and participation in water resource management. As per the figure 73 and 74, along with the data provided on **Har Ghar Nal Yojana" (HGNY),** more than 95% of the households in the study area are provided with tap water connections till date (Fatehpur: 97.85% and Mohanpur: 100 %). In view of water scarcity and low discharge potential of aquifers in the area, the regions surrounded by hilly topography, central and southern fringes of the area with shallow depth to bedrock are vulnerable to low drinking water source sustainability.

Table 14: Status of HGNY in the Study Area

Block	Total number of households (HHs)	Households with tap water connections (as on 15 Aug 2019)	Remaining households	Households provided with tap water connection since launch of the Mission	Households with tap water connections (as on date)
Mohanpur	26,615	867	25,748	25,748	26,615
Fatehpur	22,506	1,778	20,728	20,243	22,021

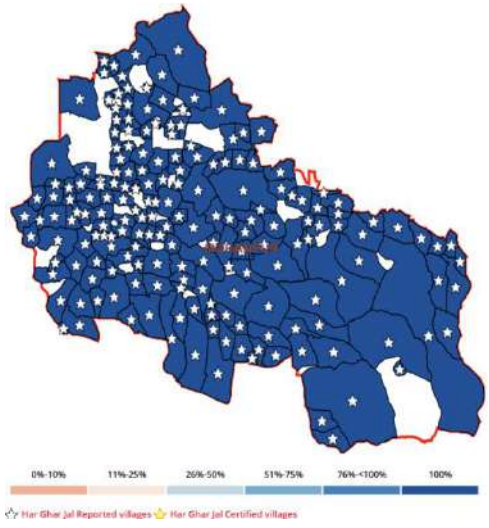


Figure 73:Har Ghar Jal reported and certified village in Mohanpur Block, Gaya district.

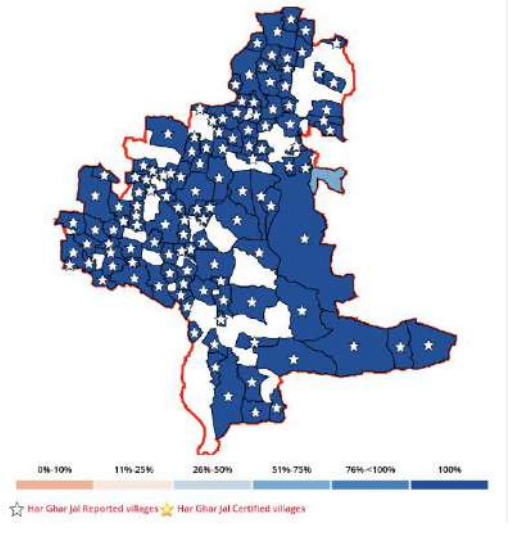


Figure 74: Har Ghar Jal reported and certified village in Fatehpur Block, Gaya district.

Chapter 13: Conclusions and Recommendations

Conclusions:

- The study is comprising of Mohanpur and Fatehpur block of Gaya district, Bihar covering an area of 680 Sq.km with mappable area of 665.43 sq. km. The area is characterized by structural plains and a seasonal river system conducive to agriculture. The area supports a rural majority of its 4, 35,761 population including 2, 21,732 males and 2, 14,029 female population across 407 villages in 37 Gram Panchayat, primarily engaged in farming.
- An intermittent tributary of Falagu River and Dadhar river originating from southern part of area; an adjoining boundary with Jharkhand State has slope south to north and drain from middle of the Mohanpur block and Fatehpur block respectively.
- The area is subtropical and receives average annual rainfall of 724 mm of which nearly more than 85% occurs during the monsoon season. However, Normal rainfall (period 1951-2000) of Gaya district is 1003.9 mm.
- The block is agriculturally dominated, with a net sown area of 16,836 hectares and a gross-cropped area of 36,869 hectares. The main crop type is Paddy forming 87.53 % of the total crop produced. The other 13% of production is from gram, wheat, and pulses.
- The geology of area is predominantly shaped by the Chotanagpur Gneissic Complex and various sedimentary formations from different geological periods. The Chotanagpur Gneissic Complex, a significant geological feature in the region, primarily comprises biotite gneiss and porphyritic granite. Due to its geological characteristics, these aquifers form limited storage capacity as they have low porosity and permeability.
- Marginal alluvium, weathered and fracture hard rock formation form the major aquifer type in the area till the explored depth of 200 m. but due to heterogeneity in distribution of fractures and joints in hard rock is highly irregular, leading to uneven groundwater availability. This makes it difficult to predict and manage water resources effectively
- Aquifer-I consist of marginal alluvium of coarse to fine grained sand mixed with clay and occasional kanker occurred upto the depth of 50 m and thickness ranges from 4.9 to 45.3 m, decreases gradually from north to south. Groundwater occurs under phreatic condition where depth to water level varies from 1.3 m bgl to 9.85 m bgl. Groundwater is generally potable having TDS value ranging from 243 to 1143 ppm.

- Aquifer-II comprises weathered and fractured formation of granitic gneiss rock type mixed with phyllite and quartzite of Archean period. The depth of aquifer encountered upto 90 m and thickness ranges from 4 to 82 m having more thickness near southern part of the area. Most of the abstraction structure are handpump. Groundwater occurs under phreatic to semi confined condition where depth to water level varies from 7 m bgl to 35 m bgl.
- As per Dynamic Ground Water Resource Assessment-2023, the stage of groundwater development of Mohanpur and Fatehpur block is 17.20% and 26.66 % respectively. The irrigation draft makes up 46.69% & 59.34% in Mohanpur and Fatehpur block respectively of the total draft. Area falls under Safe category.
- The water quality is suitable for drinking and agricultural use except in a few patches where fluoride and nitrate has been found above the permissible limit. 16.8% samples (13 locations) show fluoride concentration beyond permissible limit and varies from 1.51 mg/l to 2.05 mg/l. and 12.38% samples (14 locations) shows nitrate concentration above permissible limit of 45 mg/l and ranges from 48 to 69 mg/l.
- The broad objective of the study area was to demarcation of aquifer dispositions and its characterisation, aquifer vis-à-vis season wise depth to water level regime analysis along with its quality, delineation of recharge and discharge areas, assessment of risk of Ground Water source sustainability plan for drinking water and formulation of sustainable ground water management plan.
- In order to achieve the objectives various works have been done GP wise including Hydrogeological investigations, intensive well inventory, Geophysical survey, Exploratory wells, GW Quality survey, Farmers feedback and data collection from state agencies.
- Recharge and discharge areas has been demarcated in the study area by utilising watershed to identified the recharge area. It has been observed the study area is confined solely upper reach of watershed in southern most part from where all drainage originated. It shows that all the area drains from this region and discharge area fall in north, far away from the study area
- Exercise carried out based on the SoP of sustainability of groundwater sources for drinking water revealed that 188 villages (38.92%) fall in the High-risk category, 295 villages (61.08%) in the Risk category.

Recommendations:

- From the conclusions drawn, much scope exists for development of ground water resources to increase the irrigation potential in the district. Keeping in mind the existing scenario, recommendations are accordingly made out for development, augmentation, and management of ground water resources.
- It is envisaged that the surplus runoff of 31.71 mcm is available in the study area to be recharged/ harvested through different type of feasible artificial structure. In supply side management intervention 155 nos. of check dam/ gully plug, 117 nos. of percolation tank, 135 nos. of nala bund and along with this 10 % of the surplus runoff are designated for renovation of pre-existing water conservation structure.
- In the area where fluoride contamination reported should be covered under multi-village piped water supply schemes with conventional treatment, using surface water to control population health risk of dental and skeletal fluorosis.
- In areas of high concentration of Fluoride, Public should be made aware about the adverse health effects of consumption of fluoride contaminated water.
- Drilling of exploratory wells in fluoride affected areas by individuals should be regulated and supervised by authorities.
- Regular monitoring of water level behavior along with water quality are key management strategies which are essential to ensure sustainable groundwater resources, including water treatment technologies, efficient irrigation practices, watershed management, and public awareness on water conservation and quality.
- As a conservation measure, Educating and involving local communities in groundwater management practices can lead to better maintenance of recharge structures and more sustainable water use.
- The above interventions may enhance the drinking water supply and well sustainability in the study area.

List of annexures:

Annexure 1: Details of exploratory wells.

Location Name	Block	District	Lat	Long	Elevation (m asl)	Cumulative Discharge (in lps)	Transmissivity	Storativity	Drilled Depth (m)	Depth Of Potential Fractures Encountered (m)	Casing Depth (In mbgl)
Ramsahay Uchcha Vidyalay, Fatehpur	Fatehpur	Gaya	24.631734	85.220643	147.4	1.3	4.45 (Late) and 0.26 (Early)	NA	161.1	At 28 m and at 90 m	27
Madhya Vidhalay, Pakaria	Mohanpur	Gaya	24.5772321	85.1241242	147.9	0.3	NA	NA	202.8	60 M	15
High School (10+2), Mohanpur	Mohanpur	Gaya	24.5189	85.1316	153.2	Dry	NA	NA	202.8	NA	17
Powa Middle School , Fatehpur	Fatehpur	Gaya	24.6224288	85.27489	132.9	Dry	NA	NA	172.3	NA	14.5
Katihan	Fatehpur	Gaya	24.6224288	85.27489	152.4	Dry	NA	NA	118	NA	12
Katihan	Fatehpur	Gaya	24.6224288	85.27489	152.4	Dry	NA	NA	98.85	NA	
Amkola	Mohanpur	Gaya	24.5772321	85.1241242	163.2	Dry	NA	NA	202.8	NA	18.2
Block Campus, Mohanpur	Mohanpur	Gaya	24.57916	85.08457	161	Dry	NA	NA	175.5	NA	25.8

Annexure 2: Litholog of exploratory wells, Pakaria Middle School, Mohanpur block, Gaya district

Sample no	Depth (m)		time (min)	Lithology
	from	to		
1	0	4.6	12	Top soil, clay, brownish in colour, sticky with little to no sand
2	4.6	7.6	14	Top soil, clay, brownish in colour, sticky with little to no sand
3	7.6	10.7	13	Sand with weathered granitic gneiss (greyish white in colour) as fine cuttings with little medium sized chips. Prominent Quartz with noticable mica fragments and with little feldspar
4	10.7	13.7	15	Sand with weathered granitic gneiss (greyish white in colour) as fine cuttings with little medium sized chips. Prominent Quartz with noticable mica fragments and with little feldspar
5	13.7	16.8		Sand with weathered granitic gneiss (greyish white in colour) as fine cuttings with little medium sized chips. Prominent Quartz with noticable mica fragments and with little feldspar. Brownish colour grains witht transluscent character is also observed here.
6	16.8	19.8	8	Granitic gneiss (greyish white in colour) as medium sized chips with sub angular shape and little cutting. Prominent Quartz with feldspar. No mica observed
7	19.8	22.9	9	Granitic gneiss with mafic grains as fine powder cutting with little proportion of chips of medium size
8	22.9	25.9	7	Granitic gneiss with mafic grains as fine powder cutting with very little proportion of chips of medium size
9	25.9	29	8	Granitic gneiss with mafic grains as fine powder cutting with very little proportion of chips of medium size
10	29	32	6	Granitic gneiss with mafic grains as fine powder cutting with very little proportion of chips of medium size
11	32	35.1	9	Granitic gneiss, medium to fine cutting with subangular chips and prominent quartz
12	35.1	38.1	5	Granitic gneiss, medium to fine cutting with subangular chips and prominent quartz with increasing size and proportion of chips
13	38.1	41.2	8	Granitic gneiss, medium cuttings with subangular to sub rounded chips and prominent quartz
14	41.2	44.2	6	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains
15	44.2	47.3	8	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction
16	47.3	50.3	7	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction
17	50.3	53.4	9	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction

Sample no	Depth (m)		time (min)	Lithology
	from	to		
18	53.4	56.4	8	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction. Fine powder is less in proportion to quartz rich rock cuttings
19	56.4	59.4	9	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction. Fine powder is less in proportion to quartz rich rock cuttings
20	59.5	62.5	7	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction. Fine powder is less in proportion to quartz rich rock cuttings
21	62.5	65.6	6	Granitic gneiss, medium to fine cutting with subangular chips and subangular to sub rounded quartz grains with increasing quartz fraction. Fine powder is less in proportion to quartz rich rock cuttings
22	65.6	68.6	6	Granitic gneiss, medium to fine cutting with subrounded chips and subangular to sub rounded quartz grains with increasing quartz fraction. Fine powder is less in proportion to quartz rich rock cuttings
23	68.6	71.7	9	Mafic rock, with subrounded to subangular chips and fine black powdered sample
24	71.7	74.7	8	Mafic rock, with subrounded to subangular chips and fine black powdered sample with some quartz chips
25	74.7	77.8	9	Mafic rock, with majorly fine black powdered sample with some quartz chips
26	77.8	80.8	7	Mafic rock, with majorly fine black powdered sample
27	80.8	83.9	10	Mafic rock, with majorly fine black powdered sample
28	83.9	86.9	9	Mafic rock, with majorly fine black powdered sample
29	86.9	90	11	Mafic rock, with majorly fine black powdered sample with increased sub angular to sub rounded rock cuttings of granitic gneiss
30	90	93	8	Granitic gneiss, greyish in colour, predominance of fine powdered sample (negligible rock fragments/cuttings)
31	93	96.1	9	Granitic gneiss, greyish in colour, predominance of fine powdered sample (negligible rock fragments/cuttings)
32	96.1	99.1	8	Granitic gneiss, greyish in colour, predominance of fine powdered sample with increasing size of cuttings having more fraction of quartz grains
33	99.1	102.2	10	Granitic gneiss, greyish in colour, predominance of fine powdered sample with increasing size of cuttings having more fraction of quartz grains
34	102.2	105.2	9	Granitic gneiss, greyish in colour, predominance of fine powdered sample with increasing size of cuttings having subrounded micaceous character
35	105.2	108.3	11	Granitic gneiss, greyish in colour, predominance of fine powdered sample with finer size and brown coloured subrounded micaceous character

Sample no	Depth (m)		time (min)	Lithology
	from	to		
36	108.3	111.3	10	Granitic gneiss, greyish in colour, predominance of fine powdered sample with finer size and brown coloured subrounded micaceous character
37	111.3	114.4	12	Granitic gneiss, greyish in colour, subrounded chips to fine powdered sample with decreased micaceous character
38	114.4	117.4	11	Granitic gneiss, greyish in colour, subrounded chips to fine powdered sample
39	117.4	120.5	13	Granitic gneiss, greyish in colour, subrounded chips to sub angular rock chips sample
40	120.5	123.5	12	Granitic gneiss, greyish in colour, subrounded chips to sub angular rock chips sample with micaceous character
41	123.5	126.6	14	Granitic gneiss, greyish in colour, predominance of fine powder with sub angular rock chips sample with micaceous character
42	126.6	129.6	11	Granitic gneiss, greyish in colour, predominance of rock cuttings in proportion with fine powdered sample
43	129.6	132.7	15	Granitic gneiss, greyish in colour, predominance of rock cuttings in proportion with fine powdered sample
44	132.7	135.7	12	Granitic gneiss, greyish in colour, predominance of rock cuttings in proportion with fine powdered sample
45	135.7	138.8	14	Granitic gneiss, greyish in colour, predominance of rock cuttings in proportion with fine powdered sample with sub angular - subrounded chips with micaceous character
46	138.8	141.8	12	Granitic gneiss, greyish in colour, predominance of fine powdered samples over rock cuttings
47	141.8	144.9	15	Granitic gneiss, greyish in colour, predominance of fine powdered samples over rock cuttings
48	144.9	147.9	14	Granitic gneiss, greyish in colour, predominance of fine powdered samples over rock cuttings
49	147.9	151	16	Granitic gneiss, greyish in colour, predominance of rock cuttings over fine powdered samples
50	151	154	15	Granitic gneiss, greyish in colour, predominance of fine powdered samples over rock cuttings having black micaceous character
51	154	157.1	14	Granitic gneiss, greyish in colour, predominance of fine powdered samples over rock cuttings having black micaceous character
52	157.1	160.1	13	Granitic gneiss, greyish in colour and predominance of fine powdered samples having black micaceous character
53	160.1	163.2	16	Fine powdered samples having black micaceous character
54	163.2	166.2	12	Fine powdered samples having black micaceous character with little quartz

Sample no	Depth (m)		time (min)	Lithology
	from	to		
55	166.2	169.3	11	Granitic gneiss , rock cuttings with quartz and Fine powdered samples having black micaceous character
56	169.3	172.3	10	Granitic gneiss , rock cuttings with prominent quartz and Fine powdered samples having black micaceous character
57	172.3	175.4	13	Granitic gneiss , sub angualr rock chips and cuttings with quartz
58	175.4	178.4	11	Granitic gneiss , sub angualr rock chips and cuttings with quartz with black fine micaceous powdered sample
59	178.4	181.5	11	Granitic gneiss , sub angualr rock chips and cuttings with quartz with black fine micaceous powdered sample
60	181.5	184.5	10	Granitic gneiss and quartz rock chips along with prominent fine rock cuttings of black micaceous character
61	184.5	187.6	12	Granitic gneiss and quartz rock chips along with fine rock cuttings of black micaceous character
62	187.6	190.6	11	Granitic gneiss and quartz rock chips along with fine rock cuttings of black micaceous character
63	190.6	193.7	10	Granitic gneiss - greyish white rock cutting with sub rounded rock chips
64	193.7	196.7	9	Granitic gneiss - greyish white sub rounded rock chips with rock cuttings consisting of feldspar
65	196.7	199.8	11	Granitic gneiss - greyish white sub rounded rock chips with rock cuttings consisting of feldspar and prominent black micaceous fine powdered sample
66	199.8	202.8	10	Granitic gneiss - greyish white sub rounded rock chips with rock cuttings consisting of feldspar and prominent black micaceous fine powdered sample

Annexure 3: Litholog of exploratory wells, Ram sahay school, Fatehpur block, Gaya District

Site :	Ram sahay school Fatehpur			
Sample no	Depth (m)		time (min)	Lithology
	from	to		
1	0	4.5	18	Top soil : clay with little fine sand brownish coloured sticky clay
2	4.5	7.6	10	Top soil : clay with little fine sand brownish coloured sticky clay
3	7.6	10.6	14	Top soil : clay with little fine sand brownish coloured sticky clay ; with increasing sand fraction
4	10.6	13.7	16	Sand: fine to coarse grained, yellowish brown coloured , subrounded, quartz and feldspar with few black grain
5	13.7	16.7	11	Sand: mostly fine to coarse grained with few gravel sized grains, yellowish brown coloured , subrounded, quartz and feldspar with few black grains
6	16.7	19.8	13	Boulder/Pebble - mixed with coarse grained sand
7	19.8	22.8	11	Sandy clay/ Mixed - clay yellowish brown coloured, sticky with sand (15 -20%), sand fine to coarse grained, quartz feldspar grains with few black grains
8	22.8	25.9	12	Sandy clay/ Mixed - clay yellowish brown coloured, sticky with sand (15 -20%), sand fine to coarse grained, quartz feldspar grains with few black grains
9	25.9	28.9	3	Boulder - big boulder sized cutting , weathered
10	28.9	32	4	Granite gneiss: Weathered, fine powdered cutting with medium sized chips, subrounded to subangular. few brownish chips
11	32	35	4	Granite gneiss: fresh, fine powdered cutting with medium sized chips, subrounded to subangular. few brownish chips
12	35	38.1	5	Granite gneiss: fresh, fine powdered cutting with medium sized chips, subrounded to subangular. few brownish chips
13	38.1	41.1	5	Granite gneiss: fresh, fine powdered cutting with medium sized chips, subrounded to subangular. few brownish chips
14	41.1	44.2	4	Granite gneiss: fresh, fine powdered cutting with more proportion of medium sized chips , subrounded to subangular. few brownish chips
15	44.2	47.2	5	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips
16	47.2	50.3	5	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips
17	50.3	53.3	5	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips

Site :	Ram sahay school Fatehpur			
Sample no	Depth (m)		time (min)	Lithology
	from	to		
18	53.3	56.4	4	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips
19	56.4	59.4	5	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips
20	59.4	62.5	4	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. less proportion of brownish chips
21	62.5	65.5	5	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips , increasing fraction of feldspar and quartz
22	65.5	68.6	5	Granite gneiss: fresh, mostly fine powdered cutting with few medium sized chips, subrounded to subangular. few brownish chips , increasing fraction of feldspar and quartz
23	68.6	71.6	5	Granite gneiss: fresh, mostly medium sized chips with few rock cuttings, subrounded to subangular.
24	71.6	74.7	4	Granite gneiss: fresh, mostly medium sized chips with few rock cuttings, subrounded to subangular.
25	74.7	77.7	6	Mafic gneiss/ schist (?) ; fresh ; medium sized chips with little cuttings; subrounded chips
26	77.7	80.8	5	Mafic gneiss/ schist (?) ; weathered ; medium sized chips with little cuttings; subrounded chips
27	80.8	83.8	10	Granitic gneiss ; slightly weathered ; medium sized chips with fine cutting; subrounded to subangular
28	83.8	86.9	6	Granitic gneiss ; slightly weathered ; medium to fine sized chips with fine cutting; subrounded to subangular
29	86.9	89.9	7	Granitic gneiss ; weathered ; fine sized chips ; subrounded to subangular
30	89.9	93	5	Granitic gneiss ; weathered ; fine to very fine sized chips with cutting; subrounded to subangular
31	93	96	7	Granitic gneiss ; weathered ; fine to very fine sized chips with cutting; subrounded to subangular ; few dark fine sized chips
32	96	99.1	7	Granitic gneiss ; slightly weathered ; fine to very fine sized chips with cutting; subrounded to subangular ; few dark fine sized chips
33	99.1	102.1	7	Granitic gneiss ; slightly weathered ; fine to very fine sized chips with cutting; subrounded to subangular
34	102.1	105.2	8	Granitic gneiss ; slightly weathered ; fine to very fine sized chips with cutting; subrounded to subangular with increasing quartz fraction
35	105.2	108.2	7	Mafic gneiss/ schist (?) ; slightly weathered ; fine to very fine sized chips with little cuttings; subrounded to sub angular chips

Site :	Ram sahay school Fatehpur			
Sample no	Depth (m)		time (min)	Lithology
	from	to		
36	108.2	111.3	6	Mafic gneiss/ schist (?) ; slightly weathered ; fine to very fine sized chips with little cuttings; subrounded to sub angular chips
37	111.3	114.3	7	Mafic gneiss/ schist (?) ; slightly weathered ; fine to very fine sized chips with little cuttings; subrounded to sub angular chips
38	114.3	117.4	6	Mafic gneiss/ schist (?) ; slightly weathered ; fine to very fine sized chips with little cuttings; subrounded to sub angular chips
39	117.4	120.4	7	Granitic gneiss with prominent quartz and black grains ; slightly weathered ; medium sized chips with fine cutting; subrounded to subangular
40	120.4	123.5	7	Granitic gneiss with prominent quartz and black grains ; slightly weathered ; medium sized chips with fine cutting; subrounded to subangular
41	123.5	126.5	6	Granitic gneiss with prominent quartz and black grains ; weathered ; medium sized chips with very fine cutting; subrounded to subangular
42	126.5	129.6	6	Granitic gneiss with prominent quartz and black grains ; weathered ; medium sized chips with very fine cutting; subrounded to subangular
43	129.6	132.6	6	Granitic gneiss ; slightly weathered ; medium sized chips with fine cutting; subrounded to subangular with increasing feldspar with respect to quartz fraction
44	132.6	135.7	4	Granitic gneiss ; slightly weathered ; medium sized chips with fine cutting; subrounded to subangular with increasing feldspar with respect to quartz fraction
45	135.7	138.7	6	Granitic gneiss ; slightly weathered ; fine to medium sized chips with fine cutting; subrounded to subangular with increasing feldspar with respect to quartz fraction
46	138.7	141.8	4	Granitic gneiss ; weathered ; fine to medium sized chips with fine cutting; subrounded to subangular with increasing feldspar with respect to quartz fraction
47	141.8	144.8	6	Granitic gneiss ; weathered ; fine sized chips with fine cutting; subrounded to subangular with increasing feldspar with respect to quartz fraction
48	144.8	147.9	6	Granitic gneiss ; weathered ; fine to medium sized chips with fine cutting; subrounded to subangular with increasing feldspar with respect to quartz fraction
49	147.9	150.9	7	Granitic gneiss ; weathered ; fine to medium sized chips with fine cutting; subrounded to subangular with increased quartz with respect to feldspar fraction
50	150.9	154	6	Granitic gneiss ; weathered ; fine to medium sized chips with fine cutting; subrounded to subangular with increased quartz with respect to feldspar fraction

Site :	Ram sahay school Fatehpur			
Sample no	Depth (m)		time (min)	Lithology
	from	to		
51	154	157	7	Granitic gneiss ; weathered ; fine to medium sized chips with fine cutting; subrounded to subangular with increased quartz with respect to feldspar fraction
52	157	160.1	7	Granitic gneiss ; weathered ; fine sized chips with fine cutting; subrounded to subangular with increased quartz with respect to feldspar fraction
	160.1	161.1	3	

Annexure 4: Litholog of exploratory wells, 10+2 School, Mohanpur block, Gaya District

Depth (m)		Lithology
From	to	
0	4.6	Clay: Yellowish color, sand percentage very low
4.6	7.6	Clay: Yellowish color, sand percentage increases
7.6	10.7	Clay: Sand mixed , Whitish yellow color
10.7	13.7	Clay: Sand mixed , Whitish yellow color
13.7	16.8	Granite Gneiss:Powdered grain, Greyish white color
16.8	19.8	Granite Gneiss:Powdered grain, Greyish white color
19.8	22.9	Granite Gneiss:Powdered grain, Greyish white color
22.9	25.9	Granite Gneiss:Powdered grain, Greyish white color
25.9	29.0	Granite Gneiss:Powdered grain, Greyish black color
29.0	32.0	Granite Gneiss:Powdered grain, Greyish black color
32.0	35.1	Granite Gneiss:Powdered grain, Greyish white color
35.1	38.1	Granite Gneiss:Powdered grain, Greyish white color
38.1	41.2	Granite Gneiss:Powdered grain, Greyish white color
41.2	44.2	Granite Gneiss:Powdered grain, Greyish white color
44.2	47.3	Granite Gneiss:Powdered grain, Greyish white color
47.3	50.3	Granite Gneiss:Powdered grain, Greyish white color
50.3	53.4	Granite Gneiss:Powdered grain, Greyish white color
53.4	56.4	Granite Gneiss:Powdered grain, Greyish white color
56.4	59.5	Granite Gneiss:Powdered grain, Greyish white color
59.5	62.5	Granite Gneiss:Powdered grain, Greyish white color

Depth (m)		Lithology
From	to	
62.5	65.6	Granite Gneiss:Powdered grain, Greyish white color
65.6	68.6	Granite Gneiss:Powdered grain, Greyish white color
68.6	71.7	Granite Gneiss:Powdered grain, Greyish white color
71.7	74.7	Granite Gneiss:Powdered grain, Greyish Black color
74.7	77.8	Granite Gneiss:Powdered grain, Greyish White color
77.8	80.8	Granite Gneiss:Powdered grain, Greyish White color
80.8	83.9	Granite Gneiss:Powdered grain, Greyish White color
83.9	86.9	Granite Gneiss:Powdered grain, Greyish White color
86.9	90.0	Granite Gneiss:Powdered grain, Greyish Black color
90.0	93.0	Granite Gneiss:Powdered grain, Greyish Black color
93.0	96.1	Granite Gneiss:Powdered grain, Greyish White color
96.1	99.1	Granite Gneiss:Powdered grain, Greyish White color
99.1	102.2	Granite Gneiss:Powdered grain, Greyish White color
102.2	105.2	Granite Gneiss:Powdered grain, Greyish White color
105.2	108.3	Granite Gneiss:Powdered grain, Greyish White color
108.3	111.3	Granite Gneiss:Powdered grain, Greyish White color
111.3	114.4	Granite Gneiss:Powdered grain, Greyish White color
114.4	117.4	Granite Gneiss:Powdered grain, Greyish White color
117.4	120.5	Granite Gneiss:Powdered grain, Greyish White color
120.5	123.5	Granite Gneiss:Powdered grain, Greyish White color

Depth (m)		Lithology
From	to	
123.5	126.6	Granite Gneiss:Powdered mixed with chips, Greyish White color
126.6	129.6	Granite Gneiss:Powdered mixed with chips, Greyish White color
129.6	132.7	Granite Gneiss:Powdered mixed with chips, Greyish White color
132.7	135.7	Granite Gneiss:Powdered mixed with chips, Greyish White color
135.7	138.8	Granite Gneiss:Powdered grain, Black color
138.8	141.8	Granite Gneiss:Powdered grain, Black color
141.8	144.9	Granite Gneiss:Powdered grain, Black color
144.9	147.9	Granite Gneiss:Powdered grain, Black color
147.9	151.0	Granite Gneiss:Powdered grain, Black color
151.0	154.0	Granite Gneiss:Powdered grain, Black color
154.0	157.1	Granite Gneiss:Powdered grain, Greyish White color
157.1	160.1	Granite Gneiss:Powdered grain, Greyish White color
160.1	163.2	Granite Gneiss:Powdered grain, Greyish White color
163.2	166.2	Granite Gneiss:Powdered grain, Greyish White color
166.2	169.3	Granite Gneiss:Powdered grain, Greyish White color
169.3	172.3	Granite Gneiss:Powdered grain, Greyish White color
172.3	175.4	Granite Gneiss:Powdered grain, Greyish Black color
175.4	178.4	Granite Gneiss:Powdered grain, Greyish Black color
178.4	181.5	Granite Gneiss:Powdered grain, Greyish Black color
181.5	184.5	Granite Gneiss:Powdered grain, Greyish Black color
184.5	187.6	Granite Gneiss:Powdered mixed with chips, Reddish grey color
187.6	190.6	Granite Gneiss:Powdered mixed with chips, Reddish grey color
190.6	193.7	Granite Gneiss:Powdered mixed with chips, Reddish grey color

Depth (m)		Lithology
From	to	
193.7	196.7	Granite Gneiss:Powdered mixed with chips, Reddish grey color
196.7	199.8	Granite Gneiss:Powdered mixed with chips, Reddish grey color
199.8	202.8	Granite Gneiss:Powdered mixed with chips, Reddish grey color

Annexure 5: Litholog of exploratory wells, Middle school ,Amkola,Mohanpur block, Gaya District

Depth (m)		Lithology
From	to	
0	4.6	Clay: Yellowish grey color, sand percentage very low
4.6	7.6	Clay: Yellowish color, sand percentage increases
7.6	10.7	Granite Gneiss: Weathered Powdered grain with quartz fragment, Greyish white color
10.7	13.7	Granite Gneiss: Weathered Powdered grain with quartz fragment, Greyish white color
13.7	16.8	Granite Gneiss: Weathered Powdered grain with quartz fragment, Greyish white color
16.8	19.8	Granite Gneiss: Weathered Powdered grain with quartz fragment, Greyish white color
19.8	22.9	Granite Gneiss:Powdered grain with few chips , Greyish color
22.9	25.9	Granite Gneiss:Powdered grain with few chips , Greyish color
25.9	29.0	Granite Gneiss:Powdered grain with few chips , Greyish color
29.0	32.0	Granite Gneiss:Powdered grain with few chips , Greyish color
32.0	35.1	Granite Gneiss:Powdered grain with few chips , Greyish color
35.1	38.1	Granite Gneiss:Powdered grain with few chips , Greyish color
38.1	41.2	Granite Gneiss:Powdered grain with few chips , Greyish color
41.2	44.2	Granite Gneiss:Powdered grain with few chips , Greyish color
44.2	47.3	Granite Gneiss:Powdered grain with few chips , Greyish color
47.3	50.3	Granite Gneiss:Powdered grain with few chips , Greyish color
50.3	53.4	Granite Gneiss:Powdered grain with few chips , Greyish color
53.4	56.4	Granite Gneiss:Powdered grain with few chips , Greyish color
56.4	59.5	Granite Gneiss:Powdered grain with few chips , Greyish color
59.5	62.5	Granite Gneiss:Powdered grain with few chips , Greyish color
62.5	65.6	Granite Gneiss:Powdered grain with few chips , Greyish white color
65.6	68.6	Granite Gneiss:Powdered grain with few chips , Greyish white color
68.6	71.7	Granite Gneiss:Powdered grain with few chips , Greyish color
71.7	74.7	Granite Gneiss:Powdered grain with few chips , Greyish color
74.7	77.8	Granite Gneiss:Powdered grain with few chips , Greyish color
77.8	80.8	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color
80.8	83.9	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color
83.9	86.9	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color

Depth (m)		Lithology
From	to	
86.9	90.0	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color
90.0	93.0	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color
93.0	96.1	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color
96.1	99.1	Granite Gneiss:Powdered grain few chips with some having pinkish color, Greyish color
99.1	102.2	Granite Gneiss: Mainly chips (few are pinkish color) less powdered grain, Greyish White color
102.2	105.2	Granite Gneiss: Mainly chips (few are pinkish color) less powdered grain, Greyish White color
105.2	108.3	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
108.3	111.3	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
111.3	114.4	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
114.4	117.4	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
117.4	120.5	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
120.5	123.5	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
123.5	126.6	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
126.6	129.6	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
129.6	132.7	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
132.7	135.7	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
135.7	138.8	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
138.8	141.8	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
141.8	144.9	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
144.9	147.9	Granite Gneiss:Powdered and chips (few are pinkish color) grain, Greyish color
147.9	151.0	Granite Gneiss:Powdered grain with few chips, Greyish color

Depth (m)		Lithology
From	to	
151.0	154.0	Granite Gneiss:Powdered grain with few chips, Greyish color
154.0	157.1	Granite Gneiss:Powdered grain with few chips, Greyish color
157.1	160.1	Granite Gneiss:Powdered grain with few chips, Greyish color
160.1	163.2	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
163.2	166.2	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
166.2	169.3	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
169.3	172.3	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
172.3	175.4	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
175.4	178.4	Granite Gneiss:Chip size fragment quartrz content found, Greenish grey color
178.4	181.5	Granite Gneiss:Chip size fragment quartrz content found, Greenish grey color
181.5	184.5	Granite Gneiss:Chip size fragment quartrz content found, Greenish grey color
184.5	187.6	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
187.6	190.6	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
190.6	193.7	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
193.7	196.7	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
196.7	199.8	Granite Gneiss: Mainly chips less powdered grain, Greyish black color
199.8	202.8	Granite Gneiss: Mainly chips less powdered grain, Greyish black color

Annexure 6: Litholog of exploratory wells, Powa, Fatehpur block, Gaya District.

