

भारत सरकार

Government of India

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास एवं गंगा संरक्षण बिभाग

Ministry of Jal Shakti, Department of Water Resources,
River Development & Ganga Rejuvenation

केन्द्रीय भूमि जल बोर्ड

Central Ground Water Board



राजनांदगांव जिला, छत्तीसगढ़ के जलभृत मानचित्रण एवं भूजल प्रबंधन योजना

Aquifer Mapping and Ground Water Management Plan of Rajnandgaon District, Chhattisgarh

केन्द्रीय भूमि जल बोर्ड

उत्तर मध्य छत्तीसगढ़ क्षेत्र

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March 2023

FOREWORD

Groundwater resources are being developed over years in order to meet domestic, irrigation and industrial requirements. The spatial distribution of availability of ground water resources however, is uneven and is being indiscriminately exploited by various users thereby creating relentless pressure. On the other hand, rapid urbanization, industrialization and land use changes has resulted decline of water levels in many parts of the country.

There is an urgent need for scientific approach in proper management of the available ground water resources for sustainability of this precious natural resource for present and future generation.

Central Ground Water Board has been in the forefront of activities for occurrence, development, and management of this resource through various scientific studies and techniques. Over the last four decades CGWB, NCCR, Raipur has gathered a huge amount of data regarding ground water resources of Chhattisgarh. Based on this experience aquifer mapping of Rajnandgaon district was prepared with the vast amount of data generated and available with North Central Chhattisgarh Region. The report embodies all the features of ground water and related aspects of the study area including physiography, meteorological conditions, hydrology, drainage, geomorphology, geology, hydrogeology, ground water resources, hydrochemistry, geophysics, ground water problems etc.

*The report titled **"A REPORT ON AQUIFER MAPPING AND GROUNDWATER MANAGEMENT PLAN OF RAJNANDGAON DISTRICT, CHHATTISGARH"** is prepared by Shri Sarboday Barik, Assistant Hydrogeologist, under supervision of Mrs. Prachi Gupta, Scientist-C. I appreciate the concerted efforts put by the author to make it possible to bring the report in its present shape. I hope this report will no doubt be useful and worthy for the benefit of Rajnandgaon district and would be a useful document for academicians, administrators, planners and all the stakeholders in ground water.*

Though utmost care has been taken to minimize the errors, some errors may have inadvertently crept in. It is expected that these mistakes will be taken in the proper spirit.

Dr. Prabir K. Naik
(REGIONAL DIRECTOR)

कार्यकारी सारांश

जलभृत मानचित्रण एक बहुआयामी वैज्ञानिक प्रक्रिया है जिसमें जलभृतों में भूजल की मात्रा, गुणवत्ता और संचलन की विशेषता के लिए भूगर्भीय, जल विज्ञान, भूभौतिकीय, जल विज्ञान और गुणवत्ता डेटा के संयोजन को एकीकृत किया जाता है। हालांकि, पिछले एक दशक में भूजल विकास से भूजल प्रबंधन पर ध्यान केंद्रित होने के कारण, स्थानीय स्तर पर भूजल संसाधनों के न्यायसंगत और सतत् प्रबंधन के लिए बड़े पैमाने पर अधिक विश्वसनीय और व्यापक स्तर पर जलभृत मानचित्रों की आवश्यकता महसूस की गई है। भूजल का वॉल्यूमेट्रिक मूल्यांकन के साथ भविष्य में इसके विकास और प्रबंधन हेतु योजना जलभृत मानचित्रण के प्राथमिक उद्देश्य हैं।