Site		Powa , Fatehpur, Gaya
Depth (m)		Lithology
From	to	
0	4.5	Top soil : clay with little fine sand brownish coloured sticky clay
4.5	7.6	Top soil : clay with little fine sand brownish coloured sticky clay
7.6	10.6	Top soil : clay with little fine sand brownish coloured sticky clay
10.6	13.7	Granite Gneiss: Weathered grain with micaceous fragments, Greyish color
13.7	16.7	Granite Gneiss:Powdered grain with few chips , Greyish color
16.7	19.8	Granite Gneiss:Powdered grain with few chips , Greyish color
19.8	22.8	Granite Gneiss:Powdered grain with few chips , Greyish color
22.8	25.9	Granite Gneiss:Powdered grain with few chips , Greyish color
25.9	28.9	Granite Gneiss:Powdered grain with few chips , Greyish color
28.9	32	Granite Gneiss:Powdered grain with few chips , Greyish color
32	35	Granite Gneiss:Powdered grain with few chips , Greyish color
35	38.1	Granite Gneiss:Powdered grain with few chips , Greyish color
38.1	41.1	Granite Gneiss:Powdered grain with few chips , Greyish color
41.1	44.2	Granite Gneiss:Powdered grain with few chips , Greyish color
44.2	47.2	Granite Gneiss: Mainly chips less powdered grain, Greyish color
47.2	50.3	Granite Gneiss: Mainly chips less powdered grain, Greyish color
50.3	53.3	Granite Gneiss: Mainly chips less powdered grain, Greyish color
53.3	56.4	Granite Gneiss: Mainly chips less powdered grain, Greyish color
56.4	59.4	Granite Gneiss:Powdered grain with few chips , Greyish color
59.4	62.5	Granite Gneiss:Powdered grain with few chips , Greyish color
62.5	65.5	Granite Gneiss:Powdered grain with few chips , Greyish color
65.5	68.6	Granite Gneiss:Powdered grain with few chips , Greyish color
68.6	71.6	Granite Gneiss:Powdered grain with few chips , Greyish color
71.6	74.7	Granite Gneiss:Powdered grain with few chips , Greyish color
74.7	77.7	Granite Gneiss:Powdered grain with few chips , Greyish color
77.7	80.8	Granite Gneiss:Powdered grain with few chips , Greyish color
80.8	83.8	Granite Gneiss:Powdered grain with few chips , Greyish color

Site		Powa , Fatehpur, Gaya
Depth (m)		Lithology
From	to	
83.8	86.9	Granite Gneiss:Powdered grain with few chips , Greyish color
86.9	89.9	Granite Gneiss:Powdered grain with few chips , Greyish color
89.9	93	Granite Gneiss: Mainly chips less powdered grain, Greyish color
93	96	Granite Gneiss: Mainly chips less powdered grain, Greyish color
96	99.1	Granite Gneiss: Mainly chips less powdered grain, Greyish color
99.1	102.1	Granite Gneiss: Mainly chips less powdered grain, Greyish color
102.1	105.2	Granite Gneiss: Mainly chips less powdered grain, Greyish color
105.2	108.2	Granite Gneiss: Mainly chips less powdered grain, Greyish color
108.2	111.3	Granite Gneiss: Mainly chips less powdered grain, Greyish color
111.3	114.3	Granite Gneiss: Mainly chips less powdered grain, Greyish color
114.3	117.4	Granite Gneiss:Powdered grain with few chips , Greyish black color
117.4	120.4	Granite Gneiss:Powdered grain with few chips , Greyish black color
120.4	123.5	Granite Gneiss:Powdered grain with few chips , Greyish black color
123.5	126.5	Granite Gneiss:Powdered grain with few chips , Greyish black color
126.5	129.6	Granite Gneiss:Powdered grain with few chips , Greyish black color
129.6	132.6	Granite Gneiss:Powdered grain with few chips , Greyish black color
132.6	135.7	Granite Gneiss:Powdered grain with few chips , Greyish black color
135.7	138.7	Granite Gneiss:Powdered grain with few chips , Greyish black color
138.7	141.8	Granite Gneiss:Powdered grain with few chips , Greyish black color
141.8	144.8	Granite Gneiss:Powdered grain with few chips , Greyish black color
144.8	147.9	Granite Gneiss:Powdered grain with few chips , Greyish black color
147.9	150.9	Granite Gneiss: Mainly chips less powdered grain, Greyish color
150.9	154	Granite Gneiss: Mainly chips less powdered grain, Greyish color
154	157	Granite Gneiss: Mainly chips less powdered grain, Greyish color
157	160.1	Granite Gneiss: Mainly chips less powdered grain, Greyish color
160.1	163.1	Granite Gneiss:Powdered grain with few chips , Greyish black color
163.1	166.2	Granite Gneiss:Powdered grain with few chips , Greyish black color
166.2	169.2	Granite Gneiss:Powdered grain with few chips , Greyish black color
169.2	172.3	Granite Gneiss:Powdered grain with few chips , Greyish black color

Annexure 7: Annexure-III: Details of wells given by PHED in study area.

DISTRICT	Block	Well name	Elevation (in masl)	Total Depth (in mbgl)	Latitude	Longitude
Gaya	Mohanpur	Bagula1	141	86.25	24.54577	85.05325
Gaya	Fatehpur	Bhare	200.5	128.01	24.64299	85.24333
Gaya	Mohanpur	Bongia	71	93.00	24.50648	85.11813
Gaya	Mohanpur	Chaw	181.4	89.00	24.52629	85.0921
Gaya	Mohanpur	Gowat	151.3	91.00	24.51134	85.10039
Gaya	Fatehpur	Jaipur5	134.5	128.01	24.58832	85.23847
Gaya	Mohanpur	Jalhi	195.4	90.00	24.5137	85.11902
Gaya	Mohanpur	Jamuni	197	90.00	24.5065	85.10556
Gaya	Fatehpur	Kathautiya Kewal5	148.8	154.80	24.55236	85.29819
Gaya	Mohanpur	Khajurahi	106.1	88.00	24.57634	85.08436
Gaya	Mohanpur	Kharagpura	52.8	90.00	24.52534	85.08177
Gaya	Fatehpur	Lodhwe South1	132	124.96	24.61067	85.2687
Gaya	Fatehpur	Meyari	126.7	88.69	24.71046	85.3171
Gaya	Fatehpur	Nagawa12	125.5	123.74	24.5148476	85.09101
Gaya	Mohanpur	Piprahi	163.3	92.00	24.57368	85.07842
Gaya	Mohanpur	Shantinagar	144.4	91.00	24.58394	85.07962
Gaya	Mohanpur	Siriyawan	140.5	10.97	24.579	85.08113

Annexure 8: Details of Interpreted TEM Results in study area.

Interpreted TEM Results															
S. No	Location	Coordinates		Resistivity (ohm-m)							Depth (m)				
		Longitude	Latitude	ρ1	ρ2	ρ3	ρ4	ρ5	ρ6		d1	d2	d3	d4	d5
1	Alwalpur	85.29942	24.72208	59.81	6.0073	73.885	344.77	9570.8			0.46633	2.4061	23.388	53.779	
2	Alwalpur	85.29944	24.72214	62.19	5.7951	69.956	347.11	9579.6			0.46686	2.2718	21.835	52.018	
3	Alwalpur	85.29947	24.72222	61.516	5.7842	69.572	345.72	9578.9			0.47962	2.3246	22.336	52.603	
4	Garediabigha	85.06501	24.67788	31.525	5.5289	19	505.95	16911			1.1438	4.5275	24.502	51.896	
5	Jamhaita	85.19731	24.61756	38.191	9.3586	77.635	3467.1	1587.6			0.39076	8.4539	20.585	388.06	
6	Jamhaita	85.19719	24.61758	38.208	9.4024	77.664	3467.1	1587.6			0.39102	8.4307	20.566	388.05	
7	Jamhaita	85.19711	24.61758	38.227	9.4178	77.66	3467	1587.6			0.3913	8.4275	20.567	388.05	
8	Kachanpur	85.04106	24.62306	31.881	5.8934	89.204	208.36	94278			1.4129	7.4286	23.332	53.034	
9	Kachanpur	85.04117	24.62303	31.593	5.8189	89.404	208.7	94279			1.3948	7.3207	23.189	52.845	
10	Kachanpur	85.04125	24.623	31.598	5.8402	89.422	208.7	94279			1.395	7.3054	23.173	52.83	
11	Khap	85.14283	24.57031	142.2	12.594	92.214	20705	7512.7			1.2285	3.3412	9.3448	203.85	
12	Khap	85.14272	24.57031	142.06	12.638	92.517	20703	7512.9			1.2268	3.3113	9.2781	203.79	
13	Khap	85.14267	24.57031	139.5	12.123	89.849	20714	7514.2			1.1824	3.2108	8.9797	203.53	
14	Mayapur	85.14178	24.62653	64.182	56.675	11.116	218.98	3866	9567.1		3.0003	7.2513	16.15	29.741	100.01
15	Mayapur	85.14175	24.62658	66.326	57.031	9.4843	218.5	4026	9924.5		3.267	7.3616	14.769	26.861	95.213
16	Mayapur	85.14175	24.62667	61.43	56.69	11.286	219.3	3869.5	9575.4		2.9385	7.1732	16.069	29.629	99.847
17	Mohanpur	85.08064	24.57872	44.549	14.026	162.04	493.19	808.82	140.33		2.6319	10.154	20.446	70.304	367.2
18	Mohanpur	85.08069	24.57864	28.999	19.415	130.81	192.39	554.15	143.3		2.1871	12.424	23.206	112.08	434.98
19	Mohanpur	85.08069	24.57856	55.152	33.752	121.19	212.37	623.49	142.03		4.3855	35.323	50.082	117.94	431.98
20	Pathriya	85.2225	24.58014	36.435	26.161	3.2653	219.27	2595.6	902.3		1.1307	2.78	5.6979	14.708	244.57
21	Pathriya	85.22247	24.58003	36.214	26.067	3.2918	218.88	2593.4	901.93		1.1535	2.805	5.796	14.818	244.58
22	Pathriya	85.22242	24.57994	36.422	26.146	3.233	219.2	2595.4	902.31		1.1309	2.7809	5.7247	14.737	244.6
23	Pateiya	85.01156	24.60764	190.39	36.042	10855					1.6643	9.6118			
24	Pateiya	85.01164	24.60758	190.39	36.042	10855					1.6643	9.6117			
25	Pateiya	85.01172	24.60753	190.39	36.042	10855					1.6643	9.6117			
26	Gurupa	85.28931	24.56939												
27	Gurupa	85.28939	24.56939												

Interpreted TEM Results															
S. No	Location	Coordinates		Resistivity (ohm-m)							Depth (m)				
		Longitude	Latitude	ρ1	ρ2	ρ3	ρ4	ρ5	ρ6		d1	d2	d3	d4	d5
28	Gurupa	85.28947	24.56936												
29	Kaati	85.30089	24.64456	29.902	53.397	11.246	351.31	1417.6	55.36		2.4121	4.795	9.3209	16.882	148.27
30	Kaati	85.30092	24.64464	25.116	54.751	13.319	341.93	1280.5	57.215		2.1718	5.067	10.32	18.26	168.85
31	Kaati	85.30089	24.64475	19.973	55.249	13.669	339.15	1151.3	64.111		1.9895	4.8435	10.019	17.973	205.87
32	Gavardaha	85.27067	24.59997												
33	Gavardaha	85.27058	24.6												
34	Gavardaha	85.27047	24.6												
35	Kachanpur	85.2395	24.66672	42.328	8.5265	219.87	2099.8	1.39E+05			1.3688	11.861	21.895	102.68	
36	Kachanpur	85.23947	24.66664	42.336	8.587	219.91	2099.9	1.39E+05			1.3687	11.796	21.829	102.61	
37	Kachanpur	85.23956	24.66656	42.336	8.587	219.91	2099.9	1.39E+05			1.3687	11.796	21.829	102.61	

Annexure 9: Details of Interpreted TEM Results in study area.

Interpreted VES Results																
S. No	Location	Coordinates		Resistivity (ohm-m)							Depth (m)					
		Longitude	Latitude	ρ1	ρ2	ρ3	ρ4	ρ5	ρ6	ρ7	d1	d2	d3	d4	d5	d6
1	Ganeshchack	85.03656	24.62505	26.43	11.832	45.826	70.426	93991			0.99846	11.202	33.209	54.867		
2	Bankat	85.04273	24.59243	40.213	9.729	169.54	896.67	38717			0.6551	9.6949	30.002	120.19		
3	Nawadih	85.02735	24.57172	24.674	10.897	33.188	419.46	54813			0.44174	2.3615	8.7639	138.89		
4	Bela	85.12558	24.54015	18.164	10.107	160.56	9597	76.512	52454		0.39038	6.3417	21.174	95.648	141.92	
5	Basupura	85.1329	24.51992	39.814	5.2848	30.883	1201.9	11221			0.26801	2.2215	3.4594	145.81		
6	Langurakhurd	85.13416	24.54064	333.79	49.804	8.0128	298.93	340.72	14929		0.53643	6.589	10.334	78.94	101.57	
7	Raghunathpur			16.699	7.1924	3065	9319.4	5410.4	30371		0.93111	12.417	36.573	94.895	122.87	
8	Pahadpur	85.20534	24.46177	7.2363	12.244	10594	2339.5	454.93			2.6389	16.234	79.298	127.87		
9	Hariyadaat	85.1975	24.56563	22.168	11.656	169.77	1040.6	32065			3.4173	14.714	78.304	123.18		
10	Ramchak	85.19754	24.53668	27.786	9.5208	18170	2148.8	38172			0.54209	5.9577	17.494	33.624		
11	Basua	85.27703	24.57116	15.633	8.8261	1045.9	190.54	1393	6131.6	1.32E+05	0.91623	4.0241	14.132	37.701	64.301	108.93
12	Alawalpur	85.29026	24.71097	30.946	13.731	84.659	222.79	860.42			0.31367	4.3325	19.043	55.864		
13	Gajhandi	85.28632	24.66179	47.996	10.452	115.22	2.7832	2630.6	65482		0.90296	1.5826	3.8938	6.2222	136.59	
14	Sarvada	85.28845	24.60301	27.337	13.489	1374.1	1525.8				0.47557	6.4578	118.06			
15	Salayia Taad	85.26806	24.58886	27.314	433.67	222.12	1411.8	20400			1.9657	6.8302	23.149	143.77		
16	Jamhaita	85.19693	24.61908	23.168	7.5108	20.095	254.29	9702.7	392.66		0.25274	2.2799	14.558	26.223	80.267	
17	Guriawan	85.06198	24.67752	7.0263	1.6544	330.58	3.36E+05	72749			2.6657	4.7427	22.904	42.231		
18	Diwan	84.97895	24.55373	25.519	8.875	845.98	221.41				0.74264	15.041	118.58			
19	Lakhaipur/Siyama	85.07767	24.57956	24.27	11.428	1178	430.92				1.171	12.088	41.915			
20	Bhagwanpur	85.14339	24.56804	22.72	5.3663	28.116	189.73	466.49			1.2062	8.3986	13.658	107.6		
21	Diwan (Binda)	85.01526	24.60563	23.37	10.51	80.06	3877	290.2			0.75	10.42	20.51	45.13		

Interpreted VES Results																
S. No	**Location**	**Coordinates**		**Resistivity (ohm-m)**							**Depth (m)**					
		Longitude	**Latitude**	**ρ1**	**ρ2**	**ρ3**	**ρ4**	**ρ5**	**ρ6**	**ρ7**	**d1**	**d2**	**d3**	**d4**	**d5**	**d6**
22	Ganjati	85.14761	24.63965	6.1253	3.8553	159.43	2165.4	47067			4.3589	5.4678	13.704	26.734		
23	Mayapur	85.21003	24.64766	8.0719	4.5075	12.696	197.42	5791.4	2021.6		2.8463	5.1653	11.864	20.992	195.64	
24	Jaspur	85.28288	24.73564	7.6824	23.614	46.162	1.41E+05				3.0838	7.2707	15.539			
25	Lodhwe	85.29892	24.63926	37.961	11.06	8081.7	4.46E+05				0.61813	8.7514	18.436			
26	Koriya	85.31028	24.57764	33.091	15.216	3119.2	316.81				0.5632	11.569	78.274			
27	Sidhugora	85.22091	24.5631	156.13	110.53	2692.8	968.03	4039			0.79455	8.7597	12.672	117.61		

Annexure 10: Details of Ground Water Chemistry Results, Premonsoon in study area

S No.	BLOCK	LOCATION	LAT	LON	WELL TYPE	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
1	Fatehpur	Raghopur	24.65	85.19	DW	7.7	790	514	340	94	25.5	22.6	2.3	0	335.5	63.9	27.4	3.0	0.0	0.6
2	Fatehpur	Raghopur	24.63	85.20	DTW	7.8	1094	711	440	108	41.3	40.3	15.9	0	359.9	142.0	37.4	13.2	0.0	0.4
3	Fatehpur	Rajabigha	24.65	85.23	STW	7.9	841	547	340	108	17.0	30.1	13.6	0	274.5	106.5	34.6	6.8	0.1	0.4
4	Fatehpur	Rajabigha	24.64	85.23	DTW	8.0	729	474	315	108	10.9	15.7	10.1	0	341.6	53.3	7.8	3.1	0.2	0.7
5	Fatehpur	Badaun	24.66	85.24	STW	8.0	594	386	245	84	8.5	17.9	9.1	0	207.4	71.0	20.3	7.2	0.0	0.6
6	Fatehpur	Badaun	24.68	85.24	DTW	7.9	565	367	230	80	7.3	18.1	9.2	0	219.6	67.5	5.0	1.6	0.4	0.7
7	Fatehpur	Madanbigha	24.71	85.27	DTW	8.1	807	525	335	90	26.7	22.2	18.1	0	213.5	110.1	39.5	34.1	0.2	0.6
8	Fatehpur	Bakhari	24.71	85.30	DW	7.9	489	318	210	42	25.5	12.5	3.4	0	237.9	28.4	6.6	2.7	0.0	0.9
9	Fatehpur	Bakhari	24.71	85.30	DTW	7.9	560	364	240	46	30.4	15.7	3.2	0	280.6	24.9	9.8	7.7	0.0	0.9
10	Fatehpur	Farka	24.70	85.31	DW	8.1	375	244	160	28	21.9	10.6	5.6	0	128.1	53.3	2.5	2.9	0.0	0.5
11	Fatehpur	Farka	24.70	85.31	DTW	8.1	528	343	220	32	34.0	15.4	6.2	0	268.4	21.3	4.7	11.8	0.2	0.7
12	Fatehpur	Sultanpur	24.70	85.28	DW	8.1	538	350	240	50	27.9	12.6	2.6	0	274.5	14.2	3.1	20.5	0.0	0.6
13	Fatehpur	Sultanpur	24.70	85.28	DTW	8.0	448	291	200	28	31.6	8.3	5.6	0	231.8	17.8	4.1	0.9	0.0	0.5
14	Fatehpur	Baratar	24.63	85.25	DW	8.0	409	266	180	26	27.9	10.0	3.4	0	213.5	14.2	4.0	0.6	0.0	1.1
15	Fatehpur	Baratar	24.63	85.25	DTW	7.9	372	242	170	26	25.5	6.2	0.6	0	195.2	10.7	6.1	4.4	0.2	1.2
16	Fatehpur	Lodhwe	24.64	85.29	DW	8.0	623	405	270	28	48.6	15.7	7.6	0	329.4	21.3	6.2	2.0	0.1	0.6
17	Fatehpur	Lodhwe	24.64	85.29	DTW	8.1	873	567	355	76	40.1	33.5	4.5	0	213.5	159.8	20.0	18.2	0.0	1.1
18	Fatehpur	Gajhanda	24.66	85.28	DW	8.2	543	353	225	50	24.3	18.6	5.4	0	274.5	28.4	3.2	5.1	0.0	1.1
19	Fatehpur	Gajhanda	24.66	85.28	DTW	8.0	609	396	260	58	27.9	15.3	6.4	0	292.8	39.1	6.5	0.6	0.0	1.4
20	Fatehpur	Samda	24.66	85.26	DTW	7.9	538	350	240	52	26.7	11.4	2.5	0	280.6	21.3	4.5	5.6	0.0	1.0
21	Fatehpur	Dumari Chatti	24.61	85.23	STW	8.1	1225	796	490	90	64.4	50.0	12.4	0	335.5	177.5	55.0	31.9	0.1	0.4
22	Fatehpur	Sandeshwar	24.60	85.23	DTW	8.2	581	378	250	30	42.5	16.5	2.0	0	268.4	35.5	10.5	9.3	0.2	1.4
23	Fatehpur	Mannhona	24.58	85.26	DW	8.0	534	347	215	26	36.5	22.6	3.0	0	262.3	21.3	12.1	3.5	0.0	1.5
24	Fatehpur	Mannhona	24.58	85.26	DTW	7.9	864	562	320	82	27.9	48.6	3.5	0	378.2	63.9	17.5	13.0	0.0	1.7
25	Fatehpur	Bagh Mandwa	24.58	85.28	DW	8.0	1125	731	345	76	37.7	99.7	2.4	0	451.4	120.7	7.7	10.3	0.0	1.6
26	Fatehpur	Bagh Mandwa	24.58	85.28	DTW	8.1	870	566	315	82	26.7	54.2	3.2	0	378.2	63.9	17.0	10.3	0.0	1.8
27	Fatehpur	Brindavan	24.61	85.27	DW	8.2	541	352	200	40	24.3	30.4	5.2	0	274.5	14.2	7.8	14.0	0.0	1.6

S No.	BLOCK	LOCATION	LAT	LON	WELL TYPE	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
28	Fatehpur	Brindavan	24.60	85.23	DTW	8.1	561	365	255	22	48.6	10.6	0.6	0	219.6	53.3	5.0	21.5	0.2	1.7
29	Mohanpur	Hariharpur	24.68	85.05	DTW	7.9	532	346	215	44	25.5	22.6	2.7	0	268.4	14.2	12.7	11.6	0.0	0.6
30	Fatehpur	Jamhaita	24.62	85.20	STW	8.0	590	384	235	62	19.4	25.7	1.0	0	244.0	46.2	14.1	19.4	0.0	1.0
31	Fatehpur	Jamhaita	24.62	85.20	DTW	7.9	556	361	175	44	15.8	45.3	1.1	0	225.7	39.1	15.1	26.4	0.0	1.0
32	Fatehpur	Isarwe	24.61	85.16	DW	8.0	1759	1143	620	156	55.9	102.3	30.5	0	384.3	330.2	66.1	31.9	0.0	0.9
33	Fatehpur	Isarwe	24.61	85.16	DTW	8.1	664	432	245	50	29.2	35.9	4.2	0	225.7	78.1	16.5	24.3	0.2	1.0
34	Fatehpur	Dariaura	24.60	85.14	STW	8.1	503	327	215	60	15.8	15.6	1.1	0	262.3	17.8	4.6	0.4	0.2	0.9
35	Mohanpur	Jogia	24.59	85.12	DW	7.9	1543	1003	535	116	59.5	88.7	32.4	0	408.7	255.6	63.8	11.2	0.0	0.9
36	Mohanpur	Jogia	24.59	85.12	DTW	8.0	793	515	320	76	31.6	30.6	5.7	0	237.9	95.9	45.5	25.1	0.0	0.7
37	Mohanpur	Mohanpur	24.57	85.08	STW	8.0	492	320	185	26	29.2	24.4	3.9	0	256.2	17.8	6.9	3.2	0.0	1.0
38	Mohanpur	Mohanpur	24.57	85.08	DTW	8.2	495	322	175	28	25.5	31.0	2.1	0	262.3	17.8	5.3	1.2	0.0	0.9
39	Mohanpur	Baliari	24.56	85.07	STW	8.2	461	300	205	44	23.1	10.8	0.9	0	213.5	24.9	12.4	10.3	0.2	0.6
40	Fatehpur	Bishunpura	24.59	85.13	STW	8.1	438	285	170	34	20.7	22.7	0.5	0	183.0	28.4	10.5	17.7	0.0	0.4
41	Fatehpur	Bishunpura	24.59	85.13	DTW	8.1	455	296	175	54	9.7	22.0	2.1	0	128.1	71.0	9.7	15.0	0.0	0.5
42	Fatehpur	Charokhari	24.58	85.20	DW	7.8	655	426	285	64	30.4	17.5	1.9	0	274.5	42.6	23.6	22.8	0.0	0.6
43	Fatehpur	Charokhari	24.57	85.20	DTW	7.9	827	538	280	80	19.4	54.2	9.5	0	402.6	42.6	21.3	0.4	0.0	0.9
44	Mohanpur	Harniadag	24.56	85.20	DW	8.0	1071	696	345	60	47.4	79.7	15.6	0	500.2	60.4	16.1	22.1	0.2	1.5
45	Mohanpur	Harniadag	24.56	85.20	DTW	8.0	851	553	280	64	29.2	63.9	6.5	0	402.6	49.7	15.8	3.3	0.0	1.0
46	Mohanpur	Masaundha	24.51	85.20	DW	8.1	563	366	215	36	30.4	29.5	1.0	0	237.9	49.7	12.6	0.3	0.0	1.8
47	Mohanpur	Masaundha	24.51	85.20	DTW	8.0	1051	683	330	70	37.7	78.3	18.5	0	286.7	149.1	52.8	29.0	0.0	1.7
48	Mohanpur	Ram Chak	24.54	85.20	DW	8.0	740	481	275	58	31.6	43.5	1.6	0	305.0	53.3	24.2	17.4	0.0	1.5
49	Mohanpur	Ram Chak	24.54	85.20	DTW	8.0	768	499	300	80	24.3	35.6	2.9	0	323.3	71.0	14.0	4.4	0.0	1.0
50	Fatehpur	Dharhara Khurd	24.59	85.21	STW	8.1	567	369	185	52	13.4	40.5	5.6	0	274.5	28.4	9.3	10.3	0.0	1.0
51	Fatehpur	Dharhara Khurd	24.59	85.21	DTW	8.0	575	374	200	60	12.2	33.7	9.8	0	244.0	39.1	16.1	20.3	0.1	0.9
52	Fatehpur	Fatehpur	24.63	85.21	DTW	8.0	409	266	160	40	14.6	19.6	0.5	0	201.3	21.3	7.3	3.1	0.0	0.8
53	Fatehpur	Dhangram	24.65	85.21	DW	8.3	628	408	225	80	6.1	40.0	3.0	0	225.7	67.5	22.2	9.3	0.0	0.8
54	Fatehpur	Dhangram	24.65	85.21	DTW	8.1	529	344	195	66	7.3	31.7	1.9	0	268.4	17.8	11.0	6.0	0.0	0.7
55	Fatehpur	Raghopur	24.65	85.19	DW	8.2	531	345	190	52	14.6	33.4	3.9	0	237.9	35.5	15.1	0.8	0.0	0.7

S No.	BLOCK	LOCATION	LAT	LON	WELL TYPE	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
56	Fatehpur	Raghopur	24.66	85.19	DTW	7.9	1171	761	425	80	54.7	60.5	21.7	0	427.0	120.7	39.3	30.4	0.2	1.2
57	Fatehpur	Salaiya Kala	24.63	85.13	STW	8.0	622	404	235	76	10.9	32.5	5.4	0	329.4	17.8	5.8	6.8	0.0	0.9
58	Fatehpur	Salaiya Kala	24.63	85.13	DTW	8.2	591	384	225	70	12.2	29.7	3.7	0	280.6	32.0	8.2	14.9	0.0	0.8
59	Fatehpur	Maharam Bigha	24.63	85.14	STW	8.1	1848	1201	730	186	64.4	75.4	20.7	0	402.6	333.7	85.0	31.0	0.0	0.5
60	Fatehpur	Maharam Bigha	24.63	85.14	DTW	8.2	795	517	320	76	31.6	33.4	5.2	0	353.8	53.3	11.7	17.6	0.0	0.9
61	Fatehpur	Aranga	24.63	85.11	STW	7.9	548	356	225	60	18.2	20.1	2.7	0	256.2	32.0	8.0	13.2	0.3	0.7
62	Fatehpur	Aranga	24.63	85.11	DTW	8.0	614	399	205	76	3.6	44.0	6.4	0	286.7	39.1	10.6	0.0	0.0	1.4
63	Fatehpur	Banahi	24.63	85.11	STW	8.1	544	354	220	60	17.0	22.7	3.5	0	274.5	24.9	4.6	4.6	0.0	0.9
64	Fatehpur	Gulzar Bigha	24.72	85.26	STW	8.1	909	591	345	72	40.1	48.9	5.1	0	305.0	110.1	20.2	28.2	0.0	1.1
65	Fatehpur	Gulzar Bigha	24.71	85.26	DTW	8.3	456	296	170	40	17.0	24.7	2.0	0	231.8	24.9	4.3	0.1	0.0	0.2
66	Fatehpur	Barkail	24.68	85.24	STW	7.9	874	568	355	110	19.4	35.5	2.7	0	329.4	92.3	24.6	17.0	0.2	0.3
67	Fatehpur	Barkail	24.68	85.24	DTW	8.0	612	398	235	88	3.6	30.7	1.8	0	244.0	53.3	16.3	15.2	0.0	1.1
68	Fatehpur	Dumri	24.68	85.23	STW	8.1	623	405	265	92	8.5	19.5	2.6	0	219.6	71.0	22.7	10.3	0.0	0.8
69	Fatehpur	Dumri	24.68	85.23	DTW	8.0	542	352	245	84	8.5	10.6	1.1	0	250.1	35.5	6.3	11.7	0.0	0.7
70	Fatehpur	Kisanpur	24.67	85.23	STW	8.1	553	359	230	60	19.4	22.0	1.0	0	231.8	46.2	13.1	5.1	0.0	0.9
71	Mohanpur	Kenari	24.66	85.04	STW	7.9	875	569	300	82	23.1	65.0	0.5	0	372.1	56.8	33.1	17.7	0.0	0.7
72	Mohanpur	Kenari	24.66	85.03	DTW	7.9	623	405	225	30	36.5	39.6	1.8	0	341.6	17.8	1.1	1.4	0.0	0.8
73	Mohanpur	Sewa Bigha	24.66	85.02	DTW	8.0	939	610	330	60	43.7	61.3	2.1	0	451.4	53.3	20.1	6.0	0.0	0.7
74	Mohanpur	Sewa Bigha	24.65	85.01	STW	7.9	663	431	265	30	46.2	29.5	0.7	0	262.3	56.8	22.1	18.9	0.0	0.6
75	Mohanpur	Chornima	24.63	85.04	DW	7.8	823	535	230	52	24.3	83.6	2.0	0	366.0	60.4	16.9	6.0	0.0	0.8
76	Mohanpur	Chornima	24.64	85.03	DTW	7.9	1025	666	350	82	35.2	75.0	1.7	0	384.3	106.5	20.1	28.7	0.2	0.7
77	Mohanpur	Matihani	24.63	85.05	DW	8.0	731	475	250	44	34.0	51.2	1.1	0	305.0	46.2	37.3	15.3	0.0	0.7
78	Mohanpur	Matihani	24.62	85.06	DTW	8.0	818	532	275	48	37.7	58.2	3.7	0	256.2	117.2	28.1	6.9	0.0	0.5
79	Mohanpur	Hardiaspur	24.62	84.99	STW	8.2	863	561	220	42	27.9	97.9	0.3	0	378.2	60.4	15.8	20.3	0.0	0.7
80	Mohanpur	Hardiaspur	24.62	84.98	DTW	8.2	975	634	320	70	35.2	69.4	15.0	0	372.1	92.3	42.1	3.2	0.3	0.6
81	Mohanpur	Ladu	24.61	85.00	STW	8.0	630	410	210	48	21.9	41.5	13.0	0	280.6	28.4	28.0	13.5	0.0	0.5
82	Mohanpur	Ladu	24.61	85.00	DTW	8.0	578	376	200	22	35.2	41.7	1.0	0	286.7	24.9	9.9	4.5	0.1	0.7
83	Mohanpur	Reribagh	24.60	85.03	DTW	7.9	1167	759	450	104	46.2	62.5	0.6	0	414.8	117.2	49.0	28.7	0.0	0.8

S No.	BLOCK	LOCATION	LAT	LON	WELL TYPE	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
84	Mohanpur	Reribagh	24.60	85.03	STW	7.9	844	549	360	98	27.9	29.1	0.5	0	445.3	21.3	9.5	15.1	0.0	0.8
85	Mohanpur	Etwa	24.61	85.06	DTW	8.0	876	569	315	66	36.5	55.0	0.9	0	469.7	32.0	8.1	2.1	0.0	0.7
86	Mohanpur	Etwa	24.61	85.06	STW	8.0	1017	661	355	68	45.0	68.3	1.6	0	402.6	113.6	8.9	13.6	0.2	0.6
87	Mohanpur	Dhanichak	24.59	85.07	DTW	8.1	1107	720	385	82	43.7	74.6	2.2	0	488.0	78.1	37.5	8.6	0.2	0.8
88	Mohanpur	Dhanichak	24.59	85.07	STW	8.1	849	552	345	60	47.4	37.2	1.0	0	378.2	63.9	16.6	2.6	0.0	0.7
89	Mohanpur	Baliyari	24.56	85.07	STW	8.2	631	410	270	42	40.1	18.1	1.6	0	280.6	39.1	14.5	20.6	0.0	0.7
90	Mohanpur	Baliyari	24.56	85.07	DTW	8.0	789	513	235	60	20.7	70.3	1.8	0	396.5	35.5	14.5	4.3	0.1	0.9
91	Mohanpur	Musaila	24.54	85.09	DTW	7.9	859	558	365	64	49.8	26.2	0.8	0	311.1	78.1	46.7	20.1	0.0	0.7
92	Mohanpur	Musaila	24.55	85.10	STW	7.9	713	463	215	48	23.1	63.2	2.5	0	311.1	46.2	32.0	5.6	0.0	0.6
93	Mohanpur	Pancholi Bhuntoli	24.56	85.09	DTW	8.0	652	424	200	28	31.6	55.1	2.7	0	366.0	17.8	2.6	0.6	0.0	0.8
94	Mohanpur	Pancholi Bhuntoli	24.57	85.09	STW	8.0	667	434	225	38	31.6	45.0	6.4	0	378.2	17.8	0.5	1.2	0.0	0.7
95	Mohanpur	Dhirachak	24.57	85.03	STW	8.0	745	484	315	60	40.1	21.8	5.0	0	329.4	49.7	28.1	5.6	0.0	0.3
96	Mohanpur	Dhirachak	24.57	85.03	DTW	7.9	521	339	235	34	36.5	10.6	0.3	0	268.4	17.8	6.3	12.4	0.0	0.5
97	Mohanpur	Joribigha	24.53	85.04	DW	8.1	569	370	135	40	8.5	68.9	2.1	0	256.2	39.1	9.8	5.2	0.0	0.8
98	Mohanpur	Bandigarh Bagha	24.53	85.05	DTW	7.9	840	546	270	56	31.6	65.0	4.1	0	378.2	46.2	27.7	20.1	0.0	0.9
99	Mohanpur	Bandigarh Bagha	24.53	85.06	DTW	7.9	758	493	230	40	31.6	66.8	0.2	0	329.4	49.7	36.3	1.3	0.0	0.9
100	Mohanpur	Bandigarh Bagha	24.52	85.06	DW	7.8	810	527	310	38	52.2	44.1	0.8	0	463.6	7.1	6.0	3.7	0.0	0.9
101	Mohanpur	Gopalkhera	24.51	85.08	DTW	8.1	1155	751	375	56	57.1	88.0	7.3	0	329.4	142.0	82.3	29.5	0.0	0.6
102	Mohanpur	Gopalkhera	24.51	85.08	DW	7.9	1355	881	490	114	49.8	86.9	1.9	0	274.5	234.3	89.2	31.3	0.3	0.3
103	Mohanpur	Khajurahi	24.51	85.08	DW	7.9	1194	776	410	102	37.7	78.4	11.4	0	439.2	127.8	40.4	20.0	0.2	0.9
104	Mohanpur	Khajurahi	24.51	85.08	DTW	8.0	1136	738	430	90	49.8	61.3	5.9	0	341.6	138.5	62.7	28.2	0.2	0.7
105	Mohanpur	Bilaspur	24.50	85.11	STW	8.1	891	579	275	60	30.4	74.0	4.8	0	280.6	85.2	71.0	27.1	0.2	0.8
106	Mohanpur	Bilaspur	24.50	85.11	DTW	8.2	1136	738	380	72	48.6	82.2	3.7	0	359.9	117.2	84.5	30.5	0.0	0.7
107	Mohanpur	Sindhuar	24.53	85.03	DTW	8.2	468	304	220	34	32.8	7.3	0.8	0	195.2	35.5	13.4	8.9	0.0	0.4
108	Mohanpur	Sahnu	24.55	85.04	DW	8.0	670	436	235	28	40.1	45.2	4.2	0	353.8	17.8	11.5	4.0	0.0	0.9
109	Mohanpur	Sahnu	24.55	85.04	DTW	7.9	2130	1385	720	172	70.5	150.1	12.1	0	500.2	376.3	97.2	29.9	0.0	0.9

S No.	BLOCK	LOCATION	LAT	LON	WELL TYPE	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
110	Mohanpur	Dumri	24.60	85.09	DTW	8.0	978	636	335	60	45.0	63.8	9.1	0	378.2	78.1	44.5	29.6	0.3	0.6
111	Mohanpur	Dumri	24.59	85.09	DW	8.2	747	486	255	50	31.6	51.5	4.1	0	341.6	42.6	32.1	2.4	0.0	0.5
112	Mohanpur	Manjuri	24.53	85.13	DW	8.2	903	587	300	60	36.5	69.0	3.6	0	341.6	63.9	53.8	24.7	0.0	0.8
113	Mohanpur	Manjuri	24.53	85.13	DTW	8.0	1382	898	510	116	53.5	72.4	20.3	0	475.8	142.0	66.6	31.9	0.0	0.9
114	Mohanpur	Amar Kola	24.52	85.13	dw	8.0	560	364	195	40	23.1	37.2	1.2	0	292.8	17.8	10.2	2.0	0.2	1.6
115	Mohanpur	Nawadih	24.51	85.13	dtw	8.2	785	510	300	62	35.2	39.5	3.7	0	317.2	39.1	51.1	31.3	0.0	0.9
116	Mohanpur	Masaundha	24.48	85.14	dtw	8.0	894	581	290	60	34.0	63.7	12.3	0	420.9	53.3	22.7	0.3	0.0	1.8
117	Mohanpur	Baijnathpur	24.46	85.15	dw	8.1	1125	731	425	86	51.0	50.2	20.4	0	445.3	74.6	63.5	32.6	0.0	1.4
118	Mohanpur	Matgarha	24.51	85.18	dtw	8.1	1054	685	325	60	42.5	88.5	10.3	0	396.5	71.0	69.5	31.0	0.2	0.8
119	Mohanpur	Matgarha	24.51	85.18	dcb	7.8	1068	694	355	86	34.0	73.2	12.6	0	408.7	71.0	74.1	26.7	0.0	0.9
120	Mohanpur	Karar Chunan	24.51	85.21	dw	8.0	853	554	235	24	42.5	77.5	15.3	0	366.0	60.4	35.2	2.5	0.1	1.7
121	Mohanpur	Karar Chunan	24.51	85.21	dw	8.2	953	619	300	60	36.5	80.7	3.0	0	366.0	53.3	75.4	20.1	0.0	1.8
122	Mohanpur	Jhugan	24.54	85.23	dtw	8.1	1899	1234	550	122	59.5	160.3	36.7	0	610.0	227.2	94.4	39.0	0.0	1.5
123	Mohanpur	Jhugan	24.54	85.23	dw	7.8	571	371	155	20	25.5	55.0	6.3	0	231.8	39.1	29.5	8.1	0.2	1.5
124	Mohanpur	Goli	24.55	85.24	dtw	7.9	750	488	210	42	25.5	73.7	1.8	0	347.7	39.1	24.6	9.5	0.0	1.4
125	Mohanpur	Manjhla Kala	24.55	85.26	dw	8.0	566	368	245	36	37.7	16.6	3.6	0	256.2	24.9	15.0	23.0	0.1	0.8
126	Mohanpur	Dundhi	24.53	85.27	dw	8.2	886	576	350	70	42.5	39.2	4.1	0	408.7	46.2	27.5	20.1	0.0	0.7
127	Mohanpur	Dundhi	24.531	85.2728	stw	8.2	981	638	375	76	45.0	45.6	15.2	0	366.0	74.6	53.7	30.7	0.1	0.6

Annexure 11: Details of Ground Water Chemistry Results, Postmonsoon in study area.

S No.	DISTRICT	BLOCK	LOCATION	Depth (m)	TYPE OF WELL	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
1	Gaya	Fatehpur	Bakhari	9.1	DW	7.82	639	415.35	185	28	27.945	58.21	5.66	0	329.4	21.3	20.3	0.21	0	0.57
2	Gaya	Fatehpur	Sultanpur	9.1	DW	7.79	779	506.35	225	48	25.515	73.95	4.88	0	439.2	7.1	4.65	15.31	0	0.51
3	Gaya	Fatehpur	Gulzar Bigha	45.72	DTW	7.67	651	423.15	220	34	32.805	48.36	1.73	0	335.5	28.4	6.36	1.54	0	0.34
4	Gaya	Fatehpur	Bakhari	45.72	DTW	8.13	749	486.85	205	38	26.73	74.03	5.96	0	402.6	21.3	12.43	3.39	0	0.22
5	Gaya	Fatehpur	Farka	42.672	DTW	8.19	759	493.35	180	32	24.3	89.7	2.9	0	414.8	21.3	8.6	2.2	0.15	0.58
6	Gaya	Fatehpur	Baratar	9.1	DW	7.76	597	388.05	185	30	26.73	50.23	2.87	0	262.3	21.3	47.36	4.93	0	0.71
7	Gaya	Fatehpur	Barkail	6.4	DW	7.86	891	579.15	280	58	32.805	64.84	18.01	0	420.9	53.25	24.35	1.58	0	0.09
8	Gaya	Fatehpur	Barkail	45.72	DTW	7.59	958	622.7	330	60	43.74	63.67	6.39	0	341.6	95.85	32.55	33	0	1.05
9	Gaya	Fatehpur	Dumri	45.72	DTW	7.72	881	572.65	305	62	36.45	50.32	19.22	0	366	67.45	32.22	13.88	0	0.79
10	Gaya	Fatehpur	Dumri	16.764	STW	7.87	799	519.35	305	56	40.095	35.08	12.11	0	359.9	39.05	14.03	43.25	0	0.9
11	Gaya	Fatehpur	Gulzar Bigha	18.288	STW	7.81	1667	1083.55	400	72	53.46	174.31	41.38	0	433.1	255.6	78.21	43.25	0	1.09
12	Gaya	Fatehpur	Kisanpur	15.24	STW	7.86	849	551.85	260	48	34.02	66.99	10.97	0	366	56.8	30.63	14.11	0	0.34
13	Gaya	Fatehpur	Mannhona	9.1	DW	7.99	1524	990.6	350	64	46.17	168.14	38.14	0	561.2	142	74.62	21.07	0	1.35
14	Gaya	Fatehpur	Mannhona	42.672	DTW	7.77	1708	1110.2	405	80	49.815	179.58	43.69	0	689.3	113.6	85.39	48	0	1.51
15	Gaya	Fatehpur	Singhia	18.28	STW	7.99	1343	872.95	325	60	42.525	142.57	30.25	0	640.5	63.9	29.19	30	0.11	0.5
16	Gaya	Fatehpur	Singhia	45.72	BORING	8.01	1691	1099.15	390	16	85.05	188.24	37.07	0	738.1	102.95	71.84	21.24	0.08	0.54
17	Gaya	Fatehpur	Srinagar	12,19	STW	7.7	933	606.45	230	38	32.805	104.22	6.5	0	475.8	35.5	21.89	7.59	0	0
18	Gaya	Fatehpur	Brindavan	11.3	DW	7.77	792	514.8	215	42	26.73	83.74	1.02	0	390.4	24.85	27.55	9.76	0	1.26
19	Gaya	Fatehpur	Brindavan	18.28	STW	7.86	868	564.2	290	46	42.525	62.11	4.61	0	201.3	106.5	84.06	36	0	1.62
20	Gaya	Fatehpur	Brindavan	9.1	DW	7.87	605	393.25	165	24	25.515	60.78	2.24	0	286.7	24.85	16.96	17.11	0.11	0.84
21	Gaya	Fatehpur	Bagh Mandwa	9.1	DW	7.93	1270	825.5	235	24	42.525	174.61	16.55	0	536.8	106.5	36.65	0.55	0	1.41
22	Gaya	Fatehpur	Bagh Mandwa	42.672	DTW	7.76	1403	911.95	285	52	37.665	166.84	44.07	0	433.1	142	95.02	51	0	1.65
23	Gaya	Fatehpur	Bagh Mandwa	45.72	DTW	8.02	889	577.85	145	24	20.655	131.02	10.22	0	445.3	31.95	24.19	10.24	0	1.21
24	Gaya	Fatehpur	Lodhwe	9.1	DW	7.44	1555	1010.75	465	66	72.9	121.57	40.54	0	414.8	213	75.22	69	0.22	0.36
25	Gaya	Fatehpur	Lodhwe	60.96	DTW	7.9	661	429.65	225	32	35.235	45.65	3.46	0	347.7	28.4	4.98	0.42	0	0.78

S No.	DISTRICT	BLOCK	LOCATION	Depth (m)	TYPE OF WELL	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
26	Gaya	Fatehpur	Gajhanda	11.3	DW	7.91	581	377.65	175	28	25.515	50.82	4.89	0	298.9	21.3	8.33	4.72	0	0.65
27	Gaya	Fatehpur	Gajhanda	45.72	DTW	8.1	816	530.4	235	36	35.235	75.41	8.66	0	427	31.95	9.6	0.28	0	0.7
28	Gaya	Fatehpur	Baratar	56.388	DTW	8.02	678	440.7	150	30	18.225	86.29	2.18	0	305	31.95	30.14	8.84	0.17	1.4
29	Gaya	Fatehpur	Samda	45.72	DTW	7.77	1296	842.4	375	54	58.32	98.05	43.27	0	366	138.45	113.09	41.2	0	1.06
30	Gaya	Fatehpur	Jamhaita	12.19	DW	7.8	533	346.45	125	34	9.72	60.67	6.54	0	231.8	35.5	19.1	4.75	0	1.38
31	Gaya	Fatehpur	Jamhaita	45.72	DTW	7.96	663	430.95	170	38	18.225	72.3	3.05	0	298.9	39.05	20.97	9.51	0	1.43
32	Gaya	Fatehpur	Isarwe	10.67	DW	7.8	1922	1249.3	690	152	75.33	100.64	38.63	0	506.3	284	101.85	51	0.11	0.45
33	Gaya	Fatehpur	Isarwe	45.72	DTW	7.81	767	498.55	245	34	38.88	61.6	2.59	0	402.6	28.4	8.96	4.48	0	0.82
34	Gaya	Fatehpur	Dariaura	10.67	DW	7.99	1235	802.75	410	48	70.47	87.97	10.75	0	366	145.55	68.41	48	0.15	1.28
35	Gaya	Fatehpur	Fatehpur	45.72	DTW	7.92	541	351.65	190	38	23.085	32.01	7.84	0	274.5	21.3	14.29	1.47	0	0.39
36	Gaya	Fatehpur	Raghopur	12.18	DW	7.86	975	633.75	300	38	49.815	82.24	5.7	0	402.6	71	41.67	18.62	0	0.7
37	Gaya	Fatehpur	Raghopur	42.672	DTW	7.98	1142	742.3	355	76	40.095	96.88	6.33	0	408.7	106.5	62.04	20.27	0	1.76
38	Gaya	Fatehpur	Rajabigha	4.90	DW	7.9	921	598.65	260	40	38.88	84.22	15.22	0	311.1	88.75	57.66	19.64	0.13	0.68
39	Gaya	Fatehpur	Raghopur	9.1	DW	7.63	1207	784.55	370	80	41.31	96.53	20.54	0	463.6	92.3	76.93	13.04	0.13	0.39
40	Gaya	Fatehpur	Raghopur	42.672	DTW	7.9	935	607.75	250	32	41.31	100.55	0.14	0	402.6	49.7	43.76	22.84	0.09	0.84
41	Gaya	Fatehpur	Dhangram	10.67	DW	7.7	1195	776.75	345	40	59.535	96.6	31.85	0	390.4	131.35	76.96	15.38	0	0.91
42	Gaya	Fatehpur	Bishunpura	8.8	DW	7.77	1281	832.65	460	84	60.75	69.23	25.33	0	408.7	149.1	60.27	36	0	0.97
43	Gaya	Fatehpur	Dumari Chatti	18.28	STW	7.58	1295	841.75	390	32	75.33	111.54	10.25	0	396.5	138.45	81.22	51.13	0.09	1.06
44	Gaya	Fatehpur	Sandeshwar	15.24	STW	7.61	845	549.25	225	36	32.805	85.17	7.55	0	439.2	24.85	18.05	7.38	0.14	1.67
45	Gaya	Mohanpur	Jogia	10.67	DW	7.9	835	542.75	315	30	58.32	44.38	4.96	0	341.6	56.8	48.63	2.75	0	1.13
46	Gaya	Mohanpur	Jogia	42.672	DTW	7.98	992	644.8	370	60	53.46	48.01	16.2	0	408.7	74.55	42.47	14.13	0	0.91
47	Gaya	Fatehpur	Dariaura	54.864	DTW	7.99	781	507.65	280	36	46.17	38.17	20.02	0	420.9	24.85	7.72	2.2	0	0.91
48	Gaya	Mohanpur	Amar Kola	9.4512195	DW	8.05	531	345.15	215	32	32.805	21.51	2.5	0	244	21.3	30.02	1.58	0.18	1.85
49	Gaya	Mohanpur	Baijnathpur	9.1463415	DW	7.82	801	520.65	255	44	35.235	66.14	2.36	0	414.8	21.3	15.64	11.46	0	1.25
50	Gaya	Mohanpur	Kenari	30.48	DTW	7.76	699	454.35	225	44	27.945	55.8	1.32	0	335.5	35.5	14.42	10.92	0	0.96
51	Gaya	Mohanpur	Sindhuar	33.536585	DTW	7.97	1561	1014.65	560	160	38.88	93.31	12.69	0	414.8	181.05	145.6	43.24	0	0.59
52	Gaya	Mohanpur	Nawadih	18.292683	DTW	8.29	745	484.25	255	54	29.16	46.48	11.34	0	170.8	88.75	62.23	50.32	0	1.35
53	Gaya	Mohanpur	Khajurahi	9.1463415	DW	8.17	1004	652.6	315	70	34.02	81.32	8.88	0	341.6	131.35	20.66	12.55	0.19	1.38

S No.	DISTRICT	BLOCK	LOCATION	Depth (m)	TYPE OF WELL	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
54	Gaya	Mohanpur	Joribigha	10.670732	DW	7.41	679	441.35	220	60	17.01	51.07	5.59	0	292.8	46.15	23	11.55	0	1.17
55	Gaya	Mohanpur	Gopalkhera	8.8	DW	7.96	1265	822.25	405	158	2.43	97.71	10.63	0	128.1	252.05	117	62.35	0.19	1.04
56	Gaya	Mohanpur	Gopalkhera	36.58	DTW	8.1	924	600.6	265	88	10.935	85.32	8.01	0	250.1	142	54	3.33	0	0.04
57	Gaya	Mohanpur	Bandigarh Bagha	38.1	DTW	8.34	613	398.45	225	52	23.085	36.08	4.74	12	164.7	88.75	22.5	2.01	0	0.23
58	Gaya	Mohanpur	Bandigarh Bagha	10.670732	DW	8.4	828	538.2	230	40	31.59	75.29	17.67	21	298.9	81.65	13.01	2.35	0	0.69
59	Gaya	Mohanpur	Sahnu	9.1463415	DW	8.4	667	433.55	250	42	35.235	33.02	9.74	12	280.6	21.3	40.2	8.85	0	0.86
60	Gaya	Mohanpur	Chornima	12.195122	DW	8.29	1013	658.45	250	66	20.655	109.25	16.3	0	311.1	163.3	11.95	7.2	0.1	0.21
61	Gaya	Mohanpur	Chornima	60.96	DTW	8.35	734	477.1	275	64	27.945	38.91	4.78	9	305	46.15	15.74	23.4	0	0.95
62	Gaya	Mohanpur	Khajurahi	41.15	DTW	8.29	834	542.1	245	90	4.86	74.25	9.2	0	335.5	88.75	4.85	7.94	0.15	1.43
63	Gaya	Mohanpur	Amar Kola	45.72	DTW	8.45	831	540.15	155	44	10.935	113.36	12.9	24	347.7	35.5	21.48	16.99	0.11	1.32
64	Gaya	Mohanpur	Sewa Bigha	12.19	STW	8.16	907	589.55	235	50	26.73	96.12	5.92	0	366	78.1	22.84	22.07	0	1.07
65	Gaya	Mohanpur	Lakhaipur	9.14	DW	8.07	1651	1073.15	550	120	60.75	101.2	42.5	0	311.1	287.55	107.2	64.01	0.25	1.21
66	Gaya	Mohanpur	Lakhaipur	10.66	STW	8.22	1572	1021.8	460	108	46.17	120.9	48.3	0	329.4	269.8	96.63	42	0.22	1.34
67	Gaya	Mohanpur	Baliyari	7.92	DW	8.18	841	546.65	250	72	17.01	69.82	13.02	0	268.4	131.35	10.54	5.62	0.09	0.87
68	Gaya	Mohanpur	Baliyari	36.58	DTW	8.41	562	365.3	235	68	15.795	20.2	2.9	0	244	28.4	17.66	23.28	0	0.93
69	Gaya	Mohanpur	Harniadag	60.96	DTW	8.23	592	384.8	230	56	21.87	30.24	1.45	0	189.1	56.8	37.11	22.49	0	1.12
70	Gaya	Mohanpur	Harniadag	56.38	DTW	8.4	1017	661.05	335	50	51.03	71.54	15.27	27	329.4	53.25	90.21	20.76	0.09	1.94
71	Gaya	Mohanpur	Ram Chak	45.72	DTW	8.25	692	449.8	305	58	38.88	16.41	2.88	0	305	60.35	4.02	5.61	0	1.41
72	Gaya	Fatehpur	Charokhari	30.48	DTW	8.49	887	576.55	295	76	25.515	62.04	10.31	12	286.7	102.95	34.33	7.25	0	1.41
73	Gaya	Mohanpur	Harniadag	54	DTW	8.25	873	567.45	280	40	43.74	65.39	12.17	0	305	106.5	31.72	0.11	0	1.15
74	Gaya	Mohanpur	Dhirachak	36.5853659	DTW	8.19	463	300.95	200	42	23.085	11.71	5.85	0	189.1	35.5	4.16	26.61	0	0.59
75	Gaya	Mohanpur	Hardiaspur	12.19	STW	8.47	453	294.45	160	42	13.365	27.06	5.11	6	152.5	53.25	15.51	0.14	0	0.91
76	Gaya	Mohanpur	Reribagh	36.585366	DTW	8.45	680	442	230	48	26.73	45.92	6.06	15	256.2	60.35	17.31	2.25	0	0.67
77	Gaya	Mohanpur	Ladu	18.292683	STW	8.4	551	358.15	205	46	21.87	28.99	5.24	6	195.2	56.8	23.79	1.54	0	0.45
78	Gaya	Mohanpur	Dhanichak	30.487805	DTW	8.49	902	586.3	280	50	37.665	71.27	14.71	18	268.4	102.95	42.09	10.55	0.19	1.03
79	Gaya	Mohanpur	Matihani	7.9268293	DW	8.34	918	596.7	290	74	25.515	65.02	22.64	21	274.5	106.5	35.48	11	0	1.43
80	Gaya	Mohanpur	Matihani	45.731707	DTW	8.16	1145	744.25	345	68	42.525	95.81	13.59	0	231.8	166.85	87.45	69	0	1.16

S No.	DISTRICT	BLOCK	LOCATION	Depth (m)	TYPE OF WELL	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
81	Gaya	Mohanpur	Masaundha	38.109756	DTW	8.26	931	605.15	215	42	26.73	101.78	24.51	0	366	95.85	13.82	13	0	1.98
82	Gaya	Mohanpur	Dundhi	4.8780488	DW	8.04	801	520.65	230	52	24.3	67.34	20.32	0	207.4	106.5	29.54	57	0	1.22
83	Gaya	Mohanpur	Dundhi	36.58	DTW	7.92	382	248.3	100	36	2.43	33.12	15.25	0	85.4	49.7	29.64	21.26	0	1.96
84	Gaya	Fatehpur	Goli	45.731707	DTW	8.24	1162	755.3	320	42	52.245	113.31	12.67	0	341.6	113.6	89.06	53.51	0.11	1.72
85	Gaya	Fatehpur	Manjhla Kala	7.6219512	DW	8.41	1117	726.05	355	92	30.375	81.64	20.89	12	274.5	138.45	84.22	30	0.22	1.41
86	Gaya	Fatehpur	Dharhara Khurd	9.1	DW	8.35	671	436.15	255	62	24.3	33.28	4.95	9	256.2	56.8	25.38	1.3	0.08	1.71
87	Gaya	Mohanpur	Masaundha	51.816	DTW	8.32	673	437.45	250	60	24.3	35.52	9.64	12	244	56.8	18.25	15.03	0	1.82
88	Gaya	Mohanpur	Masaundha	38.1	DTW	8.3	749	486.85	255	44	35.235	48.05	12.44	18	244	49.7	33.05	41.64	0	1.6
89	Gaya	Mohanpur	Karar Chunan	9.1463415	DW	8.32	889	577.85	245	46	31.59	81.47	15.67	0	341.6	88.75	31.08	2.2	0.15	1.81
90	Gaya	Mohanpur	Karar Chunan	45.72	DTW	8.49	968	629.2	230	40	31.59	101.39	25.17	27	305	63.9	50.53	54	0	1.95
91	Gaya	Mohanpur	Matgarha	53.35	DTW	8.23	1225	796.25	305	70	31.59	120.15	36.87	0	323.3	142	87.21	62.5	0.25	1.32
92	Gaya	Mohanpur	Sewa Bigha	48.780488	DTW	8.39	925	601.25	300	100	12.15	70.12	6.95	6	335.5	95.85	25.37	18.91	0	1.16
93	Gaya	Fatehpur	Aranga	15.24	STW	8.3	642	417.3	235	54	24.3	35.73	5.2	0	231.8	74.55	10.39	17.56	0.15	0.73
94	Gaya	Fatehpur	Etwa	18.28	STW	8.3	993	645.45	295	50	41.31	90.57	4.63	0	280.6	152.65	22.47	30	0.09	1.04
95	Gaya	Mohanpur	Pancholi Bhuntoli	36.585366	DTW	8.27	614	399.1	235	52	25.515	29.14	7.2	0	244	71	1.85	0.92	0	1.08
96	Gaya	Mohanpur	Pancholi Bhuntoli	15.24	STW	8.4	655	425.75	180	40	19.44	62.31	8.35	12	292.8	42.6	2.24	2.52	0	1.05
97	Gaya	Mohanpur	Dumri	48.780488	DTW	8.4	987	641.55	330	128	2.43	60.63	25.19	12	280.6	106.5	52.11	44.12	0.11	0.66
98	Gaya	Mohanpur	Dumri	9.14	DW	8.26	981	637.65	260	56	29.16	95.94	15.62	0	335.5	102.95	49.34	23.32	0.24	0.45
99	Gaya	Fatehpur	Salaiya Kala	42.672	DTW	8.4	631	410.15	255	70	19.44	24.71	4.15	6	237.9	63.9	11.91	7.63	0	1.15
100	Gaya	Fatehpur	Maharam Bigha	54.864	DTW	8.24	915	594.75	320	74	32.805	53.05	16.73	0	250.1	142	20.42	36	0	1.43
101	Gaya	Mohanpur	Dhanichak	13.71	STW	8.03	968	629.2	365	100	27.945	49.78	7.06	0	292.8	142	37.62	4.37	0.07	1.26
102	Gaya	Mohanpur	Jhurang	36.58	DTW	8.24	1084	704.6	310	60	38.88	93.02	22.51	0	402.6	110.05	44.36	8.85	0	2.05
103	Gaya	Mohanpur	Mohanpur	45.73	DTW	8.21	372	241.8	135	40	8.505	21.29	2.96	0	158.6	35.5	2.84	0.25	0	1.43
104	Gaya	Fatehpur	Charokhari	10.67	DW	8.31	768	499.2	260	64	24.3	55.51	2.31	12	262.3	63.9	28.75	30	0	1.06
105	Gaya	Fatehpur	Dharhara Khurd	30.48	DTW	8.27	612	397.8	200	58	13.365	46.19	4.65	0	201.3	71	12.04	28.18	0.1	1.32
106	Gaya	Mohanpur	Masaundha	51.816	DTW	8.23	1190	773.5	380	74	47.385	92.5	11.73	0	329.4	127.8	99.17	44.24	0	1.73
107	Gaya	Mohanpur	Kenari	10.060976	STW	8.18	725	471.25	225	64	15.795	55.34	12.11	0	280.6	74.55	13.08	15.03	0	1.35

S No.	DISTRICT	BLOCK	LOCATION	Depth (m)	TYPE OF WELL	pH	EC	TDS	TH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	PO_4^{3-}	F^{-}
108	Gaya	Mohanpur	Kenari	10.06	STW	8.22	739	480.35	215	70	9.72	68.56	3.43	0	268.4	71	31.27	19.07	0	1.19
109	Gaya	Fatehpur	Maharam Bigha	18.288	STW	8.48	638	414.7	150	44	9.72	72.17	8.18	9	122	102.95	36.49	23.81	0	0.98
110	Gaya	Mohanpur	Reribagh	12.19	STW	8.4	541	351.65	180	60	7.29	40.83	2.5	18	250.1	17.75	4.01	4.89	0	1.16
111	Gaya	Mohanpur	Etwa	36.585366	DTW	8.32	666	432.9	145	48	6.075	78.1	14.57	6	231.8	74.55	21.16	0.55	0.06	1.32
112	Gaya	Mohanpur	Jhurang	45.73	DTW	8.33	1511	982.15	410	70	57.105	135.87	36.72	18	335.5	223.65	95.19	41.18	0.18	1.98
113	Gaya	Mohanpur	Harniadag	54	DTW	8.39	972	631.8	300	50	42.525	73.01	19.91	21	378.2	63.9	26.73	24	0.12	1.82

Annexure 12: Double Ring Infiltrometer Test at Nimmi, Fatehpur, Gaya district.