जलभृत मानचित्रण कार्यक्रम के तहत, राजनांदगांव जिले के 02 विकास खंड छुरिया और अंबागढ़ चौकी के 1,537 वर्ग किमी क्षेत्र को शामिल किया गया है। यह सर्वे ऑफ इंडिया की डिग्री शीट संख्या 64C, 64D, 64G और 64H के भागों में (1:2,50,000 स्केल) तथा अक्षांश 20°70'- 22°29'N और देशांतर 80°23' से 81°29' के बीच आता है। यह जिला उत्तर में कवर्धा जिले, पश्चिम में मध्य प्रदेश और महाराष्ट्र राज्य और पूर्व में बेमेतरा, दुर्ग और बालोद जिले और दक्षिण में क्रमशः कांकेर जिले से घिरा है। जिला मुख्यालय राज्य के भीतर दुर्ग, बालोद और बेमेतरा जैसे आसपास के जिलों से सड़क मार्ग से अच्छी तरह से जुड़ा हुआ है और निकटतम रेलवे स्टेशन राजनांदगांव (छत्तीसगढ़) और डोंगरगढ़ (छत्तीसगढ़) में है। राज्य के भीतर निकटतम हवाई अड्डा रायपुर की राजधानी है जो रायपुर से लगभग 72 किमी दूर है। जिले के भीतर सभी महत्वपूर्ण स्थान राज्य राजमार्गों और अन्य सभी सड़कों के नेटवर्क से अच्छी तरह से जुड़े हुए हैं। जनगणना 2011 के अनुसार, कुल जनसंख्या 15,37,133 (पुरुष-7,62,855, महिला-7,74,278) 1603 गांवों में निवास करती है। जनगणना के अनुसार जिले का जनसंख्या घनत्व 192 व्यक्ति/वर्ग किमी बताया गया है। जनगणना के अनुसार साक्षरता दर 75.96% है, हालांकि लिंगानुपात प्रति 1,000 पुरुषों पर 1,015 महिलाओं के अनुरूप है।

अध्ययन क्षेत्र में उपोष्ण कटिबंधीय जलवायु है। अध्ययन क्षेत्र में औसत वार्षिक वर्षा लगभग 1,068 मिमी (पिछले दस वर्षों का औसत यानी 2012 से 2021 तक) है। भू-आकृतिक रूप से अध्ययन क्षेत्र के उत्तरी, मध्य और दक्षिणी भाग जिले के उत्तर-पश्चिमी भाग में संरचनात्मक पहाड़ियों और घाटियों को प्रदर्शित करते हैं। पेडिमेंट/पेडीप्लेन जिले के मध्य भाग में मौजूद है। मैग्मैटिक और मेटामॉर्फिक चट्टानों पर अनाच्छादित पठार जिले के उत्तरी भाग में मौजूद हैं। जिले के पूर्वोत्तर भाग पर प्रोटेरोज़ोइक चट्टानों के संरचनात्मक मैदानों का कब्जा है। शुद्ध बोया गया क्षेत्र 3,69,090 हेक्टेयर है, जबकि दो फसली क्षेत्र 1,25,376 हेक्टेयर है। अध्ययन क्षेत्र में शुद्ध सिंचित क्षेत्र 93862 हेक्टेयर है जहां भूजल का योगदान केवल 52,254 हेक्टेयर है। शुद्ध सिंचित क्षेत्र के संबंध में भूजल द्वारा सिंचित क्षेत्र का प्रतिशत 55.67% है।

ब्लॉकों के लिए उत्पन्न अन्वेषणात्मक ड्रिलिंग डेटा के आधार पर, क्षेत्र में मौजूदा जलभृत प्रणालियों को फ्रेक्टिक और फ्रैक्चर /अर्ध-सीमित जलभृत में विभाजित किया जा सकता है। अध्ययन क्षेत्र में मौजूद प्रमुख जलभृत डोंगरगढ़ ग्रेनाइट, बिजली रिओलाइट, चिल्फी समूह, चंद्रपुर समूह, गुंडरदेही संरचना और चारमुरिया संरचना हैं। बलुआ पत्थर में डिस्चार्ज नगण्य से 3 एलपीएस तक है और अपक्षयित ग्रेनाइट में 10 एलपीएस तक डिस्चार्ज मिलता है खासकर ऐसे जगहों पर जहाँ जहाँ मोटे अपक्षय वाले क्षेत्र बेडरॉक फ्रैक्चर से जुड़े होते हैं।

2022 के अनुसार अध्ययन क्षेत्र में भूजल विकास का भूजल संसाधन गणना चरण 65.24% है। इसलिए, भूजल ड्राफ्ट को संतुलित करने और अध्ययन क्षेत्र में भूजल संरक्षण संरचनाओं के निर्माण पर ध्यान देने की आवश्यकता है क्योंकि चरण सेमी क्रिटिकल की ओर बढ़ रहा है। क्षेत्र में सिंचाई के लिए भूजल उत्कर्षण 35,418.67 हेक्टेयर मीटर है जबकि घरेलू उपयोग के लिए 2,978.37 हेक्टेयर मीटर और औद्योगिक क्षेत्र के लिए 238.00 हेक्टेयर मीटर है। कुल 20,023.30 हेक्टेयर मीटर भूजल भविष्य में उपयोग के लिए उपलब्ध है।

अध्ययन क्षेत्र में सर्वेक्षण के दौरान पहचाने गए प्रमुख भूजल मुद्दे इस प्रकार हैं: (i) गर्मियों के दौरान कुएं और हैंडपंप सूखना। (ii) एक्वीफर का निहित जलभूवैज्ञानिक चरित्र। (iii) फ्लोराइड सांद्रता। (v) नाइट्रेट संदूषण .vi) आर्सेनिक प्रदूषण। अध्ययन क्षेत्र में जटिल हाइड्रोजियोलॉजिकल परिस्थितियों के कारण भूजल की उपलब्धता असमान है।

जिन क्षेत्रों में भूमिगत जल की उपलब्धता सीमित है वहां सतही जल का संरक्षण और उपयोग किया जा सकता है। कई स्थानों से नाइट्रेट की सांद्रता अनुमेय सीमा से अधिक है। नियमित भूजल गुणवत्ता निगरानी भी आवश्यक है। जहां तक भूजल उपलब्धता के लिए प्रबंधन रणनीतियों का संबंध है, भूजल के प्रभावी उपयोग के लिए सिंचाई के लिए मौजूदा ड्राफ्ट को सूक्ष्म सिंचाई प्रणाली के साथ जोड़ा जा सकता है। सिंचाई पद्धति में परिवर्तन, उपलब्ध संसाधन का इष्टतम उपयोग, कृत्रिम पुनर्भरण के बाद निर्मित भूजल क्षमता के उपयोग से भूजल की बचत हो सकती है और जिले के सकल फसली क्षेत्र में वृद्धि हो सकती है।

Executive summary

Aquifer mapping is a multidisciplinary scientific process wherein a combination of geological, hydrogeological, geophysical, hydrological and quality data is integrated to characterize the quantity, quality and movement of ground water in aquifers. However, due to paradigm shift in focus from development to management of ground water in last one decade, the need for more reliable and comprehensive aquifer maps on larger scale has been felt for equitable and sustainable management of the ground water resources at local scale. Volumetric assessment of ground water and strategies for future development and management are the primary objectives of aquifer mapping.

Under the aquifer mapping Programme, 02 of the development blocks of Rajnandgaon District namely Chhuria and Ambagarh Chowki were taken up covering an area of 1,537 sq. km. It falls in the Survey of India's Degree Sheet No. 64C, 64D, 64G and 64H in parts (1:2,50,000 Scale) between latitudes 20°70'- 22°29'N and longitudes 80°23' to 81°29'. The district is bounded by Kawardha district in the north, Madhya Pradesh and Maharashtra State in the west and Bemetara, Durg and Balod district in East & Kanker District in south respectively. The district is well connected by road to adjoining districts such as Durg, Balod and Bemetara within the state, the railway connectivity is average and the nearest railway station is in Rajnandgaon (Chhattisgarh) and Dongargarh (Chhattisgarh). The nearest airport within the state is the capital of Raipur which is around 72 km from Raipur. All-important places within the district are well connected by a network of the state highways and all-other roads. According to the Census 2011, total population of 15, 37,133 (Male – 7, 62,855, Female – 7, 74,278) dwells in 1603 villages. The Population density of the district is noted as 192 persons / sq.km as per the census. The literacy rate as per the census is 75.96%, however the sex ratio corresponds to 1,015 females per 1,000 males.