Date of test	**25/2/2024**							
Location:	**Nimmi**							
Co-ordinates	**24.6599**				**85.2461**			
Taluka	**Fatehpur**							
District	**Gaya**							
SoilType:	**Clay rich soil (Domat Mitti)**							
Reading on the clock hr:min	**Time difference (minute)**	**Cumulative time (min.)**	Water level readings		**Infiltration (mm)**	**Infiltration Rate (mm/min)**	**Infiltration Rate (mm/Hr.)**	**Cumulative infiltration (mm)**
			Before Filling (mm)	After Filling (mm)				
16:08	1	1	100	100	0	0	0	0
16:09	1	2	98	100	2	2.00	120.0	2
16:10	1	3	97	100	3	3.00	180.0	5
16:11	1	4	98	100	2	2.00	120.0	7
16:12	1	5	99	100	1	1.00	60.0	8
16:13	1	6	99	100	1	1.00	60.0	9
16:14	1	7	100	100	0	0.00	0.0	9
16:15	1	8	99	100	1	1.00	60.0	10
16:16	1	9	100	100	0	0.00	0.0	10
16:17	1	10	99	100	1	1.00	60.0	11
16:19	2	12	99	101	2	1.00	60.0	13
16:21	2	14	99	100	1	0.50	30.0	14
16:23	2	16	99	100	1	0.50	30.0	15
16:28	5	21	99	100	1	0.20	12.0	16
16:33	5	26	100	100	0	0.00	0.0	16
16:38	5	31	100	100	0	0.00	0.0	16
16:48	10	41	98	100	2	0.20	12.0	18
16:58	10	51	99	100	1	0.10	6.0	19
17:08	10	61	99	100	1	0.10	6.0	20

17:28	20	81	99	100	1	0.05	3.0	21
17:48	20	101	99	100	1	0.05	3.0	22

Annexure 13: Double Ring Infiltrometer Test at Tilaiya, Mohanpur, Gaya district.

Date of test	**25/2/2024**							
Location:	**Tilaiya**							
Co-ordinates	**24.57867**				**85.08084**			
Taluka	**Mohanpur**							
District	**Gaya**							
SoilType:	**Sand mixed with clay(Balusahi mitti)**							
Reading on the clock hr:min	**Time difference (minute)**	**Cumulative time (min.)**	**Water level readings**		**Infiltration (mm)**	**Infiltration Rate (mm/min)**	**Infiltration Rate (mm/Hr.)**	**Cumulative infiltration (mm)**
			Before Filling (mm)	**After Filling (mm)**				
12:36	1	1	100	100	0	0	0	0
12:37	1	2	98	100	2	2.00	120.0	2
12:38	1	3	97	100	3	3.00	180.0	5
12:39	1	4	98	100	2	2.00	120.0	7
12:40	1	5	99	100	1	1.00	60.0	8
12:41	1	6	99	100	1	1.00	60.0	9
12:43	2	8	100	100	0	0.00	0.0	9
12:45	2	10	99	100	1	0.50	30.0	10

12:47	2	12	100	100	0	0.00	0.0	10
12:52	5	17	99	100	1	0.20	12.0	11
12:57	5	22	99	101	2	0.40	24.0	13
13:02	5	27	99	100	1	0.20	12.0	14
13:12	10	37	99	100	1	0.20	12.0	15
13:22	10	47	99	100	1	0.10	6.0	16
13:32	10	57	100	100	0	0.00	0.0	16
13:42	10	67	100	100	0	0.00	0.0	16
14:02	20	87	98	100	2	0.10	6.0	18
14:22	20	107	99	100	1	0.05	3.0	19

Annexure 14: Double Ring Infiltrometer Test at Mohanpur 10 +2 High School, Mohanpur, Gaya district.

DOUBLE RING INFILTROMETER TEST								
Date of test	25/2/2024							
Location:	Mohanpur 10 +2 High School							
Co-ordinates	24.5785				85.0807			
Taluka	Mohanpur							
District	Gaya							
SoilType:	Clay (Kewal mitti)							
Reading on the clock hr:min	Time difference (minute)	Cumulative time (min.)	Water level readings		Infiltration (mm)	Infiltration Rate (mm/min)	Infiltration Rate (mm/Hr.)	Cumulative infiltration (mm)
			Before Filling (mm)	After Filling (mm)				
12:30	1	1	150	150	0	0	0	0
12:31	1	2	150	150	0	0.00	0.0	0
12:32	1	3	150	150	0	0.00	0.0	0
12:34	2	5	149	150	1	0.50	30.0	1
12:36	2	7	150	150	0	0.00	0.0	1
12:38	2	9	150	150	0	0.00	0.0	1
12:43	5	14	149	150	1	0.20	12.0	2
12:48	5	19	150	150	0	0.00	0.0	2
12:53	5	24	149	150	1	0.20	12.0	3
12:58	5	29	150	150	0	0.00	0.0	3
13:03	5	34	149	150	1	0.20	12.0	4
13:13	10	44	149	150	1	0.10	6.0	5
13:23	10	54	150	150	0	0.00	0.0	5
13:33	10	64	149	150	1	0.10	6.0	6
13:43	10	74	150	150	0	0.00	0.0	6
13:53	10	84	149	150	1	0.10	6.0	7
14:13	20	104	148	150	2	0.10	6.0	9
15:13	20	124	149	150	1	0.05	3.0	10
16:13	20	144	149	150	1	0.05	3.0	11

Annexure 15: Double Ring Infiltrometer Test at Fatehpur Block Office, Gaya district.

Date of test	**25/2/2024**							
Location:	**Fatehpur Block Office**							
Co-ordinates	**24.6268**				**85.2117**			
Taluka	**Fatehpur**							
District	**Gaya**							
SoilType:	**Clay (Kewal mitti)**							
Reading on the clock hr:min	**Time difference (minute)**	**Cumulative time (min.)**	**Water level readings**		**Infiltration (mm)**	**Infiltration Rate (mm/min)**	**Infiltration Rate (mm/Hr.)**	**Cumulative infiltration (mm)**
			Before Filling (mm)	**After Filling (mm)**				
12:29	1	1	100	100	0	0	0	0
12:30	1	2	98	100	2	2.00	120.0	2
12:31	1	3	98	100	2	2.00	120.0	4
12:32	1	4	99	100	1	1.00	60.0	5
12:34	2	6	99	100	1	0.50	30.0	6
12:36	2	8	100	100	0	0.00	0.0	6
12:38	2	10	99	100	1	0.50	30.0	7
12:43	5	15	100	100	0	0.00	0.0	7
12:48	5	20	100	100	0	0.00	0.0	7
12:58	10	30	100	100	0	0.00	0.0	7
13:08	10	40	100	100	0	0.00	0.0	7
13:28	20	60	99	100	1	0.05	3.0	8
13:48	20	80	100	100	0	0.00	0.0	8
14:08	20	100	100	100	0	0.00	0.0	8

Annexure 16: Annexure 15: Double Ring Infiltrometer Test at Fatehpur, Gaya district

Date of test	**25/2/2024**							
Location:	**Fatehpur**							
Co-ordinates	**24.6328**				**85.2234**			
Taluka	**Fatehpur**							
District	**Gaya**							
SoilType:	**Sand mixed with clay(Jalod mitti)**							
Reading on the clock hr:min	**Time difference (minute)**	**Cumulative time (min.)**	**Water level readings**		**Infiltration (mm)**	**Infiltration Rate (mm/min)**	**Infiltration Rate (mm/Hr.)**	**Cumulative infiltration (mm)**
			Before Filling (mm)	**After Filling (mm)**				
14:56	1	1	109	110	1	1.00	60.0	1
14:57	1	2	110	110	0	0.00	0.0	1
14:58	1	3	109	110	1	1.00	60.0	2
14:59	1	4	110	110	0	0.00	0.0	2
15:01	2	6	112	110	-2	-1.00	-60.0	0
15:03	2	8	112	110	-2	-1.00	-60.0	-2
15:05	2	10	112	110	-2	-1.00	-60.0	-4
15:10	5	15	110	110	0	0.00	0.0	-4
15:15	5	20	108	110	2	0.40	24.0	-2
15:20	5	25	109	110	1	0.20	12.0	-1
15:25	5	30	110	110	0	0.00	0.0	-1
15:35	10	40	110	110	0	0.00	0.0	-1
15:45	10	50	110	110	0	0.00	0.0	-1
16:05	20	70	109	110	1	0.05	3.0	0
16:25	20	90	109	110	1	0.05	3.0	1
16:45	20	110	110	110	0	0.00	0.0	1

Annexure 17: Season wise Depth to Water level in study area.

SN	District	Block	Location	Type of well	Lat	Long	RL	Depth to Water Level (m bgl)	
								Pre Monsoon	Post Monsoon
1	Gaya	Mohanpur	Chornima	DW	24.63282	85.03635	132.7	8.05	6.05
2	Gaya	Mohanpur	Mohanpur	DW	24.63271	85.05061	134.2	7	5.94
3	Gaya	Mohanpur	Hardiaspur	DW	24.61949	84.97435	140.4	9.85	9.15
4	Gaya	Mohanpur	Baliyari	DW	24.56007	85.07418	153.5	5.55	4.3
5	Gaya	Mohanpur	Joribigha	DW	24.52765	85.0421	155.5	6.5	4.03
6	Gaya	Mohanpur	Bandigarh Bagha	DW	24.52086	85.06221	163	6.75	5.6
7	Gaya	Mohanpur	Gopalkhera	DW	24.51401	85.07877	167.4	7.95	6.82
8	Gaya	Mohanpur	Khajurahi	DW	24.50709	85.08209	166.8	6.7	7.4
9	Gaya	Mohanpur	Sahnu	DW	24.5512	85.03728	147.3	6.38	4.73
10	Gaya	Mohanpur	Dumri	DW	24.59391	85.08774	141	5.2	4.1
11	Gaya	Mohanpur	Mar Kola	DW	24.51678	85.13329	160.9	4.95	4.61
12	Gaya	Mohanpur	Baijnathpur	DW	24.46262	85.14663	175.8	6.6	3.72
13	Gaya	Mohanpur	Karar Chunan	DW	24.51494	85.20837	192.9	6.7	6.4
14	Gaya	Fatehpur	Manjhla Kala	DW	24.54806	85.25667	187	4.9	7.01
15	Gaya	Mohanpur	Dundhi	DW	24.53388	85.26955	182.9	3.8	4.38
16	Gaya	Fatehpur	Raghopur	DW	24.6485	85.1892	143.4	6.5	3.4
17	Gaya	Fatehpur	Bakhari	DW	24.7098	85.2983	130.3	7.62	7
18	Gaya	Fatehpur	Farka	DW	24.6995	85.31	136.2	4.48	4.45

SN	District	Block	Location	Type of well	Lat	Long	RL	Depth to Water Level (m bgl)	
								Pre Monsoon	Post Monsoon
19	Gaya	Fatehpur	Sultanpur	DW	24.6966	85.2804	128.6	6.43	4.5
20	Gaya	Fatehpur	Baratar	DW	24.6309	85.2525	142	5.3	4.5
21	Gaya	Fatehpur	Lodhwe	DW	24.6359	85.2945	155.1	7.5	3.8
22	Gaya	Fatehpur	Gajhanda	DW	24.6556	85.2814	136.8	3.6	2
23	Gaya	Fatehpur	Samda	DW	24.66	85.2642	145.6	8.48	5.2
24	Gaya	Fatehpur	Mannhona	DW	24.5818	85.2578	171.5	6.82	5.8
25	Gaya	Fatehpur	Bagh Mandwa	DW	24.5841	85.2775	173.3	5.12	3.2
26	Gaya	Fatehpur	Brindavan	DW	24.6102	85.2716	167.2	9.28	5
27	Gaya	Fatehpur	Jamhaita	DW	24.623	85.198	148.8	3.7	2.53
28	Gaya	Fatehpur	Isarwe	DW	24.6096	85.1586	152.2	9.1	3.94
29	Gaya	Mohanpur	Jogia	DW	24.5857	85.1184	150.6	8.35	5.12
30	Gaya	Fatehpur	Charokhari	DW	24.5763	85.1983	163.2	9.8	8.7
31	Gaya	Fatehpur	Harniadag	DW	24.5573	85.1983	167.6	7.1	5.45
32	Gaya	Fatehpur	Masaundha	DW	24.5136	85.2003	188.7	8.1	5.3
33	Gaya	Fatehpur	Dharhara Khurd	DW	24.5913	85.2114	158.1	5.6	4.1
34	Gaya	Fatehpur	Dhangram	DW	24.6545	85.2133	141.5	7	3.4
35	Gaya	Fatehpur	Raghopur	DW	24.6547	85.1874	140.7	7.1	3.7
36	Gaya	Fatehpur	Rajabigha	DW	24.6467	85.2341	144.1		4.7
37	Gaya	Fatehpur	Sandheswar	DW	24.5976	85.2362	161.7		8.7

SN	District	Block	Location	Type of well	Lat	Long	RL	Depth to Water Level (m bgl)	
								Pre Monsoon	Post Monsoon
38	Gaya	Fatehpur	Masmasi-Dariaura	DW	24.601	85.1367	148.6		4.3
39	Gaya	Fatehpur	Fatehpur	DW	24.627	85.2118	152.5		7.4
40	Gaya	Fatehpur	Barkail	DW	24.6791	85.2436	131.9		3.7
41	Gaya	Mohanpur	Kenari	STW	24.65879	85.03588	127.6	9.8	9.15
42	Gaya	Mohanpur	Sewa Bigha	STW	24.65129	85.01401	134	6	4.575
43	Gaya	Mohanpur	Reribagh	STW	24.60016	85.02949	134.8	10	9.15
44	Gaya	Mohanpur	Musaila	STW	24.54716	85.0998	152.2	6	6.1
45	Gaya	Fatehpur	Rajabigha	STW	24.6467	85.2341	144.1	10.668	9.15
46	Gaya	Fatehpur	Badaun	STW	24.6561	85.2355	139.4	4.572	3.66
47	Gaya	Fatehpur	Dumari Chatti	STW	24.6114	85.225	159	10.668	7.625
48	Gaya	Fatehpur	Jamhaita	STW	24.623	85.198	148.8	9.144	7.625
49	Gaya	Mohanpur	Baliari	STW	24.5635	85.0709	152.8	7.62	6.1
50	Gaya	Fatehpur	Bishunpura	STW	24.5946	85.1266	147.6	6.096	4.575
51	Gaya	Fatehpur	Salaiya Kala	STW	24.6268	85.1268	135.8	12.192	9.15
52	Gaya	Fatehpur	Maharam Bigha	STW	24.6302	85.1418	144.8	10.668	9.15
53	Gaya	Fatehpur	Aranga	STW	24.6313	85.1126	139	10.668	7.625
54	Gaya	Mohanpur	Banahi	STW	24.6252	85.1071	144.4	13.716	9.15
55	Gaya	Fatehpur	Gulzar Bigha	STW	24.7169	85.2588	120.7	7.62	6.1
56	Gaya	Fatehpur	Barkail	STW	24.6791	85.2436	131.9	12.192	9.15

SN	District	Block	Location	Type of well	Lat	Long	RL	Depth to Water Level (m bgl)	
								Pre Monsoon	Post Monsoon
57	Gaya	Mohanpur	Dumri	STW	24.6786	85.225	132	9.144	6.1
58	Gaya	Fatehpur	Kisanpur	STW	24.6678	85.2304	137.6	10.668	9.15

Annexure 18: Annexure 15: Pumping Test in private well at Nimmi Village, Gaya district

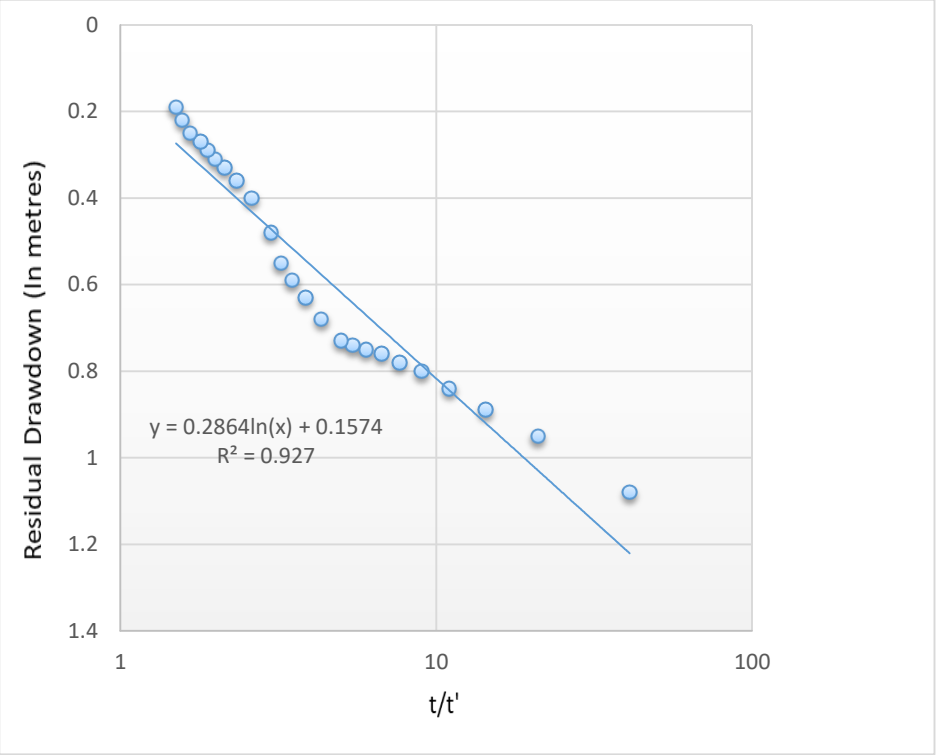
Date	**25/02/2024**
Site	**Nimmi Village**
Measuring Point	**0.2 magl**
Static Water Level	**2.90 mbmp**
Depth of the Borewell	**12.19 m**
Slot of the Borewell	**3.048 m to 12.19 m**
Motor Power	**2 HP**
Lat	**24.69807**
Long	**85.25817**

Time since pumping started, t (min)	Time since pumping stopped, t' (min)	t/t'	Depth to water level (mbmp)	Draw Down/Residual Draw Down (m)
1			3.48	0.58
2			3.59	0.69
3			3.68	0.78
4			3.75	0.85
5			3.8	0.9
6			3.86	0.96
7			3.89	0.99
8			3.94	1.04
9			3.99	1.09
10			4.05	1.15
12			4.13	1.23
14			4.19	1.29
16			4.21	1.31
18			4.26	1.36
20			4.29	1.39
25			4.36	1.46
30			4.42	1.52
35			4.46	1.56
40			4.5	1.6
41	1	41	3.98	1.08
42	2	21	3.85	0.95
43	3	14.33	3.79	0.89
44	4	11	3.74	0.84
45	5	9.00	3.7	0.8
46	6	7.67	3.68	0.78
47	7	6.71	3.66	0.76
48	8	6.00	3.65	0.75
49	9	5.44	3.64	0.74
50	10	5.00	3.63	0.73
52	12	4.33	3.58	0.68
54	14	3.86	3.53	0.63
56	16	3.50	3.49	0.59

Time since pumping started, t (min)	Time since pumping stopped, t' (min)	t/t'	Depth to water level (mbmp)	Draw Down/Residual Draw Down (m)
58	18	3.22	3.45	0.55
60	20	3.00	3.38	0.48
65	25	2.60	3.3	0.4
70	30	2.33	3.26	0.36
75	35	2.14	3.23	0.33
80	40	2.00	3.21	0.31
85	45	1.89	3.19	0.29
90	50	1.80	3.17	0.27
100	60	1.67	3.15	0.25
110	70	1.57	3.12	0.22
120	80	1.50	3.09	0.19

AQUIFER PERFORMANCE TEST
NIMMI, FATEHPUR, GAYA, BIHAR

RESIDUAL DRAWDOWN Vs t/t' PLOT
(Theis's Recovery Method)



Q (m^3/Day)	T (m2/Day)
604.8	167.91

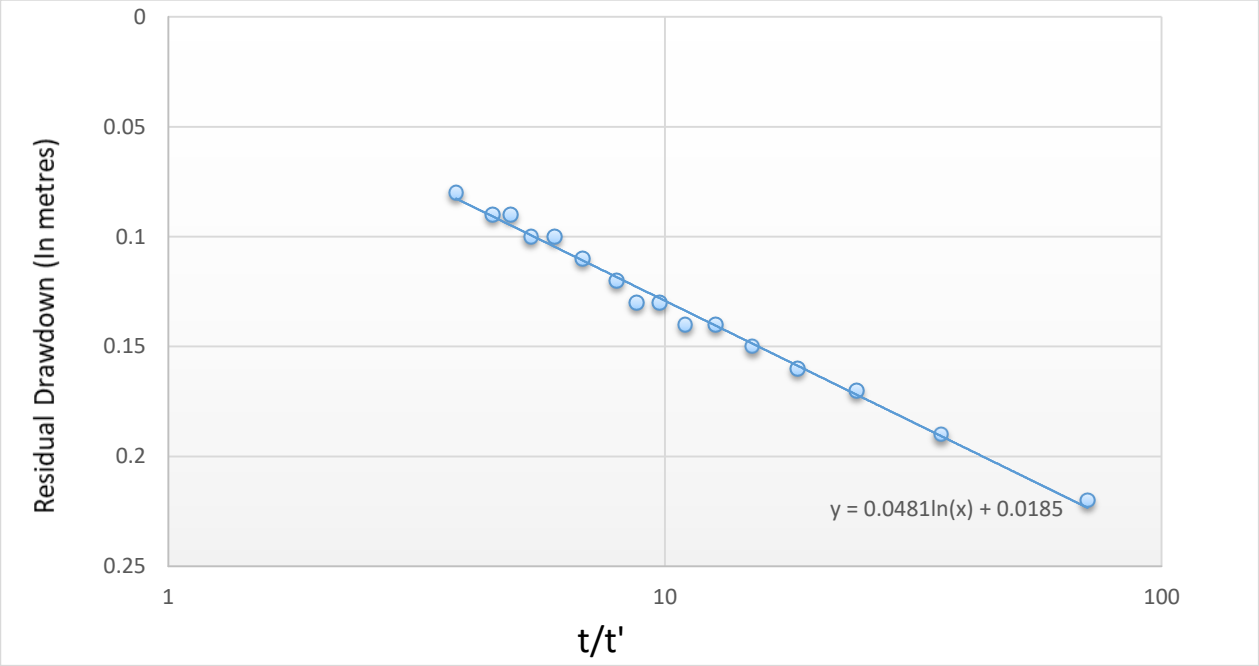
Annexure 19: Pumping Test in private well at Fatehpur Village, Gaya district.

Date				**27/02/2024**
Site				**Fatehpur Village**
Measuring Point				**Ground level**
Static Water Level				**3.94 mbmp**
Depth of the Borewell				**12.19 m**
Slot of the Borewell				**5.18 m to 12.19 m**
Motor Power				**3 HP**
Lat				**24.6426**
Long				**85.231**
Discharge				**7.1lps**
Time since pumping started, t (min)	**Time since pumping stopped, t' (min)**	**t/t'**	**Depth to water level (mbmp)**	**Draw Down/Residual Draw Down (m)**
1			5.34	1.4
2			5.39	1.45
3			5.4	1.46
4			5.42	1.48
5			5.42	1.48
6			5.43	1.49
7			5.43	1.49
8			5.44	1.5
9			5.44	1.5
10			5.45	1.51
12			5.46	1.52
14			5.47	1.53
16			5.47	1.53
18			5.48	1.54
20			5.49	1.55
25			5.5	1.56
30			5.51	1.57
35			5.52	1.58
40			5.53	1.59
45		0	5.53	1.59
50		0	5.54	1.6
60		0	5.54	1.6
70		0	5.55	1.61
71	1	71	4.16	0.22
72	2	36	4.13	0.19
73	3	24.33	4.11	0.17
74	4	18.5	4.1	0.16
75	5	15.00	4.09	0.15
76	6	12.67	4.08	0.14
77	7	11.00	4.08	0.14
78	8	9.75	4.07	0.13
79	9	8.78	4.07	0.13
80	10	8.00	4.06	0.12
82	12	6.83	4.05	0.11

84	14	6.00	4.04	0.1
86	16	5.38	4.04	0.1
88	18	4.89	4.03	0.09
90	20	4.50	4.03	0.09
95	25	3.80	4.02	0.08

AQUIFER PERFORMANCE TEST
FATEHPUR, GAYA, BIHAR

RESIDUAL DRAWDOWN Vs t/t' PLOT
(Theis's Recovery Method)



Q(m^3/Day)	T (m2/Day)
613.44	1016.19

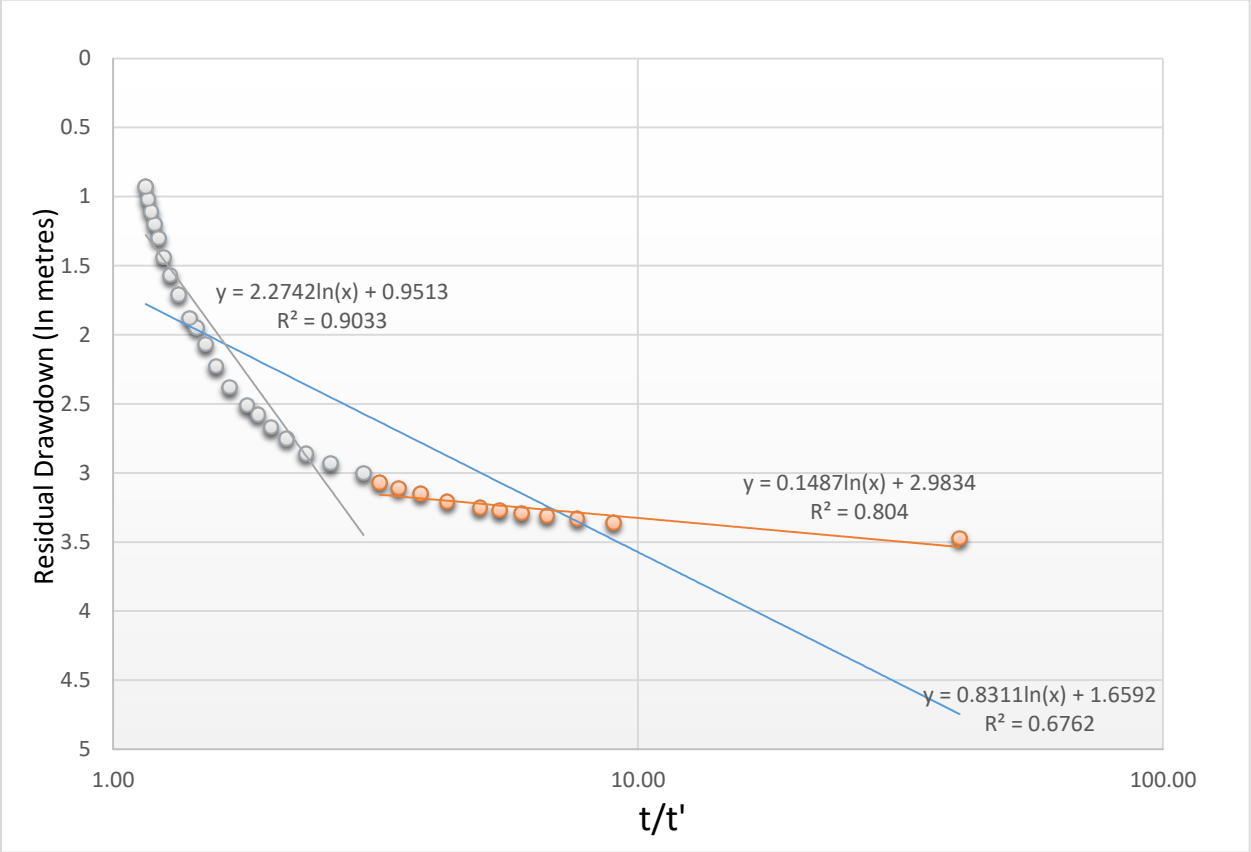
Annexure 20: Pumping Test in private dugwell at Tilaiya Village, Gaya district.