The study area experiences sub-tropical climate. The average annual rainfall for the study area is around 1,068 mm (Average of the last ten years i.e., 2012 to 2021). Geomorphologically the Northern, Central and Southern parts of the study area displays Structural Hills and Valleys are present in northwestern part of the district. Pediment/ Peditain exists on central part of the district. Denudational Plateau on Magmatic and Metamorphic rocks are present in northern most part of the district. Northeastern part of the district is occupied by structural plains of Proterozoic rocks.

The net sown area is 3, 69,090 hectares, while double-cropped area is 1, 25,376 hectares. The net irrigated area in the study area is 93862 hectares where ground water contribution is 52,254 Ha only. Percentage of area irrigated by ground water with respect to net irrigated area is 55.67%.

Based on the exploratory drilling data generated for the blocks, the existing aquifer systems in the area may be divided into phreatic and semiconfined aquifer. The major aquifers present in the study area are Dongargarh granite, Bijli rhyolite, Chilphi Group, Chandrapur Group, Gunderdehi Formation and Charmuria Formation. Discharge varies from negligible to 3 lps in Sandstone and 3 to 10 lps weathered granite and higher yields are obtained where thick weathered zones are associated with bedrock fracturing.

As per 2022 ground water resource calculation stage of ground water development in the study area is 65.24%. So, this is alarming figure and need to be focused on to balance the groundwater draft and construct groundwater conservation structures in the study area as stage is increasing towards Semi-critical categorization.

The existing demand for irrigation in the area is 35,418.67 ham while the same for domestic use is 2,978.37 Ham and for industrial field is 238.00 ham. To meet the future demand for ground water, a total quantity of 20,023.30 ham of ground water is available for future use.

The major ground water issues identified during the survey in the study area are as follows: (i) Drying of Dugwells and handpumps during summer. (ii) Inherent hydrogeological character of aquifer. (iii) Fluoride concentration. (v) Nitrate contamination (vi) arsenic pollution. In study area because of complex hydrogeological conditions ground availability is very uneven.

In area where ground water availability is limited surface water may be conserved and utilized. High value of nitrate has been reported from several locations. Regular ground water quality monitoring is also required. So far as management strategies are concerned for ground water availability, for effective utilization of Ground water existing draft for irrigation may be coupled with micro irrigation system. Change in irrigation pattern, optimum use of available resource, use of ground water potential created after artificial recharge can lead to groundwater savings and increase in gross cropped area of the district.