Date				**03-02-2024**
Site				**Tilaiya Village**
Measuring Point				**0.57 magl**
Static Water Level				**2.9 mbmp**
Depth of the Dugwell				**7.62 m**
Motor Power				**5 HP**
Lat				**24.5514**
Long				**85.0808**
Discharge				**12 lps**
Time since pumping started, t (min)	**Time since pumping stopped, t' (min)**	**t/t'**	**Depth to water level (mbmp)**	**DrawDown/Residual DrawDown (m)**
1			3.05	0.15
2			3.14	0.24
3			3.26	0.36
4			3.36	0.46
5			3.5	0.6
6			3.61	0.71
7			3.68	0.78
8			3.78	0.88
9			3.87	0.97
10			4.01	1.11
12			4.2	1.3
14			4.4	1.5
16			4.54	1.64
18			4.75	1.85
20			4.89	1.99
25			5.33	2.43
30			5.89	2.99
35			6.19	3.29
40			6.4	3.5
41	1	41.0	6.37	3.47
45	5	9.0	6.26	3.36
46	6	7.7	6.23	3.33
47	7	6.7	6.21	3.31
48	8	6.0	6.19	3.29
49	9	5.4	6.17	3.27
50	10	5.0	6.15	3.25
52	12	4.3	6.11	3.21
54	14	3.9	6.05	3.15
56	16	3.5	6.01	3.11
58	18	3.2	5.97	3.07
60	20	3.0	5.9	3
65	25	2.6	5.83	2.93
70	30	2.3	5.76	2.86
75	35	2.1	5.65	2.75
80	40	2.0	5.57	2.67

85	45	1.9	5.48	2.58
90	50	1.8	5.41	2.51
100	60	1.7	5.28	2.38
110	70	1.6	5.13	2.23
120	80	1.5	4.97	2.07
130	90	1.4	4.85	1.95
140	100	1.4	4.78	1.88
160	120	1.3	4.61	1.71
180	140	1.3	4.47	1.57
200	160	1.3	4.34	1.44
220	180	1.2	4.2	1.3
240	200	1.2	4.1	1.2
260	220	1.2	4.01	1.11
280	240	1.2	3.92	1.02
300	260	1.2	3.83	0.93

AQUIFER PERFORMANCE TEST
TILAIYA, MOHANPUR, GAYA, BIHAR

RESIDUAL DRAWDOWN Vs t/t' PLOT
(Theis's Recovery Method)



Pumping Phase	Q (m^3/Day)	T (m2/Day)
Inital	1036.8	554.40
Later	1036.8	0.419
Overall	1036.8	1.148

Annexure 21: Tentative locations for structures proposed for recharge interventions in study area.

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Charokhari	Sikri	24.5937	85.1894
Gaya	Fatehpur	Charokhari	Sikri	24.5942	85.1912
Gaya	Fatehpur	Charokhari	Sikri	24.5948	85.1863
Gaya	Fatehpur	Charokhari	Sikri	24.5958	85.1886
Gaya	Fatehpur	Charokhari	Sikri	24.5969	85.1905
Gaya	Fatehpur	Charokhari	Sikri	24.5988	85.1906
Gaya	Fatehpur	Charokhari	Sikri	24.6035	85.1821
Gaya	Fatehpur	Charokhari	Sikri	24.6008	85.1857
Gaya	Fatehpur	Charokhari	Sikri	24.6021	85.1857
Gaya	Fatehpur	Salaiya Kala	Manpur	24.6307	85.1869
Gaya	Fatehpur	Jaipur	Jaipur	24.5801	85.2323
Gaya	Fatehpur	Jaipur	Jaipur	24.5921	85.2406
Gaya	Fatehpur	Charokhari	Gangahar Hardia	24.6062	85.1839
Gaya	Fatehpur	Charokhari	Gangahar Hardia	24.6081	85.1833
Gaya	Fatehpur	Charokhari	Gangahar Hardia	24.6109	85.1802
Gaya	Fatehpur	Dumari Chati	Sahpokhar	24.6033	85.2318
Gaya	Fatehpur	Salaiya Kala	Isarwe	24.6085	85.1619
Gaya	Fatehpur	Charokhari	Pinrari	24.6122	85.1523
Gaya	Fatehpur	Pahar Pur	Sabdo	24.628	85.1853
Gaya	Fatehpur	Pahar Pur	Paharpur	24.6162	85.2063
Gaya	Fatehpur	Lodhwe South	Kathian	24.6161	85.2767
Gaya	Fatehpur	Mataso	Mataso	24.6729	85.2102
Gaya	Fatehpur	Morhe	Mayapur	24.6415	85.2072
Gaya	Fatehpur	Morhe	Raghopur	24.6528	85.1877
Gaya	Fatehpur	Mataso	Dhangawan	24.6544	85.2094
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.5968	85.3039
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.605	85.2797
Gaya	Fatehpur	Neemi	Barkail	24.6762	85.242
Gaya	Fatehpur	Naudiha Sultanpur	Naudiha	24.7	85.3
Gaya	Fatehpur	Naudiha Sultanpur	Karri	24.7137	85.2863
Gaya	Fatehpur	Nagawa	Nagwan	24.7207	85.3166
Gaya	Fatehpur	Nagawa	Nagwan	24.7229	85.3128
Gaya	Fatehpur	Naudiha Sultanpur	Jaspur	24.7304	85.2761
Gaya	Fatehpur	Naudiha Sultanpur	Jaspur	24.7364	85.2779
Gaya	Fatehpur	Naudiha Sultanpur	Khajuri	24.7379	85.2904
Gaya	Fatehpur	Naudiha Sultanpur	Khajuri	24.7423	85.2854
Gaya	Fatehpur	Dharhara Kala	Darzi Chak	24.5965	85.1946
Gaya	Fatehpur	Salaiya Kala	Bhangi	24.6319	85.1821
Gaya	Fatehpur	Salaiya Kala	Bhangi	24.6329	85.1835
Gaya	Fatehpur	Salaiya Kala	Bhangi	24.6345	85.1837
Gaya	Fatehpur	Naudiha Jhurang	Hara Kuraha	24.5297	85.2415
Gaya	Fatehpur	Jaipur	Bhawanri Kalan	24.5724	85.2167
Gaya	Fatehpur	Charokhari	Tetaria	24.5859	85.1703
Gaya	Fatehpur	Lodhwe South	Kathian	24.607768	85.2759917
Gaya	Fatehpur	Lodhwe South	Kathian	24.598454	85.2572088
Gaya	Fatehpur	Lodhwe South	Kathian	24.590478	85.2863116
Gaya	Fatehpur	Dharhara Kala	Chapri	24.593886	85.2039463
Gaya	Fatehpur	Charokhari	Bhalua	24.600726	85.1769693

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Dharhara Kala	Dharahara Kalan	24.590181	85.2059092
Gaya	Fatehpur	Dharhara Kala	Pateya	24.582087	85.2218205
Gaya	Fatehpur	Lodhwe North	Gajhanda	24.654519	85.2792107
Gaya	Fatehpur	Lodhwe North	Gajhanda	24.643247	85.2924535
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.634759	85.1547664
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.649399	85.2784704
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.649453	85.2783538
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.648358	85.2796522
Gaya	Fatehpur	Lodhwe South	Kathian	24.598454	85.2572088
Gaya	Fatehpur	Lodhwe South	Kathian	24.609398	85.304955
Gaya	Fatehpur	Lodhwe South	Kathian	24.598454	85.2572088
Gaya	Fatehpur	Lodhwe South	Kathian	24.596202	85.31032
Gaya	Fatehpur	Lodhwe South	Kathian	24.617098	85.28761
Gaya	Fatehpur	Lodhwe South	Kathian	24.62659	85.282015
Gaya	Fatehpur	Lodhwe South	Kathian	24.617188	85.2924967
Gaya	Fatehpur	Lodhwe South	Kathian	24.618997	85.288385
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.647923	85.2853976
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.643455	85.150727
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.644702	85.2899689
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.641726	85.2911605
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.633005	85.1445333
Gaya	Fatehpur	Bara	Kalyanpur	24.67182	85.3006665
Gaya	Fatehpur	Bara	Kalyanpur	24.675443	85.2962937
Gaya	Fatehpur	Bara	Basariya	24.682057	85.2961417
Gaya	Fatehpur	Bara	Simariya	24.698839	85.2943929
Gaya	Fatehpur	Bara	Basariya	24.687898	85.2994894
Gaya	Fatehpur	Bara	Basariya	24.698839	85.2943929
Gaya	Fatehpur	Pahar Pur	Sabdo	24.622589	85.1923779
Gaya	Fatehpur	Pahar Pur	Jamhaita	24.62063	85.194176
Gaya	Fatehpur	Pahar Pur	Jamhaita	24.623691	85.1939954
Gaya	Fatehpur	Pahar Pur	Jamuhar	24.622355	85.1934524
Gaya	Fatehpur	Pahar Pur	Jamuhar	24.612287	85.1862388
Gaya	Fatehpur	Pahar Pur	Jamuhar	24.622355	85.1934524
Gaya	Fatehpur	Pahar Pur	Jamuhar	24.612363	85.1869594
Gaya	Fatehpur	Pahar Pur	Jamuhar	24.612293	85.1877677
Gaya	Fatehpur	Morhe	Rosana	24.644099	85.2138097
Gaya	Fatehpur	Pahar Pur	Jamhaita	24.620003	85.2046412
Gaya	Fatehpur	Morhe	Morahe	24.643015	85.2028425
Gaya	Fatehpur	Pahar Pur	Paharpur	24.614767	85.2106697
Gaya	Fatehpur	Pahar Pur	Gopal Kera	24.596564	85.2181556
Gaya	Fatehpur	Morhe	Rupin	24.626294	85.2119188
Gaya	Fatehpur	Morhe	Rupin	24.626915	85.211585
Gaya	Fatehpur	Morhe	Rupin	24.626579	85.2116585
Gaya	Fatehpur	Jaipur	Bhawanri Kalan	24.573237	85.2170908
Gaya	Fatehpur	Jaipur	Jaipur	24.57403	85.23906
Gaya	Fatehpur	Jaipur	Jaipur	24.591726	85.2413347
Gaya	Fatehpur	Dumari Chati	Sahpokhar	24.604241	85.2325528
Gaya	Fatehpur	Nagawa	Nagwa	24.603966	85.3438547
Gaya	Fatehpur	Nagawa	Chhotahra	24.695086	85.3069207
Gaya	Fatehpur	Naudiha Sultanpur	Khajuri	24.735513	85.2860725
Gaya	Fatehpur	Naudiha Sultanpur	Khajuri	24.73752	85.2906807
Gaya	Fatehpur	Pahar Pur	Paharpur	24.615663	85.206383
Gaya	Fatehpur	Pahar Pur	Paharpur	24.615372	85.2067276
Gaya	Fatehpur	Nagawa	Pharka	24.701833	85.3126483
Gaya	Fatehpur	Nagawa	Pharka	24.70087	85.3180883

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Nagawa	Chhotahra	24.708772	85.3061217
Gaya	Fatehpur	Nagawa	Chhotahra	24.705185	85.30581
Gaya	Fatehpur	Naudiha Sultanpur	Dadpur	24.709024	85.2788293
Gaya	Fatehpur	Naudiha Sultanpur	Sultanpur	24.788269	85.35315
Gaya	Fatehpur	Naudiha Sultanpur	Sultanpur	24.701086	85.283402
Gaya	Fatehpur	Naudiha Sultanpur	Sultanpur	24.70041	85.2840046
Gaya	Fatehpur	Naudiha Sultanpur	Bakhari	24.712749	85.2991028
Gaya	Fatehpur	Charokhari	Gangahar Hardia	24.610845	85.1806336
Gaya	Fatehpur	Charokhari	Pinrari	24.619543	85.1459208
Gaya	Fatehpur	Charokhari	Gangahar Hardia	24.605052	85.1849117
Gaya	Fatehpur	Meyari	Chhiri	24.724796	85.2650592
Gaya	Fatehpur	Mataso	Dumri	24.676958	85.2318755
Gaya	Fatehpur	Mataso	Dumri	24.690038	85.2264726
Gaya	Fatehpur	Mataso	Dumri	24.678418	85.233592
Gaya	Fatehpur	Mataso	Dumri	24.68431	85.2326212
Gaya	Fatehpur	Mataso	Dumri	24.690213	85.2203232
Gaya	Fatehpur	Mataso	Ekamman	24.650582	85.2313268
Gaya	Fatehpur	Kathautiya Kewal	Taro	24.575133	85.2584117
Gaya	Fatehpur	Kathautiya Kewal	Taro	24.572996	85.2601198
Gaya	Fatehpur	Kathautiya Kewal	Manhonna	24.581193	85.2617369
Gaya	Fatehpur	Bara	Bara	24.678205	85.318351
Gaya	Fatehpur	Bara	Bara	24.677608	85.318095
Gaya	Fatehpur	Bara	Amaur	24.684318	85.2832822
Gaya	Fatehpur	Dumari Chati	Sohjana	24.629038	85.2290615
Gaya	Fatehpur	Dumari Chati	Sohjana	24.62616	85.234905
Gaya	Fatehpur	Nagawa	Pharka	24.700122	85.31603
Gaya	Fatehpur	Nagawa	Pharka	24.70019	85.3156683
Gaya	Fatehpur	Nagawa	Pharka	24.698852	85.3131933
Gaya	Fatehpur	Nagawa	Alawalpur	24.726992	85.2903917
Gaya	Fatehpur	Dumari Chati	Sohjana	24.609642	85.2245307
Gaya	Fatehpur	Dumari Chati	Sohjana	24.617942	85.231435
Gaya	Fatehpur	Salaiya Kala	Isarwe	24.611371	85.1628077
Gaya	Fatehpur	Salaiya Kala	Isarwe	24.615544	85.1604098
Gaya	Fatehpur	Meyari	Neyamatpur	24.706612	85.2745092
Gaya	Fatehpur	Meyari	Neyamatpur	24.704575	85.2780454
Gaya	Fatehpur	Meyari	Neyamatpur	24.701695	85.2796896
Gaya	Fatehpur	Meyari	Neyamatpur	24.697591	85.2791773
Gaya	Fatehpur	Lodhwe South	Kathian	24.594292	85.303245
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.57527	85.3092595
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.57043	85.30149
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.57053	85.3014733
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.57527	85.3092595
Gaya	Fatehpur	Dumari Chati	Donaiya	24.623352	85.2491133
Gaya	Fatehpur	Dumari Chati	Donaiya	24.623165	85.2491883
Gaya	Fatehpur	Dumari Chati	Halmatta	24.620325	85.2698219
Gaya	Fatehpur	Charokhari	Incha	24.59625	85.1769452

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.618786	85.1789641
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.618773	85.1740195
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.618783	85.1743435
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.619215	85.176287
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.619215	85.176287
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.643393	85.1798501
Gaya	Fatehpur	Salaiya Kala	Salaia Khurd	24.630322	85.176287
Gaya	Fatehpur	Salaiya Kala	Salaia Khurd	24.62361	85.1979857
Gaya	Fatehpur	Salaiya Kala	Salaia Khurd	24.620812	85.1915094
Gaya	Fatehpur	Neemi	Barahuria	24.684194	85.2259124
Gaya	Fatehpur	Neemi	Barahuria	24.684155	85.2260052
Gaya	Fatehpur	Neemi	Barkail	24.67886	85.2416824
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.61834	85.1663012
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.616489	85.1720759
Gaya	Fatehpur	Kathautiya Kewal	Taro	24.575073	85.258315
Gaya	Fatehpur	Meyari	Neyamatpur	24.697535	85.279096
Gaya	Fatehpur	Meyari	Neyamatpur	24.697745	85.2774008
Gaya	Fatehpur	Meyari	Neyamatpur	24.706548	85.2745181
Gaya	Fatehpur	Meyari	Neyamatpur	24.706548	85.2745181
Gaya	Fatehpur	Meyari	Neyamatpur	24.705793	85.2745773
Gaya	Fatehpur	Meyari	Neyamatpur	24.705793	85.2745773
Gaya	Fatehpur	Meyari	Meari	24.709774	85.262165
Gaya	Fatehpur	Meyari	Meari	24.712785	85.2769982
Gaya	Fatehpur	Meyari	Meari	24.706319	85.2562739
Gaya	Fatehpur	Meyari	Meari	24.706252	85.2565779
Gaya	Fatehpur	Charokhari	Sikri	24.594902	85.1898857
Gaya	Fatehpur	Charokhari	Incha	24.594718	85.174889
Gaya	Fatehpur	Charokhari	Incha	24.594868	85.1765007
Gaya	Fatehpur	Nagawa	Pharka	24.703778	85.318825
Gaya	Fatehpur	Kathautiya Kewal	Manhonna	24.580753	85.2617033
Gaya	Fatehpur	Dharhara Kala	Dharahara Kalan	24.575797	85.1978279
Gaya	Fatehpur	Dharhara Kala	Chapri	24.597467	85.2025187
Gaya	Fatehpur	Dharhara Kala	Kusmhar	24.623795	85.2038138
Gaya	Fatehpur	Charokhari	Incha	24.592597	85.1754673
Gaya	Fatehpur	Charokhari	Pinrari	24.616625	85.1477535
Gaya	Fatehpur	Charokhari	Pinrari	24.619079	85.1472727
Gaya	Fatehpur	Bhare	Ketra	24.634228	85.2624357
Gaya	Fatehpur	Bhare	Ketra	24.633037	85.2384456
Gaya	Fatehpur	Bhare	Ketra	24.6457	85.2616478
Gaya	Fatehpur	Bhare	Bakhtawarpur	24.652315	85.2619467
Gaya	Fatehpur	Jaipur	Jaipur	24.581025	85.2334767
Gaya	Fatehpur	Jaipur	Majhganwan	24.577585	85.233545
Gaya	Fatehpur	Jaipur	Hematpur	24.576783	85.227075
Gaya	Fatehpur	Jaipur	Kurumdih	24.579423	85.2143083
Gaya	Fatehpur	Jaipur	Kurumdih	24.57351	85.21536
Gaya	Fatehpur	Jaipur	Kurumdih	24.573405	85.2153417
Gaya	Fatehpur	Jaipur	Bhawanri Kalan	24.572593	85.21631
Gaya	Fatehpur	Kathautiya Kewal	Manhonna	24.58288	85.2624433
Gaya	Fatehpur	Charokhari	Sataniyan	24.588901	85.1878895
Gaya	Fatehpur	Meyari	Meari	24.71231	85.2543234
Gaya	Fatehpur	Salaiya Kala	Salaia Khurd	24.620092	85.1921571
Gaya	Fatehpur	Dharhara Kala		24.598321	85.2060801
Gaya	Fatehpur	Dharhara Kala	Kusmhar	24.618413	85.1743435
Gaya	Fatehpur	Bara	Amaur	24.680484	85.2803432

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Charokhari	Incha	24.597022	85.1698308
Gaya	Fatehpur	Charokhari	Incha	24.598697	85.1649083
Gaya	Fatehpur	Charokhari	Sikri	24.600628	85.1898594
Gaya	Fatehpur	Bara	Majhauli	24.659031	85.2724781
Gaya	Fatehpur	Lodhwe North	Gajhandi	24.654595	85.2929626
Gaya	Fatehpur	Fateh Pur	Fatehpur	24.638681	85.2294374
Gaya	Fatehpur	Fateh Pur	Fatehpur	24.635569	85.2248544
Gaya	Fatehpur	Fateh Pur	Fatehpur	24.636956	85.233592
Gaya	Fatehpur	Charokhari	Bodar Ghorsari	24.597182	85.1648366
Gaya	Fatehpur	Naudiha Sultanpur	Gumman	24.717476	85.2718698
Gaya	Fatehpur	Naudiha Sultanpur	Gumman	24.691309	85.2785523
Gaya	Fatehpur	Naudiha Sultanpur	Gumman	24.721486	85.2778882
Gaya	Fatehpur	Naudiha Sultanpur	Karri	24.721486	85.2778882
Gaya	Fatehpur	Charokhari	Dangra	24.591044	85.1462645
Gaya	Fatehpur	Naudiha Sultanpur	Karri	24.721486	85.2778882
Gaya	Fatehpur	Naudiha Sultanpur	Karri	24.714427	85.2864026
Gaya	Fatehpur	Pahar Pur	Rato Khurd	24.626866	85.191977
Gaya	Fatehpur	Pahar Pur	Raja Bigha	24.621095	85.1881804
Gaya	Fatehpur	Pahar Pur	Raja Bigha	24.621181	85.1852397
Gaya	Fatehpur	Charokhari	Gani Pipra	24.601725	85.139089
Gaya	Fatehpur	Charokhari	Gani Pipra	24.601725	85.139089
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.613452	85.1766692
Gaya	Fatehpur	Pahar Pur	Pipra	24.607499	85.1947631
Gaya	Fatehpur	Salaiya Kala	Guri	24.618403	85.1740195
Gaya	Fatehpur	Salaiya Kala	Guri	24.610587	85.1727238
Gaya	Fatehpur	Pahar Pur	Paharpur	24.610232	85.1929484
Gaya	Fatehpur	Pahar Pur	Gopal Kera	24.606308	85.2162269
Gaya	Fatehpur	Pahar Pur	Gopal Kera	24.624667	85.216049
Gaya	Fatehpur	Pahar Pur	Paharpur	24.608467	85.2227326
Gaya	Fatehpur	Meyari	Neyamatpur	24.70572	85.2745828
Gaya	Fatehpur	Meyari	Meari	24.712357	85.2494229
Gaya	Fatehpur	Bhare	Bordi	24.658534	85.2604432
Gaya	Fatehpur	Lodhwe South	Kathian	24.606643	85.2950933
Gaya	Fatehpur	Lodhwe South	Kathian	24.594318	85.3032217
Gaya	Fatehpur	Kathautiya Kewal	Alakdiha	24.539522	85.3441183
Gaya	Fatehpur	Kathautiya Kewal	Alakdiha	24.539148	85.3397467
Gaya	Fatehpur	Dharhara Kala	Darzi Chak	24.595913	85.1959961
Gaya	Fatehpur	Naudiha Jhurang	Mocharakh	24.561387	85.22997
Gaya	Fatehpur	Naudiha Jhurang	Mocharakh	24.571053	85.2219416
Gaya	Fatehpur	Naudiha Jhurang	Sarne	24.571053	85.2219416
Gaya	Fatehpur	Naudiha Jhurang	Bargawan	24.575454	85.2322976
Gaya	Fatehpur	Naudiha Jhurang	Majhila Kalan	24.574577	85.2397398
Gaya	Fatehpur	Morhe	Morahe	24.634139	85.2028337
Gaya	Fatehpur	Morhe	Morahe	24.631602	85.2037538
Gaya	Fatehpur	Charokhari	Sikri	24.59902	85.1896427
Gaya	Fatehpur	Neemi	Nimi	24.659041	85.2398791
Gaya	Fatehpur	Neemi	Badauan	24.669583	85.2455598
Gaya	Fatehpur	Neemi	Badauan	24.667225	85.2421514
Gaya	Fatehpur	Mataso	Dumri	24.689874	85.2212942

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Mataso	Dumri	24.689874	85.2212942
Gaya	Fatehpur	Mataso	Dumri	24.689874	85.2212942
Gaya	Fatehpur	Naudiha Sultanpur	Sultanpur	24.696728	85.2952986
Gaya	Fatehpur	Naudiha Sultanpur	Sultanpur	24.696728	85.2952986
Gaya	Fatehpur	Naudiha Sultanpur	Bakhari	24.696728	85.2952986
Gaya	Fatehpur	Naudiha Sultanpur	Bakhari	24.696728	85.2952986
Gaya	Fatehpur	Jaipur	Majhganwan	24.584863	85.2371517
Gaya	Fatehpur	Kathautiya Kewal	Baskotwa	24.53796	85.3524567
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.542557	85.3534667
Gaya	Fatehpur	Salaiya Kala	Salaia Khurd	24.624143	85.1741374
Gaya	Fatehpur	Mataso	Mataso	24.670379	85.2160984
Gaya	Fatehpur	Mataso	Mataso	24.668901	85.2169233
Gaya	Fatehpur	Mataso	Mataso	24.645133	85.2112598
Gaya	Fatehpur	Lodhwe North	Gajhanda	24.655985	85.2764685
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.618299	85.1707801
Gaya	Fatehpur	Salaiya Kala	Khedarpura	24.622704	85.1928047
Gaya	Fatehpur	Lodhwe South	Kathian	24.585467	85.3059883
Gaya	Fatehpur	Kathautiya Kewal	Alakdiha	24.538389	85.3382953
Gaya	Fatehpur	Kathautiya Kewal	Alakdiha	24.538354	85.3381777
Gaya	Fatehpur	Kathautiya Kewal	Manhonna	24.593868	85.276289
Gaya	Fatehpur	Kathautiya Kewal	Alakdiha	24.583674	85.2723652
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.581995	85.2636774
Gaya	Fatehpur	Lodhwe South	Kathian	24.584458	85.3043433
Gaya	Fatehpur	Lodhwe South	Kathian	24.570695	85.3050584
Gaya	Fatehpur	Lodhwe South	Kathian	24.573187	85.3018267
Gaya	Fatehpur	Lodhwe South	Kathian	24.580487	85.30602
Gaya	Fatehpur	Lodhwe South	Kathian	24.564138	85.3087467
Gaya	Fatehpur	Lodhwe South	Kathian	24.566788	85.3137517
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.63442	85.1611115
Gaya	Fatehpur	Pahar Pur	Jamhaita	24.620602	85.1942469
Gaya	Fatehpur	Pahar Pur	Gopal Kera	24.606098	85.2177535
Gaya	Fatehpur	Jaipur	Bhawanri Kalan	24.573154	85.2171734
Gaya	Fatehpur	Jaipur	Bhawanri Kalan	24.573082	85.2041376
Gaya	Fatehpur	Jaipur	Bhawanri Kalan	24.573082	85.2041376
Gaya	Fatehpur	Dumari Chati	Sahpokhar	24.603879	85.2299866
Gaya	Fatehpur	Dumari Chati	Sahpokhar	24.603879	85.2299866
Gaya	Fatehpur	Kathautiya Kewal	Alakdiha	24.538102	85.3377467
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.571821	85.2893312
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.580866	85.2796134
Gaya	Fatehpur	Kathautiya Kewal	Kathautiya Kewal	24.576976	85.2808156
Gaya	Fatehpur	Kathautiya Kewal	Taro	24.572545	85.253241
Gaya	Fatehpur	Morhe	Tapsa	24.645192	85.194345

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Fatehpur	Nagawa	Pharka	24.702942	85.3085183
Gaya	Fatehpur	Nagawa	Aiwan	24.689427	85.3125733
Gaya	Fatehpur	Dumari Chati	Dumri Chatti	24.61733	85.2223658
Gaya	Fatehpur	Jaipur	Jaipur	24.58626	85.2462105
Gaya	Fatehpur	Jaipur	Jaipur	24.576454	85.2170865
Gaya	Fatehpur	Lodhwe South	Kathian	24.589617	85.2824321
Gaya	Fatehpur	Lodhwe South	Kathian	24.589617	85.2824321
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.655317	85.281915
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.633324	85.2711154
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.619244	85.1655965
Gaya	Fatehpur	Salaiya Kala	Manpur	24.628457	85.2039535
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.630215	85.1613845
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.651423	85.176287
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.641148	85.1675404
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.6432	85.166378
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.64638	85.1655668
Gaya	Fatehpur	Bara	Amaur	24.771011	85.0044868
Gaya	Fatehpur	Bara	Simariya	24.686175	85.2859217
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.64634	85.1655751
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.647977	85.1727238
Gaya	Fatehpur	Salaiya Kala	Manpur	24.622313	85.1921571
Gaya	Fatehpur	Salaiya Kala	Manpur	24.628753	85.1913917
Gaya	Fatehpur	Salaiya Kala	Manpur	24.628882	85.1912874
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.62846	85.2039545
Gaya	Fatehpur	Charokhari	Raghunathpur	24.603272	85.157455
Gaya	Fatehpur	Lodhwe South	Kathian	24.637384	85.2943929
Gaya	Fatehpur	Lodhwe South	Kathian	24.637384	85.2943929
Gaya	Fatehpur	Charokhari	Dangra	24.587963	85.1439967
Gaya	Fatehpur	Lodhwe North	Lodhwe	24.639177	85.3044121
Gaya	Fatehpur	Kathautiya Kewal	Baskotwa	24.542848	85.35433
Gaya	Fatehpur	Dharhara Kala	Chapri	24.595128	85.20238
Gaya	Fatehpur	Lodhwe South	Kathian	24.615997	85.296325
Gaya	Fatehpur	Mataso	Mataso	24.663349	85.2151389
Gaya	Fatehpur	Mataso	Bargawan	24.657876	85.2257091
Gaya	Fatehpur	Pahar Pur	Paharpur	24.618361	85.2100043
Gaya	Fatehpur	Pahar Pur	Jamhaita	24.620486	85.1926947
Gaya	Fatehpur	Mataso	Dumri	24.678901	85.2236377
Gaya	Fatehpur	Mataso	Mataso	24.654912	85.2277671
Gaya	Fatehpur	Mataso	Mataso	24.674953	85.2293852
Gaya	Fatehpur	Charokhari	Gani Pipra	24.591029	85.1476424
Gaya	Fatehpur	Salaiya Kala	Salaia Kalan	24.626092	85.1610833
Gaya	Fatehpur	Mataso	Dumri	24.678422	85.2234205
Gaya	Fatehpur	Mataso	Mataso	24.677957	85.2190286
Gaya	Fatehpur	Neemi	Dehuri	24.668213	85.265315
Gaya	Fatehpur	Neemi	Dehuri	24.668792	85.2652033
Gaya	Fatehpur	Lodhwe North	Kanti	24.652354	85.2995643
Gaya	Fatehpur	Lodhwe North	Kanti	24.661145	85.2846951
Gaya	Fatehpur	Neemi	Rajaundha	24.671353	85.232915
Gaya	Fatehpur	Neemi	Rajaundha	24.682756	85.2420046
Gaya	Fatehpur	Neemi	Rajaundha	24.66426	85.2360533
Gaya	Mohanpur	Teswar	Banahi	24.6306	85.0354
Gaya	Mohanpur	Dema	Rajbar	24.6281	85.0099
Gaya	Mohanpur	Dema	Diwan	24.6127	85.0057
Gaya	Mohanpur	Dema	Diwan	24.6147	85.0061
Gaya	Mohanpur	Dema	Diwan	24.6204	85.0074
Gaya	Mohanpur	Dema	Diwan	24.6253	85.0193

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Teswar	Sugawan	24.6454	85.0283
Gaya	Mohanpur	Guriyawan	Guriawan	24.6619	85.055
Gaya	Mohanpur	Guriyawan	Guriawan	24.6749	85.0598
Gaya	Mohanpur	Bumuar	Bagahi	24.5541	84.9981
Gaya	Mohanpur	Ladu	Tetaria	24.5854	84.9996
Gaya	Mohanpur	Ladu	Laru	24.6032	84.9754
Gaya	Mohanpur	Ladu	Laru	24.6036	84.9694
Gaya	Mohanpur	Ladu	Laru	24.6047	84.9705
Gaya	Mohanpur	Ladu	Laru	24.6049	84.9752
Gaya	Mohanpur	Amkola	Ergir	24.4694	85.1484
Gaya	Mohanpur	Gopal Kera	Kharagpur	24.5221	85.0808
Gaya	Mohanpur	Gopal Kera	Kharagpur	24.5245	85.078
Gaya	Mohanpur	Gopal Kera	Kharagpur	24.5214	85.0793
Gaya	Mohanpur	Gopal Kera	Kharagpur	24.5224	85.0781
Gaya	Mohanpur	Kewala	Matgarha	24.5055	85.178
Gaya	Mohanpur	Sinduar	Senduar	24.5287	85.0292
Gaya	Mohanpur	Bagula	Bagula	24.5365	85.0483
Gaya	Mohanpur	Bagula	Bagula	24.5403	85.0438
Gaya	Mohanpur	Bagula	Bagula	24.5354	85.0461
Gaya	Mohanpur	Amkola	Majura	24.5369	85.1394
Gaya	Mohanpur	Musaila	Hade	24.5385	85.0857
Gaya	Mohanpur	Musaila	Hade	24.5389	85.0977
Gaya	Mohanpur	Musaila	Hade	24.5399	85.0817
Gaya	Mohanpur	Dharhara	Dharhara	24.5529	85.0537
Gaya	Mohanpur	Dharhara	Lai	24.5553	85.0236
Gaya	Mohanpur	Ambatari	Banda	24.5548	85.2184
Gaya	Mohanpur	Bumuar	Chandrahuan	24.5632	84.9962
Gaya	Mohanpur	Ambatari	Sanwar Chak	24.5579	85.2121
Gaya	Mohanpur	Siriyawan	Baliyari	24.5664	85.0817
Gaya	Mohanpur	Siriyawan	Mohanpur	24.5704	85.0841
Gaya	Mohanpur	Khardih	Khardi	24.5792	85.0155
Gaya	Mohanpur	Lakhaipur	Pathra	24.5812	85.1313
Gaya	Mohanpur	Khardih	Dhamna	24.6006	85.0379
Gaya	Mohanpur	Matihani	Barki Bihia	24.5961	85.0482
Gaya	Mohanpur	Dema	Belarpur	24.6198	85.0273
Gaya	Mohanpur	Erki	Bhagwanpur	24.6207	85.0952
Gaya	Mohanpur	Dema	Diwan	24.6073	85.011
Gaya	Mohanpur	Dema	Diwan	24.6082	85.0148
Gaya	Mohanpur	Dema	Diwan	24.6091	85.0183
Gaya	Mohanpur	Bagula	Bagula	24.539793	85.0436907
Gaya	Mohanpur	Amkola	Majura	24.531867	85.139848
Gaya	Mohanpur	Amkola	Majura	24.531867	85.139848
Gaya	Mohanpur	Lakhaipur	Pathra	24.580662	85.1307377
Gaya	Mohanpur	Erki	Nagwan	24.609828	85.1006716
Gaya	Mohanpur	Khardih	Dhamna	24.596069	85.0368756
Gaya	Mohanpur	Kewala	Ghughuri	24.561627	85.1568221
Gaya	Mohanpur	Kewala	Ghughuri	24.561813	85.156875
Gaya	Mohanpur	Kewala	Ghughuri	24.556301	85.1689828
Gaya	Mohanpur	Kewala	Ghughuri	24.564538	85.1601118
Gaya	Mohanpur	Kewala	Ghughuri	24.566057	85.1593678
Gaya	Mohanpur	Dema	Diwan	24.610088	85.0173367
Gaya	Mohanpur	Gopal Kera	Bandegara	24.522917	85.057795
Gaya	Mohanpur	Gopal Kera	Bagaha	24.519981	85.0626593
Gaya	Mohanpur	Gopal Kera	Gopal Kera	24.513734	85.0809599
Gaya	Mohanpur	Gopal Kera	Piprahi	24.512531	85.0895342
Gaya	Mohanpur	Gopal Kera	Manrar	24.516192	85.098032
Gaya	Mohanpur	Gopal Kera	Bongea	24.503298	85.1131431

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Sinduar	Senduar	24.52948	85.0286437
Gaya	Mohanpur	Bagula	Bagula	24.539846	85.0441952
Gaya	Mohanpur	Dharhara	Lai	24.555566	85.0230448
Gaya	Mohanpur	Dharhara	Naghara	24.565842	85.0319626
Gaya	Mohanpur	Dema	Rajbar	24.625996	85.0189731
Gaya	Mohanpur	Dema	Diwan	24.612232	85.0054941
Gaya	Mohanpur	Lakhaipur	Pathra	24.614299	85.1730477
Gaya	Mohanpur	Kewala	Kewala	24.56321	85.1500429
Gaya	Mohanpur	Ambatari	Amatari	24.54491	85.2059232
Gaya	Mohanpur	Ambatari	Banda	24.541897	85.2216343
Gaya	Mohanpur	Kewala	Kewala	24.546781	85.1918938
Gaya	Mohanpur	Kewala	Kewala	24.546579	85.1907079
Gaya	Mohanpur	Kewala	Kewala	24.547892	85.1921571
Gaya	Mohanpur	Kewala	Kewala	24.540071	85.1956515
Gaya	Mohanpur	Kewala	Kadarchunan	24.513386	85.2101447
Gaya	Mohanpur	Kewala	Kadarchunan	24.51345	85.2101697
Gaya	Mohanpur	Amkola	Majura	24.534877	85.1325399
Gaya	Mohanpur	Amkola	Majura	24.535701	85.1387087
Gaya	Mohanpur	Gopal Kera	Tanrawa	24.639013	85.0559805
Gaya	Mohanpur	Amkola	Jarlahi	24.555919	85.1122684
Gaya	Mohanpur	Matihani	Barki Bihia	24.599405	85.0559805
Gaya	Mohanpur	Teswar	Chorniman	24.63993	85.016362
Gaya	Mohanpur	Sinduar	Senduar	24.532299	85.0225741
Gaya	Mohanpur	Dharhara	Lai	24.560276	85.0274498
Gaya	Mohanpur	Dharhara	Ramsagar	24.573461	85.0212346
Gaya	Mohanpur	Dharhara	Salaia	24.555116	85.0488383
Gaya	Mohanpur	Dharhara	Jadua Chak	24.555001	85.0566298
Gaya	Mohanpur	Dharhara	Jadua Chak	24.5568	85.0663676
Gaya	Mohanpur	Dharhara	Jadua Chak	24.5568	85.0663676
Gaya	Mohanpur	Guriyawan	Guriawan	24.659693	85.0665545
Gaya	Mohanpur	Guriyawan	Nidani	24.621189	85.074461
Gaya	Mohanpur	Bagula	Raundawa	24.548154	85.0677139
Gaya	Mohanpur	Bagula	Raundawa	24.551194	85.0647448
Gaya	Mohanpur	Bagula	Raundawa	24.55002	85.0634314
Gaya	Mohanpur	Bagula	Raundawa	24.55424	85.0673413
Gaya	Mohanpur	Bagula	Raundawa	24.550173	85.0627814
Gaya	Mohanpur	Dema	Bishunpur	24.621438	85.0280556
Gaya	Mohanpur	Dema	Belarpur	24.612217	85.0066154
Gaya	Mohanpur	Dema	Nima	24.612217	85.0066154
Gaya	Mohanpur	Dema	Rajbar	24.622375	85.00869
Gaya	Mohanpur	Dema	Rajbar	24.643422	85.0212346
Gaya	Mohanpur	Gopal Kera	Kharagpur	24.521777	85.079178
Gaya	Mohanpur	Teswar	Teswar	24.649939	85.056445
Gaya	Mohanpur	Teswar	Teswar	24.640095	85.0326025
Gaya	Mohanpur	Bumuar	Semarwar	24.556504	85.0140731
Gaya	Mohanpur	Bumuar	Itra	24.547873	85.0085508
Gaya	Mohanpur	Bagula	Bagula	24.532286	85.0889737
Gaya	Mohanpur	Bagula	Dangra	24.542065	85.0686396
Gaya	Mohanpur	Bagula		24.522862	85.0929758
Gaya	Mohanpur	Lakhaipur	Jogiya	24.586774	85.1142008
Gaya	Mohanpur	Lakhaipur	Pathra	24.579955	85.1296222
Gaya	Mohanpur	Lakhaipur	Majhauli	24.602367	85.1357816
Gaya	Mohanpur	Lakhaipur	Majhauli	24.593346	85.1315674
Gaya	Mohanpur	Lakhaipur	Majhauli	24.592574	85.1305948
Gaya	Mohanpur	Lakhaipur	Majhauli	24.593346	85.1315674
Gaya	Mohanpur	Lakhaipur	Jogini	24.584149	85.127552
Gaya	Mohanpur	Lakhaipur	Bishunpur	24.579246	85.1305948

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Lakhaipur	Bishunpur	24.602367	85.1357816
Gaya	Mohanpur	Matihani	Kachanpur	24.629714	85.0433186
Gaya	Mohanpur	Lakhaipur	Lakhaipur	24.576962	85.1286496
Gaya	Mohanpur	Matihani	Kachanpur	24.630557	85.0352005
Gaya	Mohanpur	Matihani	Kachanpur	24.630704	85.0380162
Gaya	Mohanpur	Matihani	Ganesh Chak	24.630465	85.0436433
Gaya	Mohanpur	Matihani	Kachanpur	24.630742	85.0520849
Gaya	Mohanpur	Matihani	Kachanpur	24.628342	85.0579283
Gaya	Mohanpur	Matihani	Rendibar	24.610316	85.0387726
Gaya	Mohanpur	Matihani	Parsauni	24.5965	85.0389026
Gaya	Mohanpur	Matihani	Parsauni	24.601464	85.0397468
Gaya	Mohanpur	Matihani	Parsauni	24.596089	85.0410121
Gaya	Mohanpur	Matihani	Parsauni	24.596107	85.0429955
Gaya	Mohanpur	Matihani	Parsauni	24.597194	85.0563052
Gaya	Mohanpur	Matihani	Barki Bihia	24.599405	85.0559805
Gaya	Mohanpur	Matihani	Barki Bihia	24.599405	85.0559805
Gaya	Mohanpur	Matihani	Itahri	24.600949	85.0579283
Gaya	Mohanpur	Matihani	Rendibar	24.606305	85.0333663
Gaya	Mohanpur	Lakhaipur	Majhauli	24.592574	85.1305948
Gaya	Mohanpur	Bagula	Narhar	24.539546	85.0822691
Gaya	Mohanpur	Bagula		24.54853	85.0673181
Gaya	Mohanpur	Bagula		24.539006	85.0884338
Gaya	Mohanpur	Bagula	Raundawa	24.548193	85.0678007
Gaya	Mohanpur	Bagula		24.545792	85.0660401
Gaya	Mohanpur	Bagula		24.5458	85.0662265
Gaya	Mohanpur	Bagula		24.545864	85.0659161
Gaya	Mohanpur	Guriyawan	Guriawan	24.545944	85.0659857
Gaya	Mohanpur	Guriyawan	Guriawan	24.545817	85.0660417
Gaya	Mohanpur	Bumuar	Semarwar	24.550115	85.0648075
Gaya	Mohanpur	Bumuar	Bumuar	24.550126	85.0645562
Gaya	Mohanpur	Bumuar	Durjun Khap	24.550177	85.0643615
Gaya	Mohanpur	Guriyawan	Nidani	24.55424	85.0673413
Gaya	Mohanpur	Bagula	Raundawa	24.550167	85.0639063
Gaya	Mohanpur	Bagula	Musar Sabda	24.555492	85.0311655
Gaya	Mohanpur	Matihani	Barki Bihia	24.600261	85.0489111
Gaya	Mohanpur	Matihani		24.59789	85.0512171
Gaya	Mohanpur	Matihani	Barki Bihia	24.600558	85.0518918
Gaya	Mohanpur	Matihani	Barki Bihia	24.600458	85.0518924
Gaya	Mohanpur	Matihani	Barki Bihia	24.600795	85.0546015
Gaya	Mohanpur	Matihani	Kachanpur	24.632724	85.0382956
Gaya	Mohanpur	Matihani	Kachanpur	24.632756	85.0383317
Gaya	Mohanpur	Matihani	Kachanpur	24.632936	85.0383141
Gaya	Mohanpur	Dema	Rajbar	24.645346	85.0010916
Gaya	Mohanpur	Dema	Rajbar	24.643423	85.0099167
Gaya	Mohanpur	Dema	Diwan	24.630198	85.0355253
Gaya	Mohanpur	Dema	Diwan	24.625303	85.0201967
Gaya	Mohanpur	Teswar	Sukhdewa Chak	24.66086	85.0225339
Gaya	Mohanpur	Dema	Rajbar	24.63095	85.0134382
Gaya	Mohanpur	Dema	Rajbar	24.629302	85.0140017
Gaya	Mohanpur	Dema	Diwan	24.63095	85.0134382
Gaya	Mohanpur	Dema	Diwan	24.628718	85.0131133
Gaya	Mohanpur	Teswar	Chorniman	24.640291	85.0276522
Gaya	Mohanpur	Teswar	Chorniman	24.642531	85.0166868
Gaya	Mohanpur	Teswar	Chorniman	24.643422	85.0212346
Gaya	Mohanpur	Teswar	Sukhdewa Chak	24.649651	85.0262315
Gaya	Mohanpur	Teswar	Sugawan	24.649569	85.0280556
Gaya	Mohanpur	Teswar	Sugawan	24.64458	85.0339015

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Teswar	Jainagar	24.647335	85.0296847
Gaya	Mohanpur	Teswar	Chorniman	24.642268	85.0199353
Gaya	Mohanpur	Dema	Diwan	24.607757	85.0397468
Gaya	Mohanpur	Dema	Diwan	24.612555	85.0056406
Gaya	Mohanpur	Sinduar	Senduar	24.532381	85.0240066
Gaya	Mohanpur	Sinduar	Senduar	24.534942	85.0343275
Gaya	Mohanpur	Sinduar	Senduar	24.538733	85.034308
Gaya	Mohanpur	Sinduar	Senduar	24.535577	85.0354113
Gaya	Mohanpur	Sinduar	Senduar	24.527253	85.0232802
Gaya	Mohanpur	Sinduar	Senduar	24.531235	85.020585
Gaya	Mohanpur	Sinduar	Mero Khap	24.53231	85.0533835
Gaya	Mohanpur	Sinduar	Senduar	24.527442	85.0335864
Gaya	Mohanpur	Sinduar	Mero Khap	24.520762	85.0376215
Gaya	Mohanpur	Siriyawan	Mohanpur	24.570695	85.0855935
Gaya	Mohanpur	Erki	Erki	24.609699	85.0776346
Gaya	Mohanpur	Erki	Mehiyan	24.611982	85.0670168
Gaya	Mohanpur	Erki	Mehiyan	24.611982	85.0670168
Gaya	Mohanpur	Erki	Dhanahari	24.588584	85.0988149
Gaya	Mohanpur	Erki	Dhanahari	24.602049	85.0963636
Gaya	Mohanpur	Erki	Erki	24.617513	85.1004367
Gaya	Mohanpur	Erki		24.627033	85.0744812
Gaya	Mohanpur	Erki	Khuruwa	24.607517	85.1004367
Gaya	Mohanpur	Erki	Bhawani Bigha	24.607517	85.1004367
Gaya	Mohanpur	Erki		24.631639	85.1480984
Gaya	Mohanpur	Dharhara	Naghara	24.565523	85.0387726
Gaya	Mohanpur	Dharhara	Jadua Chak	24.565523	85.0387726
Gaya	Mohanpur	Dharhara	Nauniyan	24.558662	85.0666922
Gaya	Mohanpur	Dharhara	Jadua Chak	24.558206	85.0527342
Gaya	Mohanpur	Siriyawan	Mohanpur	24.578351	85.0851891
Gaya	Mohanpur	Siriyawan	Mohanpur	24.578429	85.0849042
Gaya	Mohanpur	Siriyawan	Mohanpur	24.578429	85.0849042
Gaya	Mohanpur	Siriyawan	Mohanpur	24.578429	85.0849042
Gaya	Mohanpur	Siriyawan	Mohanpur	24.578429	85.0849042
Gaya	Mohanpur	Bagula	Sahnu	24.550399	85.0392098
Gaya	Mohanpur	Khardih	Sujan Chak	24.596503	85.0307035
Gaya	Mohanpur	Khardih	Barheta	24.578163	85.0459195
Gaya	Mohanpur	Dharhara	Jamuna	24.563027	85.0174336
Gaya	Mohanpur	Khardih		24.579812	85.0449809
Gaya	Mohanpur	Khardih	Barheta	24.578184	85.0410457
Gaya	Mohanpur	Khardih	Mahamadpur	24.590128	85.0581239
Gaya	Mohanpur	Khardih	Sujan Chak	24.594223	85.0279624
Gaya	Mohanpur	Khardih	Dhamna	24.611219	85.0550066
Gaya	Mohanpur	Bumuar	Lahthua	24.564081	84.9838668
Gaya	Mohanpur	Teswar	Teswar	24.634973	85.0569544
Gaya	Mohanpur	Teswar	Jainagar	24.646089	85.0288364
Gaya	Mohanpur	Dharhara	Naghara	24.56197	85.0433186
Gaya	Mohanpur	Dharhara	Dharhara	24.573112	85.0218843
Gaya	Mohanpur	Teswar	Sukhdewa Chak	24.653383	85.0202601
Gaya	Mohanpur	Guriyawan	Guriawan	24.666543	85.0524278
Gaya	Mohanpur	Guriyawan	Guriawan	24.694171	84.9780157
Gaya	Mohanpur	Guriyawan	Nidani	24.611675	85.0689641
Gaya	Mohanpur	Guriyawan	Nidani	24.626292	85.097193
Gaya	Mohanpur	Guriyawan	Nidani	24.627768	85.0916962
Gaya	Mohanpur	Guriyawan	Nidani	24.626292	85.097193
Gaya	Mohanpur	Guriyawan	Lebura	24.626313	85.0751303
Gaya	Mohanpur	Bagula		24.557681	85.0254572
Gaya	Mohanpur	Bagula	Lodia	24.530628	85.0472149

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Bagula	Dangra	24.530236	85.0465656
Gaya	Mohanpur	Bumuar	Semarwar	24.552594	85.0283804
Gaya	Mohanpur	Siriyawan	Baliyari	24.576101	85.0699968
Gaya	Mohanpur	Siriyawan	Baliyari	24.576101	85.0699968
Gaya	Mohanpur	Bumuar	Semarwar	24.555657	85.0109578
Gaya	Mohanpur	Siriyawan	Siriyawan	24.576101	85.0699968
Gaya	Mohanpur	Khardih	Dhamna	24.6	85.0331484
Gaya	Mohanpur	Khardih	Dhamna	24.599256	85.0176614
Gaya	Mohanpur	Khardih	Dhamna	24.597872	85.020585
Gaya	Mohanpur	Khardih	Sujan Chak	24.599256	85.0176614
Gaya	Mohanpur	Khardih	Sujan Chak	24.608724	85.024158
Gaya	Mohanpur	Dharhara	Dhirja Chak	24.567696	85.0356939
Gaya	Mohanpur	Dharhara	Naghara	24.566885	85.0331761
Gaya	Mohanpur	Dharhara	Hamzapur	24.56254	85.0381232
Gaya	Mohanpur	Khardih	Sujan Chak	24.60167	85.0235084
Gaya	Mohanpur	Dharhara	Dhamni	24.56365	85.0381232
Gaya	Mohanpur	Dharhara	Dharhara	24.557816	85.0479543
Gaya	Mohanpur	Khardih	Khardi	24.578799	85.0147377
Gaya	Mohanpur	Khardih	Ramgiriya	24.579159	85.0144128
Gaya	Mohanpur	Khardih	Khardi	24.581909	85.0114765
Gaya	Mohanpur	Bagula	Raundawa	24.552264	85.0636708
Gaya	Mohanpur	Khardih	Khardi	24.578799	85.0147377
Gaya	Mohanpur	Khardih	Khardi	24.584406	85.016362
Gaya	Mohanpur	Dema	Diwan	24.615507	85.0153417
Gaya	Mohanpur	Bagula	Raundawa	24.548866	85.0614989
Gaya	Mohanpur	Bagula	Raundawa	24.533337	85.0621481
Gaya	Mohanpur	Dema	Diwan	24.61374	85.0229833
Gaya	Mohanpur	Bagula	Musar Sabda	24.548905	85.0400715
Gaya	Mohanpur	Sinduar	Senduar	24.524017	85.023881
Gaya	Mohanpur	Sinduar	Senduar	24.527235	85.0233196
Gaya	Mohanpur	Sinduar	Senduar	24.527493	85.0233299
Gaya	Mohanpur	Sinduar	Senduar	24.538703	85.0342825
Gaya	Mohanpur	Bagula	Dangra	24.524851	85.0403963
Gaya	Mohanpur	Gopal Kera	Gopal Kera	24.518627	85.0824734
Gaya	Mohanpur	Gopal Kera	Chawa	24.525524	85.0884745
Gaya	Mohanpur	Gopal Kera	Chawa	24.525531	85.0883422
Gaya	Mohanpur	Gopal Kera	Chawa	24.525113	85.0885271
Gaya	Mohanpur	Gopal Kera	Gopal Kera	24.519957	85.0853866
Gaya	Mohanpur	Gopal Kera	Bagaha	24.534717	85.069107
Gaya	Mohanpur	Teswar	Chorniman	24.64131	85.0278648
Gaya	Mohanpur	Kewala	Matgarha	24.493347	85.1192469
Gaya	Mohanpur	Kewala	Matgarha	24.548931	85.1898902
Gaya	Mohanpur	Kewala	Matgarha	24.507523	85.1748466
Gaya	Mohanpur	Kewala	Matgarha	24.476238	85.1399956
Gaya	Mohanpur	Kewala	Matgarha	24.476238	85.1399956
Gaya	Mohanpur	Kewala	Kewala	24.493347	85.1192469
Gaya	Mohanpur	Kewala	Matgarha	24.50801	85.180973
Gaya	Mohanpur	Kewala	Matgarha	24.507272	85.1818822
Gaya	Mohanpur	Kewala		24.476238	85.1399956
Gaya	Mohanpur	Kewala	Matgarha	24.508159	85.1860041
Gaya	Mohanpur	Kewala	Matgarha	24.548931	85.1898902
Gaya	Mohanpur	Kewala	Matgarha	24.509235	85.1849814
Gaya	Mohanpur	Kewala	Kewala	24.509715	85.1853614
Gaya	Mohanpur	Kewala		24.548931	85.1898902
Gaya	Mohanpur	Kewala	Matgarha	24.510014	85.1847069
Gaya	Mohanpur	Kewala	Ghughuri	24.556791	85.1692758
Gaya	Mohanpur	Kewala	Ghughuri	24.560564	85.162008

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Kewala	Ghughuri	24.560564	85.162008
Gaya	Mohanpur	Kewala	Ghughuri	24.565782	85.161618
Gaya	Mohanpur	Kewala	Langura Kalan	24.560608	85.1497188
Gaya	Mohanpur	Kewala	Ghughuri	24.560608	85.1497188
Gaya	Mohanpur	Kewala	Langura Kalan	24.560608	85.1497188
Gaya	Mohanpur	Dema	Diwan	24.612598	85.0069403
Gaya	Mohanpur	Dema	Diwan	24.61296	85.0403963
Gaya	Mohanpur	Kewala		24.560331	85.1526355
Gaya	Mohanpur	Dema	Diwan	24.603658	85.0190383
Gaya	Mohanpur	Dema	Diwan	24.61175	85.0036911
Gaya	Mohanpur	Dema	Diwan	24.602282	85.0196104
Gaya	Mohanpur	Dharhara	Barhai Chak	24.574265	85.0473953
Gaya	Mohanpur	Khardih	Bankat	24.584526	85.0436911
Gaya	Mohanpur	Khardih	Bankat	24.580448	85.0423445
Gaya	Mohanpur	Khardih	Bara	24.580448	85.0423445
Gaya	Mohanpur	Khardih	Bankat	24.581601	85.0436433
Gaya	Mohanpur	Khardih	Barheta	24.580448	85.0423445
Gaya	Mohanpur	Khardih	Barheta	24.597322	85.0602005
Gaya	Mohanpur	Dharhara	Barhai Chak	24.553974	85.0478643
Gaya	Mohanpur	Musaila	Shahpur	24.548213	85.0886773
Gaya	Mohanpur	Musaila	Khutaura	24.539345	85.0874605
Gaya	Mohanpur	Musaila	Arjuna	24.539345	85.0874605
Gaya	Mohanpur	Musaila	Hade	24.535758	85.0910293
Gaya	Mohanpur	Musaila	Hade	24.53429	85.0881814
Gaya	Mohanpur	Musaila	Hade	24.538129	85.084216
Gaya	Mohanpur	Musaila	Hade	24.539166	85.0819447
Gaya	Mohanpur	Musaila	Hade	24.539166	85.0819447
Gaya	Mohanpur	Musaila	Musaila	24.533576	85.0888338
Gaya	Mohanpur	Musaila	Hade	24.539166	85.0819447
Gaya	Mohanpur	Musaila	Hade	24.533029	85.0868116
Gaya	Mohanpur	Musaila	Hade	24.539345	85.0874605
Gaya	Mohanpur	Kewala	Kewala	24.56568	85.1351278
Gaya	Mohanpur	Kewala		24.56143	85.1380953
Gaya	Mohanpur	Kewala	Langura Kalan	24.554439	85.1506296
Gaya	Mohanpur	Ambatari	Banda	24.558281	85.2061715
Gaya	Mohanpur	Kewala	Matgarha	24.513133	85.1780076
Gaya	Mohanpur	Kewala	Matgarha	24.509433	85.1758216
Gaya	Mohanpur	Ladu	Balkoa	24.58686	84.9965583
Gaya	Mohanpur	Ladu	Mahuliya	24.581979	84.9877672
Gaya	Mohanpur	Ladu	Mahuliya	24.58858	84.992745
Gaya	Mohanpur	Kewala	Ghughuri	24.566027	85.1620585
Gaya	Mohanpur	Teswar	Sukhdewa Chak	24.633312	85.041301
Gaya	Mohanpur	Teswar	Sukhdewa Chak	24.652473	85.0180133
Gaya	Mohanpur	Teswar	Chorniman	24.640191	85.0275129
Gaya	Mohanpur	Dema	Diwan	24.602558	85.0250517
Gaya	Mohanpur	Dharhara	Hamzapur	24.565501	85.0381232
Gaya	Mohanpur	Dharhara	Barhai Chak	24.572626	85.0479025
Gaya	Mohanpur	Dharhara	Barhai Chak	24.553931	85.0465656
Gaya	Mohanpur	Dharhara	Barhai Chak	24.573728	85.0484999
Gaya	Mohanpur	Dharhara	Barhai Chak	24.576754	85.0463259
Gaya	Mohanpur	Dharhara	Jadua Chak	24.557296	85.058085
Gaya	Mohanpur	Teswar	Banahi	24.627845	85.0355854
Gaya	Mohanpur	Dharhara	Barhai Chak	24.573161	85.0511288
Gaya	Mohanpur	Lakhaipur	Pathra	24.580653	85.1306283
Gaya	Mohanpur	Kewala	Kewala	24.559825	85.1876707
Gaya	Mohanpur	Kewala	Kewala	24.546192	85.1913546
Gaya	Mohanpur	Kewala	Kewala	24.539309	85.1991328

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Bagula	Bagula	24.534481	85.0477672
Gaya	Mohanpur	Teswar	Ramdasa	24.63654	85.0324624
Gaya	Mohanpur	Teswar	Banahi	24.630381	85.0353974
Gaya	Mohanpur	Amkola	Langura Khurd	24.564163	85.1494377
Gaya	Mohanpur	Lakhaipur	Kenuari	24.589153	85.1089863
Gaya	Mohanpur	Dema	Jhanakpur	24.609193	85.0299167
Gaya	Mohanpur	Dema	Jhanakpur	24.607793	85.0269883
Gaya	Mohanpur	Ladu	Jogar	24.571167	84.99435
Gaya	Mohanpur	Ladu	Majhianwan	24.568143	85.001065
Gaya	Mohanpur	Dema	Diwan	24.615038	85.0057941
Gaya	Mohanpur	Dema	Diwan	24.609342	85.0092146
Gaya	Mohanpur	Ladu	Amahna	24.611685	85.0017415
Gaya	Mohanpur	Dema	Diwan	24.606208	85.0150044
Gaya	Mohanpur	Dema	Belarpur	24.608478	85.0166868
Gaya	Mohanpur	Dema	Diwan	24.592882	85.0264316
Gaya	Mohanpur	Dema	Nima	24.608478	85.0166868
Gaya	Mohanpur	Dema	Diwan	24.602303	85.019967
Gaya	Mohanpur	Dema	Bishunpur	24.60302	85.0194895
Gaya	Mohanpur	Dharhara	Jadua Chak	24.560423	85.0590377
Gaya	Mohanpur	Dharhara	Jadua Chak	24.556607	85.0595518
Gaya	Mohanpur	Dharhara	Jadua Chak	24.556188	85.0546303
Gaya	Mohanpur	Dharhara	Salaia	24.564082	85.0528704
Gaya	Mohanpur	Dharhara	Nauniyan	24.570836	85.0550952
Gaya	Mohanpur	Dharhara	Dhamni	24.561893	85.0463494
Gaya	Mohanpur	Khardih	Karjara	24.606593	85.06019
Gaya	Mohanpur	Dharhara	Bhatu Chak	24.57188	85.04358
Gaya	Mohanpur	Dharhara	Hamzapur	24.569756	85.042997
Gaya	Mohanpur	Matihani	Parsauni	24.595268	85.0387333
Gaya	Mohanpur	Dharhara	Nawadih	24.571347	85.025994
Gaya	Mohanpur	Dharhara	Lai	24.563126	85.0245027
Gaya	Mohanpur	Dharhara	Sehuan	24.561439	85.0158085
Gaya	Mohanpur	Dema	Jhanakpur	24.592882	85.0264316
Gaya	Mohanpur	Dema	Bhagwanpur	24.60947	85.0131133
Gaya	Mohanpur	Dema	Jhanakpur	24.592871	85.0261068
Gaya	Mohanpur	Dema	Diwan	24.611326	85.0020664
Gaya	Mohanpur	Musaila	Hade	24.520609	85.0920025
Gaya	Mohanpur	Dharhara	Dhamni	24.553931	85.0465656
Gaya	Mohanpur	Musaila	Hade	24.542794	85.0979532
Gaya	Mohanpur	Musaila	Hade	24.542728	85.1004367
Gaya	Mohanpur	Bumuar	Chauari	24.562757	84.9894267
Gaya	Mohanpur	Bumuar	Lahthua	24.553282	84.9942933
Gaya	Mohanpur	Bumuar	Lahthua	24.555448	84.9802912
Gaya	Mohanpur	Teswar	Inta Tikar	24.630822	85.0217067
Gaya	Mohanpur	Bumuar	Amsot	24.55316	84.9938267
Gaya	Mohanpur	Teswar	Chorniman	24.64103	85.024295
Gaya	Mohanpur	Bumuar	Semarwar	24.576632	85.016362
Gaya	Mohanpur	Bumuar	Semarwar	24.554988	84.9887423
Gaya	Mohanpur	Bumuar	Semarwar	24.568631	84.9871172
Gaya	Mohanpur	Bumuar	Semarwar	24.553705	85.0283804
Gaya	Mohanpur	Teswar	Chorniman	24.64119	85.027805
Gaya	Mohanpur	Bumuar	Itra	24.55192	85.0112117
Gaya	Mohanpur	Bumuar	Itra	24.55192	85.0112117
Gaya	Mohanpur	Teswar	Chorniman	24.640122	85.02826
Gaya	Mohanpur	Bumuar	Itra	24.548244	84.9975171
Gaya	Mohanpur	Teswar	Chorniman	24.637862	85.0270033
Gaya	Mohanpur	Bumuar	Itra	24.548244	84.9975171
Gaya	Mohanpur	Bumuar	Itra	24.548244	84.9975171