Acknowledgment

The author is grateful to Shri Sunil Kumar, Chairman, Central Ground Water Board for giving opportunity for preparation of Aquifer Map and Management Plan of, Rajnandgaon district of Chhattisgarh state. I express my sincere gratitude to Shri T.B.N. Singh Member East (Scientist), CGWB for giving valuable guidance, encouragement and suggestions during the preparation of this report. The author is thankful to Dr. Prabir K. Naik, Regional Director, Central Ground Water Board, NCCR, Raipur for extending valuable guidance and constant encouragement during the preparation of this report. The author is thankful to Shri A.K. Biswal for valuable inputs while preparing the report. I would like to acknowledge the help rendered by Smt. Prachi Gupta, Sc-C while preparing 3D disposition of aquifer, Hydrogeology map and Feasibility map of aquifers. The author is thankful to Smt. Priyanka B Sonbarse, Sc-C for valuable inputs and data acquisition. The author is thankful to Shri Uddeshya kumar, Sc-C for rendering help and valuable inputs while preparing the report. The author is thankful to Shri Sidhant Kumar Sahu, Sc-C for the guidance and suggestions. The author is thankful to Shri B. Abhishek, Sc-C for the valuable guidance and suggestions in data analysis while preparing the report. The author is thankful to Shri Rakesh Dewangan, Sc-C for the chemical analysis and valuable inputs on quality issues. The author is thankful to Shri A. K. Sinha, Sc-D for sharing the geophysical studies. The efforts made by Shri T.S. Chouhan, Draftsman, for digitization of maps are thankfully acknowledged. The author is also thankful to Ms. Sweta Mohanty for valuable inputs on quality issues. The author is also thankful to Shri Sudepta Sundar Parida for valuable inputs on resource estimation. The author is also thankful to Shri Suvam Prakash Dash for valuable inputs on Chemical data interpretation. The author is also thankful to the state agencies for providing the various needful data. The author is thankful to Technical Section, Data Centre, Chemical Section, Report Processing Section and Library of CGWB, NCCR, Raipur for providing the various needful data.

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**AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN,
RAJNANDGAON DISTRICT, CHHATTISGARH
(07 BLOCKS- Rajnandgaon, Dongagaon, Dongargarh, Khairagarh,
Chuikhadan, Chhuria & Ambagarh Chowki)**

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ABBREVIATIONS

a msl	Above mean sea level
BDR	Basic Data Report
BW	Borewell
CGWB	Central Ground Water Board
Dia	Diameter
DTW	Depth to Waterlevel
DW	Dugwell
EC	Electrical Conductivity
EW	Exploratory Wells
GS	Gabion structures
GW/ gw	Ground Water
ham	Hectare meter
HP	Handpump (Shallow)
lpcd	Litres per capita per day
lpm	Litres per minute
lps	Liters per second
m	Meter
m bgl	Meter below ground level
m²/day	Square meter/ day
m³/day	Cubic meter/day
MCM/mcm	Million Cubic Meter
NCCR	North Central Chhattisgarh Region
NHNS/ NHS	National Hydrograph Network Stations
OW	Observation Well
PZ	Piezometer
STP	Sewage Treatment Plan
T	Transmissivity
TW	Tube well

1. INTRODUCTION

1.1 Objective

Groundwater is the most valuable resource for the country. However, due to rapid and uneven development, this resource has come under stress in several parts of the country. Central Ground Water Board (CGWB) is, therefore, involved in hydrogeological investigations for the re-appraisal of groundwater regime. CGWB has also carried out ground water exploration in different phases with prime objective of demarcating and identifying the potential aquifers in different terrains for evaluating the aquifer parameters and also for developing them in future. The reports and maps generated from the studies are mostly based on administrative units such as districts and blocks and depict the subsurface disposition of aquifer on regional scale. However, due to paradigm shift in focus from development to management of ground water in last one decade, the need for more reliable and comprehensive aquifer maps on larger scale has been felt for equitable and sustainable management of the ground water resources at local scale.

1.2 Scope of study

Groundwater management plan includes ground water recharge, conservation, harvesting, development options and other protocols of managing groundwater. These protocols will be the real derivatives of the aquifer mapping exercise and will find a place in the output i.e, the aquifer map and management plan. The main activities under NAQUIM are as follows:

1.3 Approach and Methodology

The activities under the aquifer project can be summarized as follows:

- i) Data Compilation & Data Gap Analysis:** One of the important aspects of the aquifer mapping Programme was the synthesis of the large volume of data already collected during specific studies carried out by the Central Ground Water Board and various other government organizations with a new set of data generated that broadly describe an aquifer system. The data were compiled, analyzed, synthesized and interpreted from available sources. These sources were predominantly non-computerized data that were converted into computer-based GIS data sets. On the basis of these available data, Data Gaps were identified.
- ii) Data Generation:** It was evident from the data gap that additional data should be generated to fill the data gaps in order to achieve the objective of the aquifer mapping