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Teswar	Ramdasa	24.636923	85.02705
Gaya	Mohanpur	Teswar	Sagarpur	24.646195	85.0283067
Gaya	Mohanpur	Bumuar	Amsot	24.534514	84.9965422
Gaya	Mohanpur	Bumuar	Bumuar	24.529309	84.9958922
Gaya	Mohanpur	Teswar	Ramdasa	24.645878	85.0330217
Gaya	Mohanpur	Sinduar	Jamuhar	24.54516	85.0127967
Gaya	Mohanpur	Bumuar	Bumuar	24.529309	84.9958922
Gaya	Mohanpur	Sinduar	Jamuhar	24.544818	85.0128133
Gaya	Mohanpur	Bumuar	Amsot	24.53766	84.99719
Gaya	Mohanpur	Bumuar	Bumuar	24.529309	84.9958922
Gaya	Mohanpur	Sinduar	Jamuhar	24.548271	85.0433186
Gaya	Mohanpur	Musaila	Hade	24.539444	85.0982691
Gaya	Mohanpur	Sinduar	Senduar	24.542755	85.0165917
Gaya	Mohanpur	Sinduar	Jamuhar	24.54361	85.011585
Gaya	Mohanpur	Sinduar	Senduar	24.53688	85.0121387
Gaya	Mohanpur	Siriyawan	Siriyawan	24.581553	85.0737311
Gaya	Mohanpur	Siriyawan	Siriyawan	24.580779	85.0642023
Gaya	Mohanpur	Teswar	Sagarpur	24.643955	85.021265
Gaya	Mohanpur	Siriyawan	Siriyawan	24.584217	85.0628485
Gaya	Mohanpur	Siriyawan	Siriyawan	24.584217	85.0628485
Gaya	Mohanpur	Matihani	Dharahar	24.613585	85.0582733
Gaya	Mohanpur	Matihani	Pipra Chak	24.613514	85.057279
Gaya	Mohanpur	Matihani	Barki Bihia	24.598358	85.0579283
Gaya	Mohanpur	Sinduar	Jamuhar	24.530728	85.0162583
Gaya	Mohanpur	Sinduar	Jamuhar	24.526197	85.0053983
Gaya	Mohanpur	Khardih	Bihia	24.597977	85.0576037
Gaya	Mohanpur	Khardih	Bihia	24.594937	85.0577117
Gaya	Mohanpur	Musaila	Tilaiya	24.538804	85.0998595
Gaya	Mohanpur	Musaila	Khutaura	24.545765	85.0913537
Gaya	Mohanpur	Khardih	Bahera	24.582302	85.077417
Gaya	Mohanpur	Sinduar	Bazu Kalan	24.502678	85.007915
Gaya	Mohanpur	Musaila	Hade	24.539866	85.0983117
Gaya	Mohanpur	Sinduar	Bazu Kalan	24.502023	85.0105142
Gaya	Mohanpur	Musaila	Hade	24.540251	85.0980695
Gaya	Mohanpur	Musaila	Shahpur	24.545765	85.0913537
Gaya	Mohanpur	Sinduar	Roshan Chak	24.504384	85.0147377
Gaya	Mohanpur	Sinduar	Senduar	24.524817	85.0280617
Gaya	Mohanpur	Sinduar	Senduar	24.52624	85.0264733
Gaya	Mohanpur	Musaila	Musaila	24.545141	85.0978122
Gaya	Mohanpur	Sinduar	Senduar	24.534502	85.0331883
Gaya	Mohanpur	Ladu	Laru	24.588693	84.9886813
Gaya	Mohanpur	Sinduar	Senduar	24.53606	85.034115
Gaya	Mohanpur	Ladu	Jogar	24.587251	84.9894611
Gaya	Mohanpur	Ladu	Jogar	24.581343	84.9922026
Gaya	Mohanpur	Ladu	Laru	24.580191	84.9921223
Gaya	Mohanpur	Ladu	Balkoa	24.580107	84.9871172
Gaya	Mohanpur	Sinduar	Senduar	24.535885	85.0341283
Gaya	Mohanpur	Musaila	Musaila	24.544695	85.089008
Gaya	Mohanpur	Musaila	Tilaiya	24.545765	85.0913537
Gaya	Mohanpur	Sinduar	Senduar	24.548271	85.0433186
Gaya	Mohanpur	Musaila	Musaila	24.544389	85.0881776
Gaya	Mohanpur	Sinduar	Jhalar	24.544612	85.031835
Gaya	Mohanpur	Musaila	Shahpur	24.546068	85.0886973
Gaya	Mohanpur	Sinduar	Jhalar	24.54479	85.0387726
Gaya	Mohanpur	Siriyawan	Siriyawan	24.586922	85.0757523
Gaya	Mohanpur	Siriyawan	Mohanpur	24.562472	85.0701131
Gaya	Mohanpur	Siriyawan	Baliyari	24.562414	85.0700089

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Siriyawan	Baliyari	24.56267	85.0695978
Gaya	Mohanpur	Siriyawan	Siriyawan	24.559465	85.0702796
Gaya	Mohanpur	Siriyawan	Mohanpur	24.55954	85.07009
Gaya	Mohanpur	Gopal Kera	Bandegara	24.525687	85.0570006
Gaya	Mohanpur	Gopal Kera	Gopal Kera	24.525139	85.0569317
Gaya	Mohanpur	Gopal Kera	Manrar	24.523008	85.0569453
Gaya	Mohanpur	Gopal Kera	Chawa	24.523113	85.0568116
Gaya	Mohanpur	Gopal Kera	Bagaha	24.523113	85.0568116
Gaya	Mohanpur	Bagula	Raundawa	24.550073	85.0626754
Gaya	Mohanpur	Bagula	Raundawa	24.550142	85.0623283
Gaya	Mohanpur	Bagula	Raundawa	24.54682	85.06249
Gaya	Mohanpur	Bagula	Nataha	24.541025	85.0660417
Gaya	Mohanpur	Bagula	Narhar	24.53617	85.0679567
Gaya	Mohanpur	Bagula	Dangra	24.516311	85.0283804
Gaya	Mohanpur	Bagula	Dangra	24.516311	85.0283804
Gaya	Mohanpur	Bagula	Dangra	24.525988	85.0398917
Gaya	Mohanpur	Guriyawan	Guriawan	24.653529	85.0576646
Gaya	Mohanpur	Guriyawan	Nidani	24.620233	85.0746286
Gaya	Mohanpur	Guriyawan	Guriawan	24.642065	85.0687715
Gaya	Mohanpur	Guriyawan	Guriawan	24.641329	85.0744378
Gaya	Mohanpur	Erki	Bhagwanpur	24.618683	85.1003178
Gaya	Mohanpur	Erki	Khuruwa	24.557562	85.0670168
Gaya	Mohanpur	Erki	Khuruwa	24.596023	85.1187886
Gaya	Mohanpur	Erki	Rampur	24.601009	85.1018687
Gaya	Mohanpur	Erki	Dhanahari	24.608238	85.0770773
Gaya	Mohanpur	Erki	Dhanahari	24.608037	85.0822691
Gaya	Mohanpur	Erki	Erki	24.612669	85.0653939
Gaya	Mohanpur	Lakhaipur	Pakariya	24.570167	85.1270286
Gaya	Mohanpur	Lakhaipur	Pathra	24.577374	85.1299464
Gaya	Mohanpur	Lakhaipur	Majhauli	24.579068	85.135019
Gaya	Mohanpur	Lakhaipur	Majhauli	24.57715	85.1348364
Gaya	Mohanpur	Lakhaipur	Pathra	24.577374	85.1299464
Gaya	Mohanpur	Lakhaipur	Jogini	24.59021	85.1263842
Gaya	Mohanpur	Lakhaipur	Jogiya	24.586115	85.118108
Gaya	Mohanpur	Lakhaipur	Lakhaipur	24.592083	85.1067222
Gaya	Mohanpur	Lakhaipur	Lakhaipur	24.592139	85.1066358
Gaya	Mohanpur	Lakhaipur	Lakhaipur	24.589413	85.1074447
Gaya	Mohanpur	Bagula	Bagula	24.536427	85.0474017
Gaya	Mohanpur	Bagula	Bagula	24.548271	85.0433186
Gaya	Mohanpur	Bagula	Bagula	24.551385	85.0425583
Gaya	Mohanpur	Guriyawan	Nidani	24.620573	85.1005673
Gaya	Mohanpur	Guriyawan	Nidani	24.626023	85.0996559
Gaya	Mohanpur	Guriyawan	Nidani	24.625076	85.0916226
Gaya	Mohanpur	Guriyawan	Lebura	24.638615	85.0656635
Gaya	Mohanpur	Guriyawan	Guriawan	24.641689	85.0622847
Gaya	Mohanpur	Guriyawan	Guriawan	24.628027	85.0709114
Gaya	Mohanpur	Guriyawan	Guriawan	24.659274	85.0726245
Gaya	Mohanpur	Guriyawan	Guriawan	24.658044	85.0742986
Gaya	Mohanpur	Teswar	Sagarpur	24.643955	85.021265
Gaya	Mohanpur	Dharhara	Jadua Chak	24.556333	85.054685
Gaya	Mohanpur	Dharhara	Dhamni	24.556714	85.0524095
Gaya	Mohanpur	Dharhara	Hamzapur	24.569702	85.042995
Gaya	Mohanpur	Dharhara	Bhatu Chak	24.576333	85.0410457
Gaya	Mohanpur	Dharhara	Ramsagar	24.563023	85.0247233
Gaya	Mohanpur	Dharhara	Dhamni	24.561888	85.0405667
Gaya	Mohanpur	Dharhara	Salaia	24.563997	85.052905
Gaya	Mohanpur	Dharhara	Nauniyan	24.566077	85.0670168

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Dharhara	Jadua Chak	24.568319	85.0676659
Gaya	Mohanpur	Dharhara	Jadua Chak	24.556725	85.0592533
Gaya	Mohanpur	Dharhara	Lai	24.566883	85.0361183
Gaya	Mohanpur	Teswar	Chorniman	24.64124	85.0278533
Gaya	Mohanpur	Teswar	Chorniman	24.637683	85.02685
Gaya	Mohanpur	Teswar	Ramdasa	24.636928	85.0270767
Gaya	Mohanpur	Teswar	Chorniman	24.640142	85.027905
Gaya	Mohanpur	Teswar	Chorniman	24.640978	85.0246933
Gaya	Mohanpur	Teswar	Sagarpur	24.644008	85.021445
Gaya	Mohanpur	Teswar	Sagarpur	24.64615	85.0283267
Gaya	Mohanpur	Teswar	Simariya	24.636097	85.03435
Gaya	Mohanpur	Musaila	Hade	24.539454	85.0982326
Gaya	Mohanpur	Musaila	Hade	24.539278	85.098799
Gaya	Mohanpur	Ladu	Amahna	24.588127	84.9879131
Gaya	Mohanpur	Ladu	Amahna	24.586835	84.9890673
Gaya	Mohanpur	Musaila	Musaila	24.538722	85.1083926
Gaya	Mohanpur	Teswar	Inta Tikar	24.636163	85.0221783
Gaya	Mohanpur	Sinduar	Senduar	24.538785	85.034335
Gaya	Mohanpur	Sinduar	Senduar	24.539184	85.037149
Gaya	Mohanpur	Sinduar	Senduar	24.539184	85.037149
Gaya	Mohanpur	Gopal Kera	Bongea	24.500827	85.1122368
Gaya	Mohanpur	Guriyawan	Guriawan	24.53781	85.0998783
Gaya	Mohanpur	Guriyawan	Guriawan	24.537663	85.0999493
Gaya	Mohanpur	Musaila	Musaila	24.507485	85.1098426
Gaya	Mohanpur	Musaila	Jagdishpur	24.537699	85.1000807
Gaya	Mohanpur	Dharhara	Nawadih	24.57035	85.02122
Gaya	Mohanpur	Bagula	Musar Sabda	24.538701	85.0676659
Gaya	Mohanpur	Bagula	Raundawa	24.540827	85.0647448
Gaya	Mohanpur	Bagula	Musar Sabda	24.534011	85.0374737
Gaya	Mohanpur	Bagula	Chuabar	24.544726	85.0368242
Gaya	Mohanpur	Bagula	Chuabar	24.546495	85.03874
Gaya	Mohanpur	Bagula	Chuabar	24.544726	85.0368242
Gaya	Mohanpur	Bagula	Musar Sabda	24.549044	85.0442927
Gaya	Mohanpur	Bagula	Narhar	24.532078	85.0576037
Gaya	Mohanpur	Bagula	Narhar	24.538658	85.0663676
Gaya	Mohanpur	Bagula	Narhar	24.54959	85.065865
Gaya	Mohanpur	Bagula	Chuabar	24.550505	85.0651467
Gaya	Mohanpur	Bagula	Musar Sabda	24.539325	85.0640956
Gaya	Mohanpur	Bagula	Lodia	24.538658	85.0663676
Gaya	Mohanpur	Bagula	Raundawa	24.543938	85.0662316
Gaya	Mohanpur	Bagula	Chuabar	24.550038	85.034775
Gaya	Mohanpur	Bagula	Chuabar	24.549044	85.0442927
Gaya	Mohanpur	Bagula	Musar Sabda	24.549083	85.0672167
Gaya	Mohanpur	Bagula	Musar Sabda	24.534262	85.060705
Gaya	Mohanpur	Dharhara	Barhai Chak	24.574095	85.047285
Gaya	Mohanpur	Amkola	Majura	24.527658	85.1392733
Gaya	Mohanpur	Amkola	Majura	24.527595	85.139225
Gaya	Mohanpur	Amkola	Majura	24.527588	85.1392567
Gaya	Mohanpur	Amkola	Majura	24.524933	85.1344067
Gaya	Mohanpur	Kewala	Matgarha	24.503006	85.1202197
Gaya	Mohanpur	Teswar	Inta Tikar	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Banahi	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Banahi	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Banahi	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Banahi	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Banahi	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Chorniman	24.630833	85.0222397

District	Block	Panchayat	Village	Latitude	Longitude
Gaya	Mohanpur	Teswar	Chorniman	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Kenari	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Kenari	24.630833	85.0222397
Gaya	Mohanpur	Teswar	Sukhdewa Chak	24.630833	85.0222397
Gaya	Mohanpur	Musaila	Tilaiya	24.551058	85.0709822
Gaya	Mohanpur	Musaila	Tilaiya	24.550512	85.0761219
Gaya	Mohanpur	Musaila	Hade	24.541619	85.0890827
Gaya	Mohanpur	Musaila	Tilaiya	24.541619	85.0890827
Gaya	Mohanpur	Musaila	Jagdishpur	24.538129	85.084216
Gaya	Mohanpur	Musaila	Musaila	24.544789	85.0899987
Gaya	Mohanpur	Musaila	Musaila	24.538266	85.0884338
Gaya	Mohanpur	Musaila	Duhobar	24.536911	85.0923269
Gaya	Mohanpur	Musaila	Hade	24.546057	85.0887952
Gaya	Mohanpur	Musaila	Shahpur	24.549594	85.0952466
Gaya	Mohanpur	Lakhaipur	Lakhaipur	24.589302	85.1083714
Gaya	Mohanpur	Lakhaipur	Lakhaipur	24.587461	85.1098426
Gaya	Mohanpur	Lakhaipur	Lahangpur	24.587461	85.1098426
Gaya	Mohanpur	Teswar	Teswar	24.641348	85.0618909

Annexure -III

Farmer Feedback Form

Photograph

Name	Gita devi	
Village	Ramnagar	
Block	Fatehpur	
District	Gaya	
Address	Fatehpur Thana.	
Mobile Number (optional)	9006441788	
Type and number of structures		
Type	BW (Domestic	BW (Irrigation)
Number	1	1
(coordinates of the structures are to be obtained by the field officer)	24.645104,	85.280248
Drill time discharge (lps)	20 lt/~~sec~~ & min	
Depth of installation of pump	60 ft	70 ft
Casing depth (Bore wells) HR	50 ft	70 ft.
Fracture encountered depth-HR	550-60 ft	70-80 ft
Slotted pipe depths (TW) SR	50 ft	70 ft
Average water levels – pre-monsoon	~~70 ft~~ 55 ft.	55 ft
Average water levels – post-monsoon	~~250~~ 25 ft	25 ft
The well is used for	Domestic ~~/ Irrigation~~	Irrigation
Is water available throughout the year	Yes	Yes
If not for how many months water is available	Very less water	Water tnt

Pumping Duration

	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified) wheat ~~(4 months)~~ 4 month	30 day	6-7 hr/day	20 lt/~~min~~ sec

23

4-5
(2~~-10~~)

Kharif (no of months to be specified) 3 month.	30 day	~~Kshu~~/day	20ft] 4 min 30 Sec
Others (no of months to be specified)			

Area Irrigated

	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified) 4 month.	2.5 Bigha	Wheat	
Khariff (no of months to be specified) 3 month	2.5 Bigha	Dhan	
Others (no of months to be specified)			

Cropping patterns (past and present) in the village

Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Prevailing Cropping pattern in the village.	Kharif	Rabi	Other
Type of Crop	Dhan	Wheat	
Area under crop			
Reasons for change in cropping pattern in last 20 years.	- Submersible tnc. - Electricity tnc.		
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop			
Average unit cost of production			
Average unit cost of selling			
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			

Source of Energy

Solar	○ Is it connected to grid ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)
Electric ✓	○ Do you get free electricity for irrigation? ✗ ○ Do you pay a fixed charge Yes. ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- ○ During Rabi-----
Diesel	○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi

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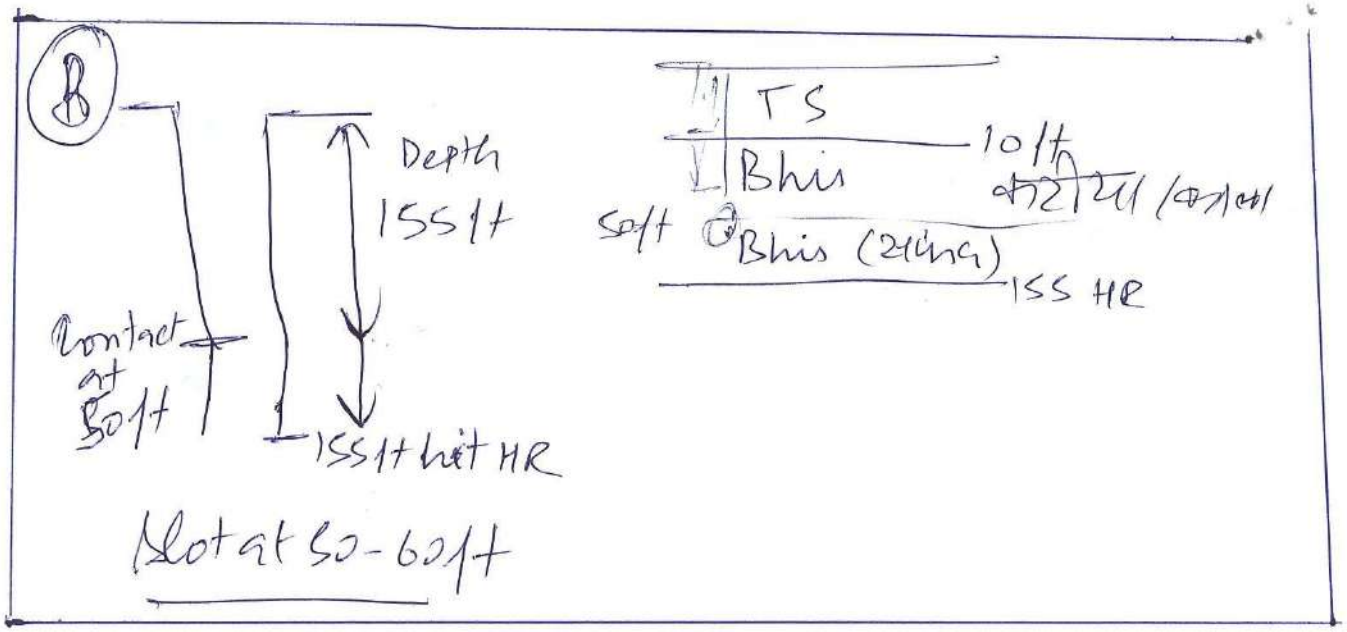
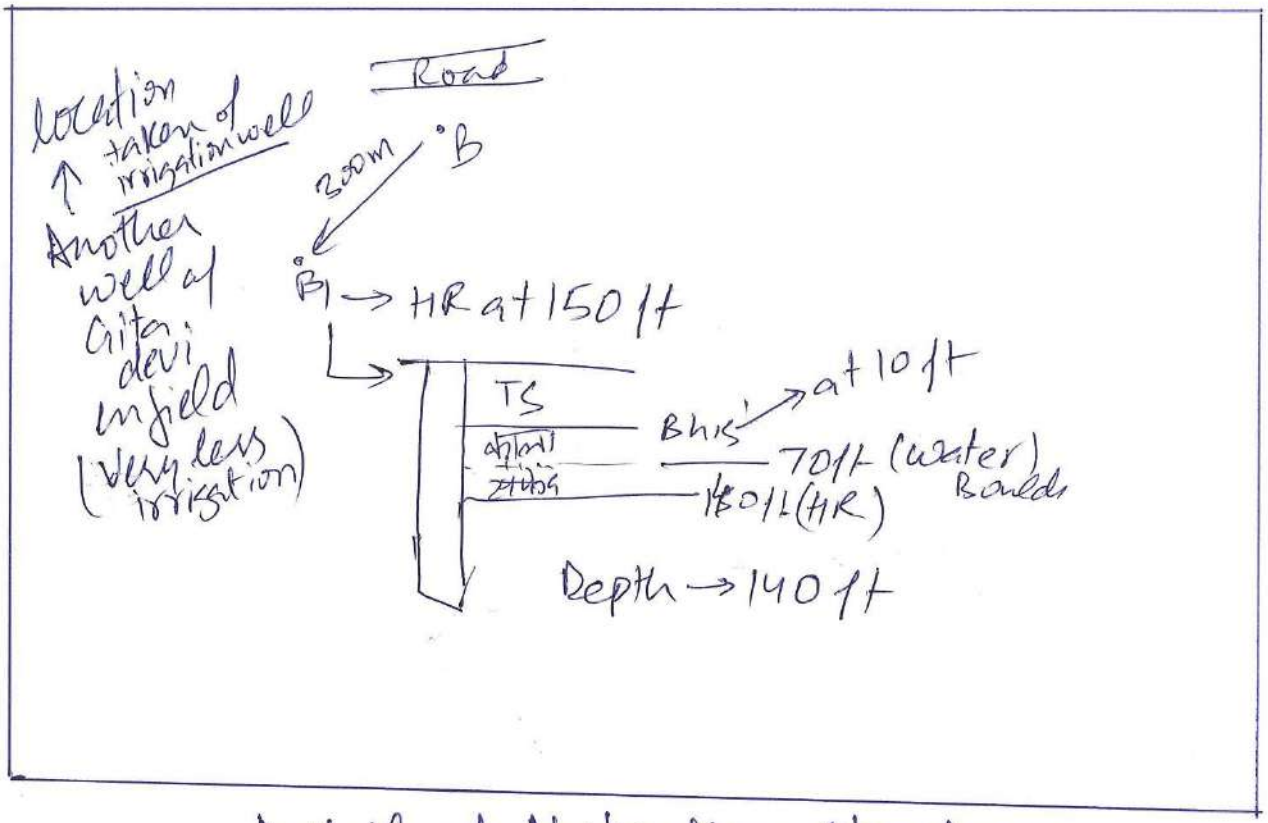
Water Market*	○ Do you share the pumped water with other farmers ○ If yes No ○ For how many days do you share pumped water in Kharif ○ For how many days do you share pumped water in Rabi Period ○ On an average how much do you charge per annum (in Rs)
	○ Do you receive additional water from boreholes of nearby farmers ○ If yes ○ For how many days do you receive pumped water in Kharif ○ For how many days do you receive pumped water in Rabi Period 50/- / Katha in Rabi ○ On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.





Details of Abstraction structures

Annexure -III

Farmer Feedback Form

Photograph		
Name	Sushil Kumar	
Village	Sewa Bigha.	
Block	Mohanpur	
District	Gaya	
Address	At house of Sushil Kumar.	
Mobile Number (optional)	9708352649	
Type and number of structures		
Type	TW	
Number	1	
(coordinates of the structures are to be obtained by the field officer)	24.651522	85.017311
Drill time discharge (lps)		
Depth of installation of pump	90 ft	
Casing depth (Bore wells) HR		
Fracture encountered depth-HR		
Slotted pipe depths (TW) SR	80 ft	
Average water levels – pre-monsoon	~~274 mbgl~~ 15.85 mbgl	
Average water levels – post-monsoon		
The well is used for	Irrigation	
Is water available throughout the year	Yes	
If not for how many months water is available		

Pumping Duration			
	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified) 4 month	15 day/Month	13 day 5 hour/day	

Kharif (no of months to be specified) 3-4 month	15 day/month	9 hours/day	
Others (no of months to be specified) 2 month	5 day/month	2 hour/day	

Area Irrigated

	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified)			
Khariff (no of months to be specified)			
Others (no of months to be specified)			

Cropping patterns (past and present) in the village

Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			Kharif – Rabi
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			Moong – Kharif – Rabi
Area under crop			
Reasons for change in cropping pattern in last 20 years.	Due to water scarcity.		
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop			
Average unit cost of production	10,000 Rs/Bigha	10,000 Rs/Bigha	Moong 40000 Rs/Bigha.
Average unit cost of selling			
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			

Source of Energy

Solar	○ Is it connected to grid ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)
Electric	○ Do you get free electricity for irrigation? ○ Do you pay a fixed charge ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- 40000/- ○ During Rabi----- 30000/-
Diesel	○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi

Water Market*	o Do you share the pumped water with other farmers Yes. o If yes o For how many days do you share pumped water in Kharif o For how many days do you share pumped water in Rabi Period o On an average how much do you charge per annum (in Rs) (100 ₹/Bigha)
	o Do you receive additional water from boreholes of nearby farmers o If yes o For how many days do you receive pumped water in Kharif o For how many days do you receive pumped water in Rabi Period o On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

Annexure -III

Farmer Feedback Form

Photograph		
Name	Rajesh Ravidas	
Village	Baijnathpur	
Block	Rohanpur	
District	Gaya	
Address	Th— ~~Mohalla~~ Sidhnagarha PO - Bachu	
Mobile Number (optional)	9631261732	
Type and number of structures		
Type	BW	BW with Pump (HP → 0.4 M
Number	1	1
(coordinates of the structures are to be obtained by the field officer)	24.462445, 85.146833	
Drill time discharge (lps)		
Depth of installation of pump	Failed Borewell (25ft)	25ft
Casing depth (Bore wells) HR	25ft	30ft (Jointed below MP)
Fracture encountered depth-HR		30ft
Slotted pipe depths (TW) SR	~~25ft~~ Failed Borewell (No Slotting)	
Average water levels – pre-monsoon	23ft	29ft
Average water levels – post-monsoon	23ft	25ft
The well is used for	Domestic Once (But Failed);	Only for Domestic
Is water available throughout the year	No.	Yes
If not for how many months water is available	No	Very less Water

Pumping Duration

	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified) 4 months	30 din	3hr/day	20lt in 4 min

→ 10 min operation with 15 min of recompment, the water increases by 1Ft

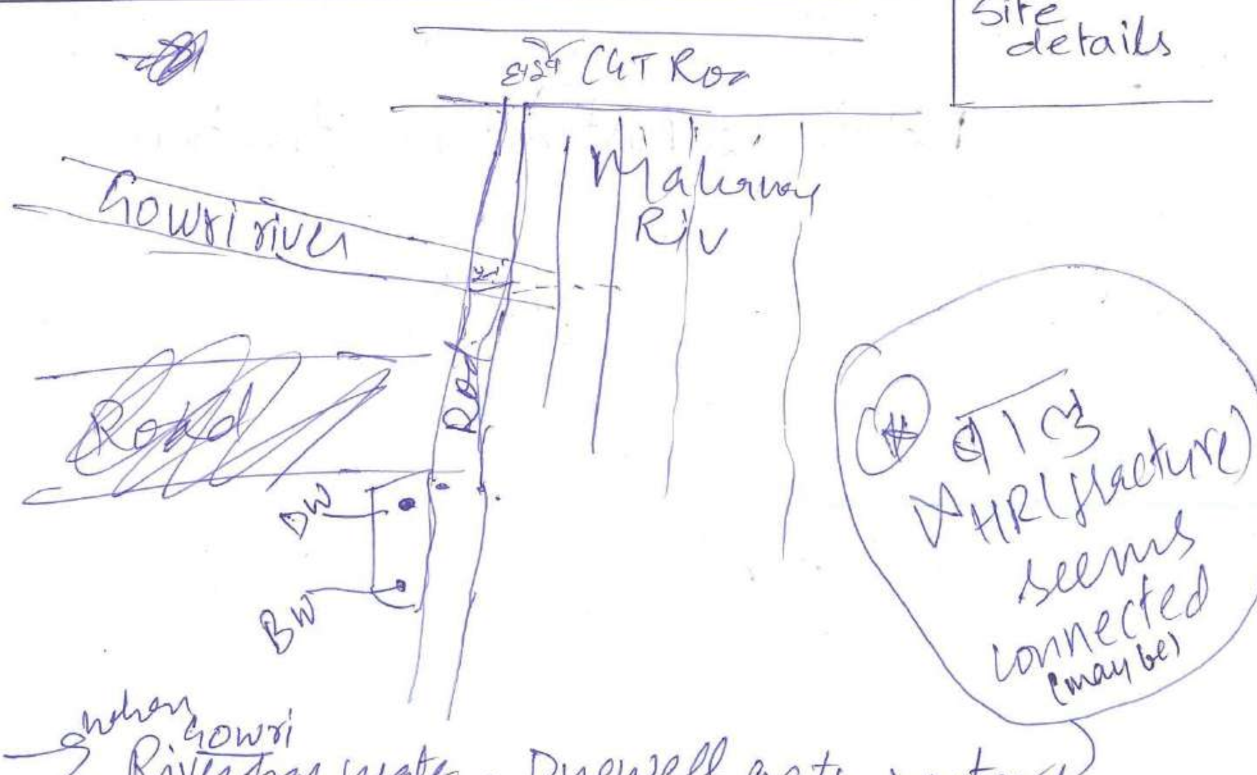
Kharif (no of months to be specified)	30 days	2hr/day	20lt in 1min
Others (no of months to be specified)			
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified) 4 Month	10 Katha	Wheat	
Khariff (no of months to be specified) 2 Month.	10 Katha	Dhan	
Others (no of months to be specified)	— No —	due to less water	
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop	Mot Madua & Makai		
Area under crop			
Prevailing Cropping pattern in the village	~~Kharif~~ Rabi	~~Rabi~~ Kharif	Other
Type of Crop	Wheat	Dhan	
Area under crop			
Reasons for change in cropping pattern in last 20 years.	— Submersible. + ve — hine + ve.		
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop			
Average unit cost of production	40000/-/Bisha	40000/-/Bisha.	
Average unit cost of selling	→ Very high cost of investment (Profit is only 100Bt)		
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			
Source of Energy			
Solar	○ Is it connected to grid ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric	○ Do you get free electricity for irrigation? ○ Do you pay a fixed charge ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- ○ During Rabi-----		
Diesel ✓	○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi } 4500/-/1Bigha		

Water Market*	○ Do you share the pumped water with other farmers ○ If yes ○ For how many days do you share pumped water in Kharif ○ For how many days do you share pumped water in Rabi Period ○ On an average how much do you charge per annum (in Rs)
	○ Do you receive additional water from boreholes of nearby farmers ○ If yes 50/- Ghanta ○ For how many days do you receive pumped water in Kharif ○ For how many days do you receive pumped water in Rabi Period ○ On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

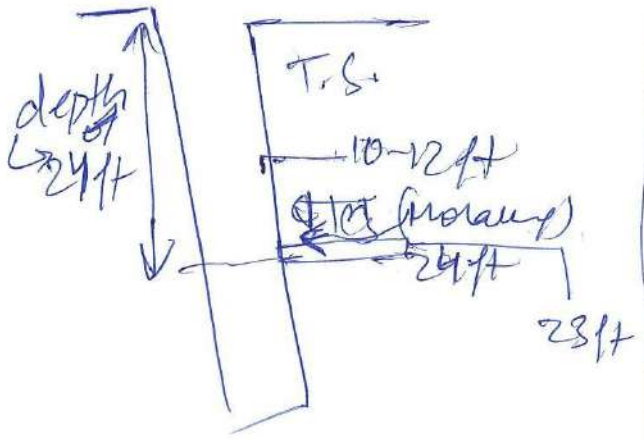
Irr. and Domestic requirement
- ~~wheat~~ – 3 एकड़ + 6 घंटा ... → ... 5 hr/day
- → Rainfed / Ahar /
- → Dependant on Dugwell

Site details



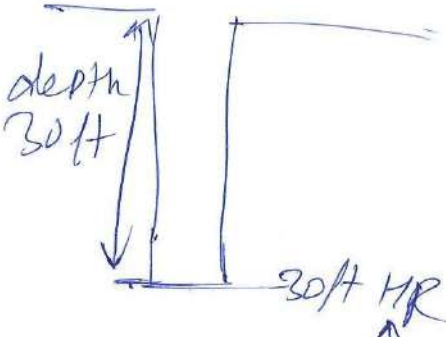
→ when Gowri River has water, Dugwell gets water & Boring

BW

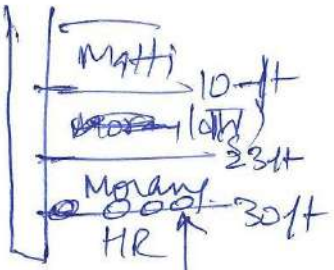


- 17ft ft Water (ind ft)
- HR at 30ft (in DW nearby)

DW



Kala Path. (Granitic gneiss)



in
→HR, water came after Earthquake. 25 year ago.

- First negligible water through Balu(ft)

Details of Abstraction Structures.

Annexure -III

Farmer Feedback Form

	Photograph	
Name	Upendra Yadav (S/o Bhagwat Yadav)	
Village	Thurani	
Block	Mohr Fatehpur	
District	Gaya	
Address	Tha — Gumpa PO — Nawdiah Thurang	
Mobile Number (optional)	8294258161	
Type and number of structures		
Type	BW	
Number	1	
(coordinates of the structures are to be obtained by the field officer)	24.535063, 85.23429	
Drill time discharge (lps)		
Depth of installation of pump	60 ft	
Casing depth (Bore wells) HR	40 ft	
Fracture encountered depth-HR		
Slotted pipe depths (TW) SR	Not required (Hard Rock)	
Average water levels – pre-monsoon	50 ft	
Average water levels – post-monsoon	10 ft	
The well is used for	Domestic only.	
Is water available throughout the year	Yes.	
If not for how many months water is available	—	

Pumping Duration

	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified)	— Rainfed —		20 lt / 5 min

Domestic 30 din Irrig 3 hr/day

→ Motor → 0.5 HP

Domestic → 30 litre 3 ltr/day 20 lt/1 min.

Kharif (no of months ~~to be~~ specified)	— Rainfed		
Others (no of months to be specified)			
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified) — Rainfed	(1 Bigha)	Wheat	
Khariff (no of months to be specified) 3 Month — Rainfed	(1 Bigha)	Dhan	
Others (no of months to be specified) No Neglig		Sarso.	
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	~~Kharif~~ Rabi	~~Rabi~~ Kharif	Other
Type of Crop	Wheat	Dhan	—
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop	wheat	Dhan	
Area under crop			
Reasons for change in cropping pattern in last 20 years.	By Rainfall		
If the cropping pattern is to be changed, which are the suitable crops that can be grown		20 Man Dhan	
Available Market for the crop	10,000 Bigha	~~See~~ 10,000 ₹/Bigha.	
Average unit cost of production			
Average unit cost of selling	20 ₹/Kg	18 ₹/Kg.	
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			
Source of Energy			
Solar	○ Is it connected to grid ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric ✓	○ Do you get free electricity for irrigation? NO ○ Do you pay a fixed charge Yes ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- 160 ₹/Month. ○ During Rabi-----		
Diesel	○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi		

Water Market*	o Do you share the pumped water with other farmers o If yes o For how many days do you share pumped water in Kharif o For how many days do you share pumped water in Rabi Period o On an average how much do you charge per annum (in Rs)
	o Do you receive additional water from boreholes of nearby farmers o If yes o For how many days do you receive pumped water in Kharif o For how many days do you receive pumped water in Rabi Period o On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

NO

yes 60₹/hour.

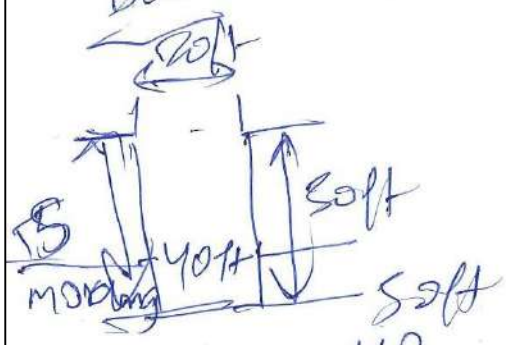
(600×3) → 1800/-/year

wheat — 2 Months

Dhan — 1½ Months

1½ Months → 6000/- — Water Market

DW (Nearby)



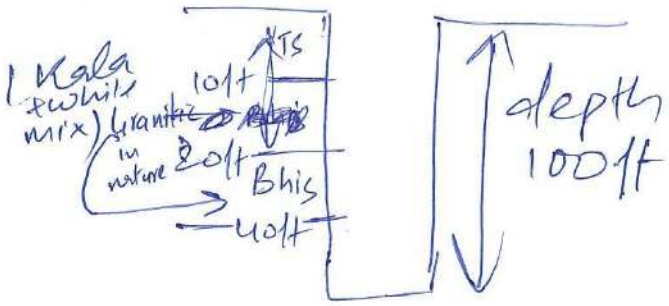
HR

→ Water from Morang here.

→ No Bhis here.

(Another DW in the area

BW



HR at 40ft
↳ Kala pathar.

- Operation for 5 min then recoup time is 120 min

- Water in Bhis
↳ 20-40ft

Details of Abstraction Structures.

Annexure -III

Farmer Feedback Form

Photograph			
Name	Upendra kumar.		
Village	Sindhuar		
Block	Mohanpur		
District	Gaya		
Address	At the entrance of Sidhuar vill, on way to Bandhe H		
Mobile Number (optional)			
Type and number of structures			
Type	BW		
Number	2		
(coordinates of the structures are to be obtained by the field officer)	24.534383 , 85.028557		
Drill time discharge (lps)			
Depth of installation of pump	70 ft.		
Casing depth (Bore wells) HR	30		
Fracture encountered depth-HR	60-65 (in one well)		
Slotted pipe depths (TW) SR			
Average water levels – pre-monsoon	70 ft		
Average water levels – post-monsoon	35 ft		
The well is used for	Domestic (Mostly)		
Is water available throughout the year	Yes (But for Domestic Purpose Mostly)		
If not for how many months water is available			
Pumping Duration	Water from water Merket.		
	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified)			10 lt in 5min

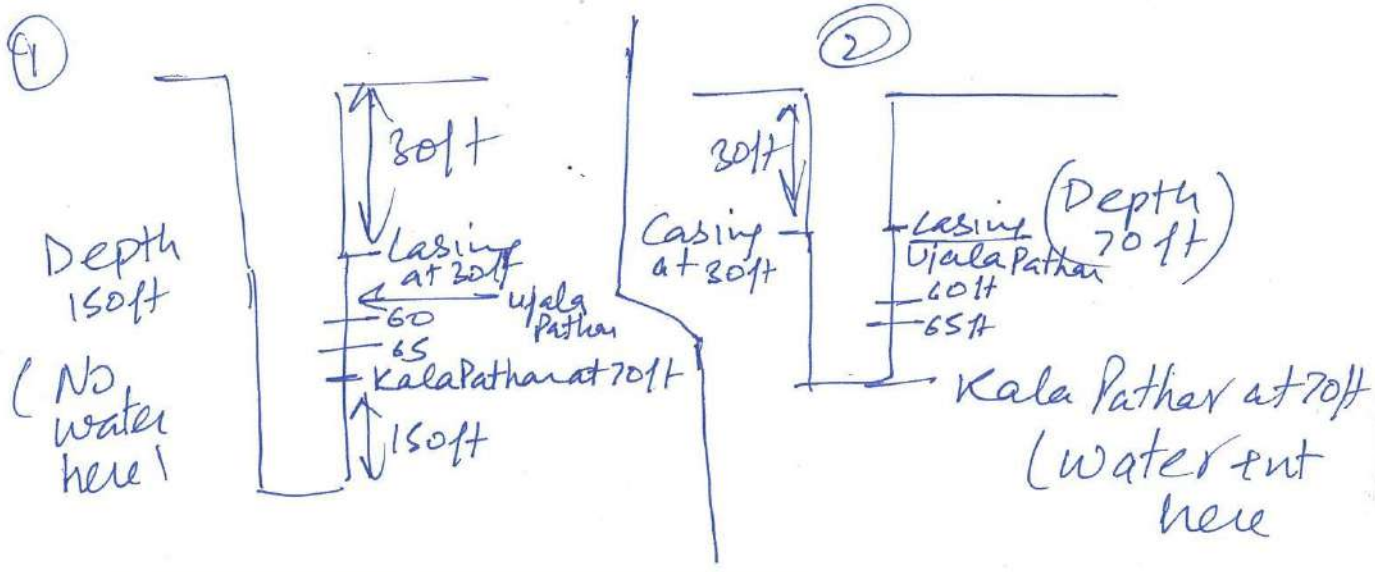
Kharif (no of months to be specified)			10lt in 2min
Others (no of months to be specified)			
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified)	5 Katha	wheat	Pump operation is only 60 min at one time
Khariff (no of months to be specified)	5katha	Dhan	
Others (no of months to be specified)	5Katha	Sarso	
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop	—	—	—
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop	Dhan	wheat	Sarso
Area under crop			
Reasons for change in cropping pattern in last 20 years.	→ + use of bor ing → + use of electricity		
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop			
Average unit cost of production			
Average unit cost of selling			
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			
Source of Energy			
Solar	o Is it connected to grid o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric ✓	o Do you get free electricity for irrigation? NO o Do you pay a fixed charge ✓ o If a fixed charge is paid, what is the per month charge o If unit-based charges are paid what is the average monthly charges in rupees o During kharif---- o During Rabi-----] 175/- / Month		
Diesel	o Average consumption of diesel (liters) per month o During Kharif o During Rabi		

Water Market*	o Do you share the pumped water with other farmers o If yes No o For how many days do you share pumped water in Kharif o For how many days do you share pumped water in Rabi Period o On an average how much do you charge per annum (in Rs)
	o Do you receive additional water from boreholes of nearby farmers Yes o If yes o For how many days do you receive pumped water in Kharif o For how many days do you receive pumped water in Rabi Period 30₹/Katha. o On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

(*) Totally Rainfed area (for irrigation)

Two boring at the location



Site details of Abstraction structures

Annexure -III

Farmer Feedback Form

Photograph		
Name	Dharmendra Kumar.	
Village	Khedarpura	
Block	Fatehpur	
District	Gaya	
Address	Thana-Fatehpur, PO Fatehpur	
Mobile Number (optional)	8002148626	
Type and number of structures		
Type	BW	
Number	1	
(coordinates of the structures are to be obtained by the field officer)	24.618171 ,	85.179298
Drill time discharge (lps)		
Depth of installation of pump	80ft.	
Casing depth (Bore wells) HR	80ft	
Fracture encountered depth-HR		
Slotted pipe depths (TW) SR	10ft (Bhis (Kale)	
Average water levels – pre-monsoon	40ft	
Average water levels – post-monsoon	10 ft	
The well is used for	Irrigation / Domestic (Now Domestic because nearby chapakal began drying up) - Now gives water for drinking in charge	
Is water available throughout the year	Yes	
If not for how many months water is available	—	

Pumping Duration			
	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified) 4 month.	30 din	12 hr/day	10Lt in 1 min

→ 1 HP Pump

Irrigation — Rainfed
Borewell.

Dhan

Kharif (no of months to be specified) 3-4 month	30 din	10 ltr/day	20 ltr in 60 sec
Others (no of months to be specified) Sarso/ moong along with wheat			
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified)	2.5 Bigha	Wheat	
Khariff (no of months to be specified)	2.5 Bigha	Dhan	
Others (no of months to be specified)	2.5 Bigha (along with wheat)	Sarso/ Moong	
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop	Teesi / Jad	—	NO Moong
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop	Wheat	Dhan	Sarso / Moong
Area under crop			
Reasons for change in cropping pattern in last 20 years.	— trend Boring — trend Electricity		
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop			
Average unit cost of production	~~30,000~~/2 Bigha	25,000/2 Bigha	
Average unit cost of selling			
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			
Source of Energy			
Solar	○ Is it connected to grid ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric ✓	○ Do you get free electricity for irrigation? NO ○ Do you pay a fixed charge ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- 10,000/month ○ During Rabi----- DO to 9,000/month.		
Diesel	○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi		

2.5 Bigha → 27 Acre

2 महीना — Wheat
4 महीना — Rice (Rainfall.

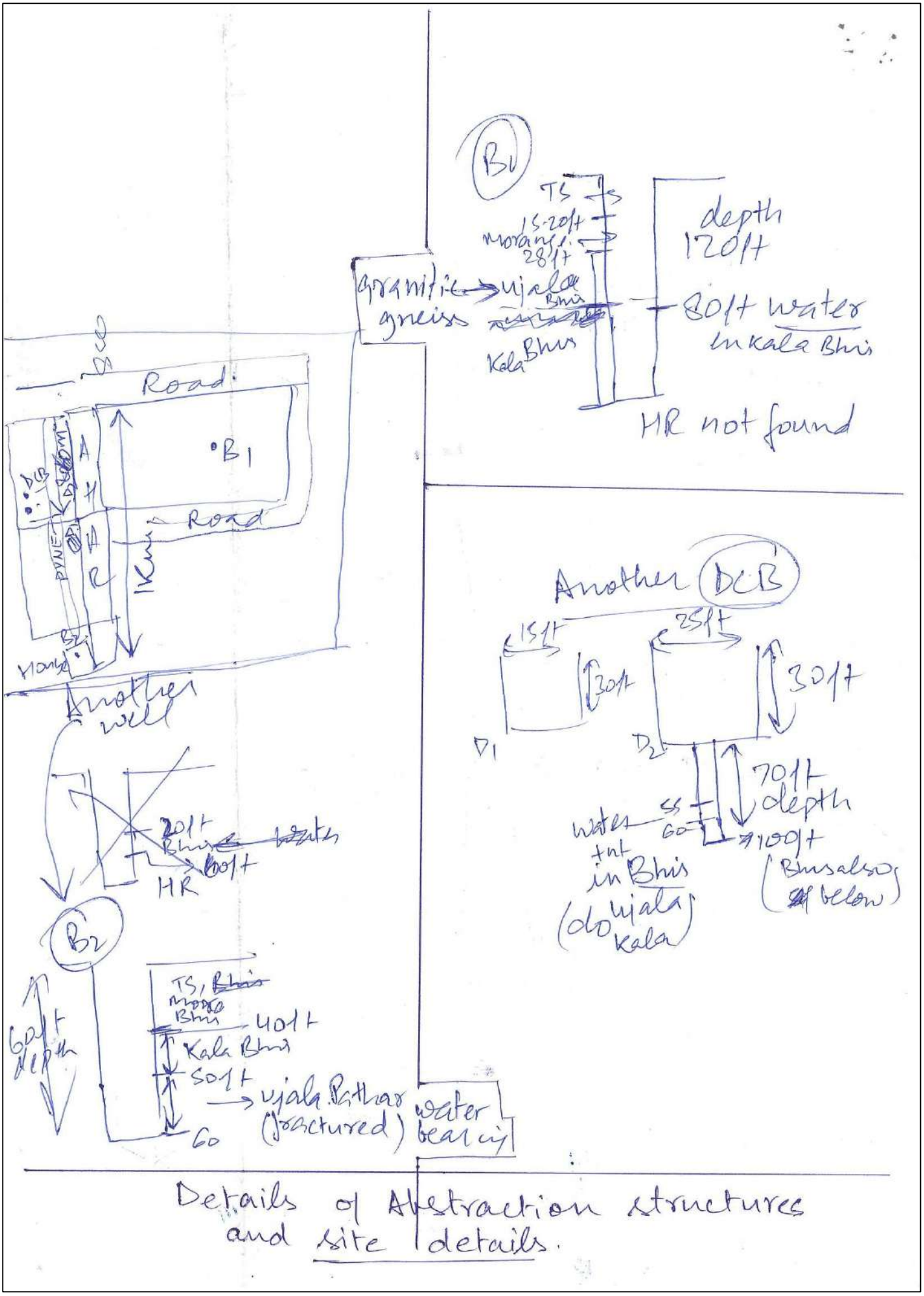
Water Market*	○ Do you share the pumped water with other farmers ○ If yes ○ For how many days do you share pumped water in Kharif ○ For how many days do you share pumped water in Rabi Period ○ On an average how much do you charge per annum (in Rs)
1 Person / 3 days 1 Person / 1 day	○ Do you receive additional water from boreholes of nearby farmers ○ If yes ○ For how many days do you receive pumped water in Kharif ○ For how many days do you receive pumped water in Rabi Period 50₹/Katha ○ On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc
- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.	

→ This boring has sustainable water

→ All other boring doesn't have water all the time.

Handpump (boring till 120ft)

↳ goes dry during Bemon



Details of Abstraction structures and site details.

Annexure -III

Farmer Feedback Form

			Photograph
Name	Bijay Manjhi.		
Village	Kewala Tola Marandhi		
Block	Mohanpur		
District	Gaya		
Address			
Mobile Number (optional)	~~9693 2894 89~~ 9693289469		
Type and number of structures			
Type	Dugwell		
Number	1		
(coordinates of the structures are to be obtained by the field officer)	24.5136 85.2003		Motor 1.5hp
Drill time discharge (lps)			
Depth of installation of pump	~~40ft~~ 35ft		
Casing depth (Bore wells) HR			
Fracture encountered depth-HR			
Slotted pipe depths (TW) SR			
Average water levels – pre-monsoon	25ft		
Average water levels – post-monsoon	10ft		
The well is used for	Irrigation		
Is water available throughout the year	Yes		
If not for how many months water is available			

Pumping Duration			
	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified)	20 day	1/2 hr	

Kharif (no of months to be specified)	10 day - 15 day	½ hr	
Others (no of months to be specified)			
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified)	3 Acre (3 bigha)	Wheat	
Khariff (no of months to be specified)	3 Acre	Paddy	
Others (no of months to be specified)			
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Reasons for change in cropping pattern in last 20 years.			
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop	For self use & fatehpur market		
Average unit cost of production	₹5000/bigha		
Average unit cost of selling	20000/bigha		
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.	No		
Source of Energy			
Solar	○ Is it connected to grid ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric	○ Do you get free electricity for irrigation? No ○ Do you pay a fixed charge ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- 300/month ○ During Rabi----- 400/month		
Diesel	○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi		

Water Market*	o Do you share the pumped water with other farmers o If yes o For how many days do you share pumped water in Kharif o For how many days do you share pumped water in Rabi Period o On an average how much do you charge per annum (in Rs)
	o Do you receive additional water from boreholes of nearby farmers o If yes o For how many days do you receive pumped water in Kharif o For how many days do you receive pumped water in Rabi Period o On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

Annexure -III

Farmer Feedback Form

Photograph		
Name	Parvin Kumar Singh	
Village	Fatehpur	
Block	Fatehpur	
District	Gaya	
Address		
Mobile Number (optional)	7542 878239	
Type and number of structures		
Type	DW	
Number	2	
(coordinates of the structures are to be obtained by the field officer)	24.6361 85.2206	
Drill time discharge (lps)	2 lps	Totaldepth = 60ft motor = 5HP
Depth of installation of pump	60 ft	
Casing depth (Bore wells) HR	50 ft	
Fracture encountered depth-HR	Not encounted	
Slotted pipe depths (TW) SR		
Average water levels – pre-monsoon	20 ft	
Average water levels – post-monsoon	15 ft.	
The well is used for	Irrigation	
Is water available throughout the year	Yes	
If not for how many months water is available		

Pumping Duration

	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified)	25 days	8-10 hrs	2 lps (Reported)

Kharif (no of months to be specified)	15 days.	6-8 hr	
Others (no of months to be specified)	.		
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified)	4 - bigha	Wheat, Mustard	
Khariff (no of months to be specified)	"	Paddy ~~Wheat~~, Corn	
Others (no of months to be specified)	"	Moong (Zaid)	
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Reasons for change in cropping pattern in last 20 years.			
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop	fatehpur market	-	
Average unit cost of production	16 ~~20~~000/ bigha	16 thousand per bigha	
Average unit cost of selling	30000/ bigha		
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.			
Source of Energy			
Solar	o Is it connected to grid o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric	o Do you get free electricity for irrigation? — NO o Do you pay a fixed charge o If a fixed charge is paid, what is the per month charge o If unit-based charges are paid what is the average monthly charges in rupees o During kharif---- Rs 400/- o During Rabi----- RS 600/-		
Diesel	o Average consumption of diesel (liters) per month o During Kharif o During Rabi		

Water Market*	o Do you share the pumped water with other farmers o If yes o For how many days do you share pumped water in Kharif o For how many days do you share pumped water in Rabi Period o On an average how much do you charge per annum (in Rs)
	o Do you receive additional water from boreholes of nearby farmers o If yes o For how many days do you receive pumped water in Kharif o For how many days do you receive pumped water in Rabi Period o On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

Annexure -III

Farmer Feedback Form

Photograph		
Name	Upendra Yadav	
Village	Bisunpura	
Block	Khanpur	
District	Gaya	
Address		
Mobile Number (optional)	9973 5663 48	
Type and number of structures		
Type	~~Fw~~ 1 Tubewell	
Number		
(coordinates of the structures are to be obtained by the field officer)	24.5946 85. 1265	
Drill time discharge (lps)	0.5 lps	
Depth of installation of pump	100ft	
Casing depth (Bore wells) HR	50 ft	
Fracture encountered depth-HR	115 ft	
Slotted pipe depths (TW) SR		
Average water levels – pre-monsoon	~~70 ft~~	
Average water levels – post-monsoon	40 ft - 50 ft	
The well is used for	Irrigation/Domestic	
Is water available throughout the year	Yes	
If not for how many months water is available		

Bore 170 ft motor - 1 HP

Pumping Duration			
	Number of days pump is operated (days) of each well	What is the average pumping duration (in hours) of each well	Instantaneous Discharge Measurement (to be carried out by the field officer) in lps
Rabi (no of months to be specified)	20 days	7 - 8 hr	

Kharif (no of months to be specified)	5-10 day	5 hr	
Others (no of months to be specified) zaid	10 day	5hr	
Area Irrigated			
	Area Irrigated	Type of crop taken	Remarks
Rabi (no of months to be specified)	1 bigha	wheat	
Khariff (no of months to be specified)	"	Paddy	
Others (no of months to be specified)	"	Moong	
Cropping patterns (past and present) in the village			
Traditional Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Prevailing Cropping pattern in the village	Kharif	Rabi	Other
Type of Crop			
Area under crop			
Reasons for change in cropping pattern in last 20 years.			
If the cropping pattern is to be changed, which are the suitable crops that can be grown			
Available Market for the crop	Fatehpur market (1 Jamhaita)		
Average unit cost of production	* 15000/bigha		
Average unit cost of selling	20000/bigha		
Existing MSP and other related information	Crop wise details are to be collected		
Other subsidies, facilities, restrictions.	—		
Source of Energy			
Solar	o Is it connected to grid o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month)		
Electric	o Do you get free electricity for irrigation? No o Do you pay a fixed charge o If a fixed charge is paid, what is the per month charge o If unit-based charges are paid what is the average monthly charges in rupees o During kharif---- 400/month o During Rabi----- 500/month.		
Diesel	o Average consumption of diesel (liters) per month o During Kharif o During Rabi		

Water Market*	o Do you share the pumped water with other farmers No o If yes o For how many days do you share pumped water in Kharif o For how many days do you share pumped water in Rabi Period o On an average how much do you charge per annum (in Rs)
	o Do you receive additional water from boreholes of nearby farmers No o If yes o For how many days do you receive pumped water in Kharif o For how many days do you receive pumped water in Rabi Period o On an average how much do you pay per annum (in Rs)
Other issues/Remarks	e.g. common problems in drilling of wells, common health issues in the area etc

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

Plate-I


GPS Map Camera
Lodhwe North, Bihar, India
J7PW+H6G, Lodhwe North, Bihar 824232, India
Lat 24.635969°
Long 85.29451°
01/07/23 12:34 PM GMT +05:30
Google

Plate-II


GPS Map Camera
Meyari, Bihar, India
Unnamed Road, Meyari, Bihar 824232, India
Lat 24.698073°
Long 85.258179°
25/02/24 12:39 PM GMT +05:30
Google


GPS Map Camera
Tilaiya, Bihar, India
H32H+46R, Tilaiya, Duhobar, Bihar 824201, India
Lat 24.549546°
Long 85.07984°
28/02/24 01:27 PM GMT +05:30
Google

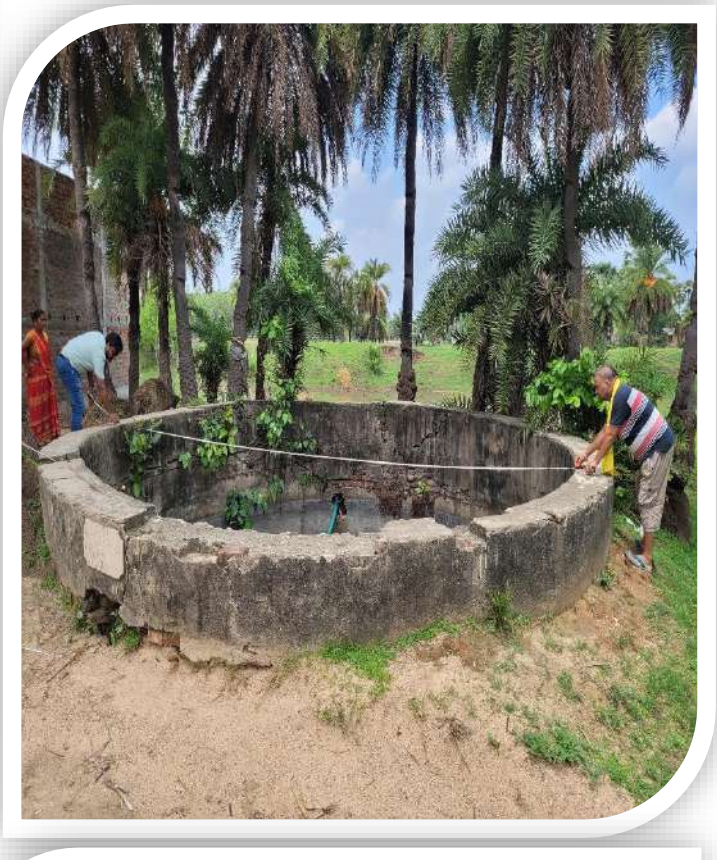

GPS Map Camera
Mero Khap, Bihar, India
G2HR+332, Mero Khap, Bihar 824201, India
Lat 24.527633°
Long 85.042141°
08/07/23 11:38 AM GMT +05:30
Google

Plate-III


GPS Map Camera
Hade, Bihar, India
Unnamed Road, Hulashganj, Hade, Bihar 824201, India
Lat 24.54185°
Long 85.090058°
28/02/24 12:58 PM GMT +05:30
Google


GPS Map Camera
Neemi, Bihar, India
M66W+6P7, Neemi, Bihar 805131, India
Lat 24.663303°
Long 85.245265°
25/02/24 01:50 PM GMT +05:30
Google

Plate-IV




GPS Map Camera
Sondiha, Bihar, India
H4C9+J6X, Sondiha, Bihar 824233, India
Lat 24.571761°
Long 85.116653°
01/03/24 03:40 PM GMT +05:30
Google

Govt. of India
Ministry Jal Shakti
Central Ground Water Board,
Mid Eastern Region,
6&7th Floor, Lok Nayak Jai Prakash Bhawan, Dak Bunglow Chauraha,
Patna- 800001
Phone: 0612-220 1076

Email: rdmer-cgwb@nic.in