Programme. This was done by multiple activities like exploratory drilling, hydro chemical analysis, use of geophysical techniques as well as detail hydrogeological surveys.

iii) Aquifer map Preparation: On the basis of integration of data generated through various hydrogeological and geophysical studies, aquifers have been delineated and characterized in terms of quality and potential. Various maps have been prepared bringing out the Characterization of Aquifers. These maps may be termed as Aquifer Maps depicting spatial (lateral and vertical) variation of the aquifers existing within the study area, quality, water level and vulnerability (quality and quantity).

IV) Aquifer Management Plan: Based on the integration of these generated, compiled, analysed and interpreted data, the management plan has been prepared for sustainable development of the aquifer existing in the area.

1.4 Area Details

Under the aquifer mapping Programme 2022-23, an area comprising of 2 no of development blocks namely Churia and Ambagarh Chowki of Rajnandgaon district was taken up covering an area of 1,537 sq. km. Under the aquifer mapping Programme 2018-19, an area comprising of 5 no of development blocks namely Rajnandgaon, Khairagarh, Chuikadan, Dongargaon, and Dongargarh of Rajnandgaon district was taken up covering an area of 4,197 sq. km. Rajnandgaon district is situated in the western part of the Chhattisgarh state. It falls in the Survey of India's Degree Sheet No. 64C, 64D, 64G and 64H between the Latitude 20°70'-22°29'N and Longitude 80°23' to 81°29'. It is surrounded by Kawardha district in north, Durg district in the east, Bastar district is in the south and Garchiroli, Bhandara (Maharashtra) and Balaghat (Madhya Pradesh) districts in the west. The District headquarter Rajnandgaon is on the Mumbai - Howrah line of southeastern railways. The National Highway no. 6 (Great Eastern Road) also passes through the town of Rajnandgaon. The nearest airport to the District is at Mana (Raipur), about 80 kms away. All-important places within the district are well connected by a network of the state highways and all-weather roads.

1.4.1 Administrative Division

District includes 09 blocks and It is further divided in 1 Nagar Palik Nigam, 2 Nagar Palika, 5 Nagar Panchayat, 7 Janpad Panchayat, 686 Gram Panchayat among which the study area confined with 07 blocks. The names of the 9 blocks are given below.

1. Rajnandgaon Block
2. Dongargaon Block
3. Dongargarh Block

4. Khairagarh Block
5. Chuikhadan Block
6. Chhuriya Block
7. Ambagarh Chowki Block
8. Mohla Block
9. Manpur Block

The administrative map for the study area is given in Figure 1.

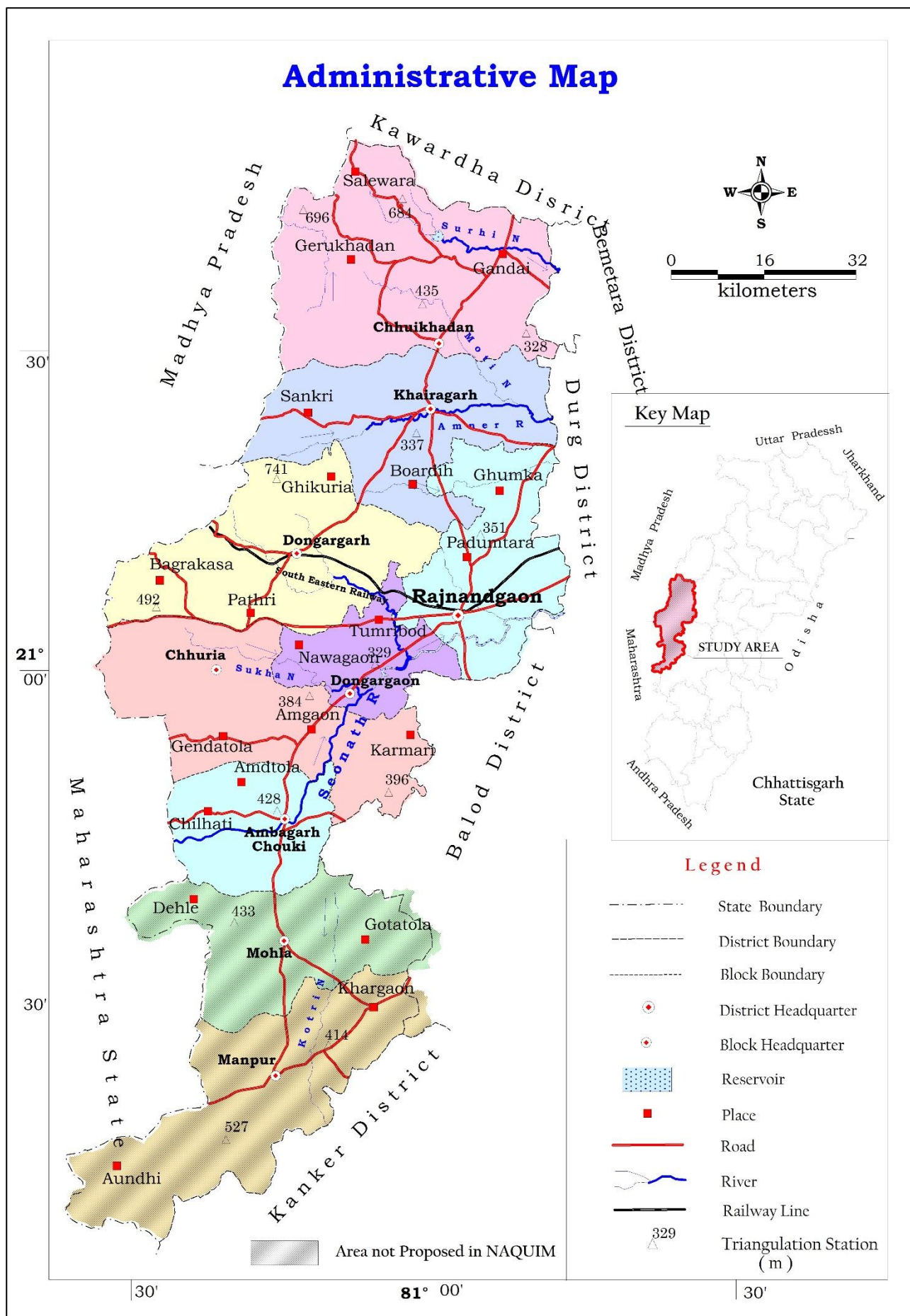


Figure 1 Administrative Map of Rajnandgaon District

1.5 Data Availability, Data Adequacy and Data gap Analysis

The hydrogeological data already available includes NHNS data, VES, exploration data, and chemical data. All the data has been analyzed and depending upon the hydrogeological conditions data gap has been identified for all the blocks.

Ground Water exploration in Rajnandgaon district was taken up during 2022-23 by deploying DTH/KLR-15/134 rig. Till March 2023, a total of 6 Piezometer wells were drilled. 18 numbers of exploratory borewells were drilled through outsourcing in 2021. So far 104 bore wells were drilled under exploratory drilling programme. Geophysical study was also carried out to unravel the hidden sub-surface hydrogeological conditions. Total 137 VES was carried out distributed in all the blocks.

For ground water monitoring of Phreatic and fractured aquifer in district, 68 dugwells and 17 piezometers are regularly monitored 04 times every year. The existing network provides information on ground water regime with fair degree of accuracy. During Groundwater monitoring of premonsoon season groundwater samples has been collected and analyzed.

Table 1 Data Integration

Districts	Blocks	Existing				Data Generation			
		EW	CHEM	VES	WL	EW	CHEM	VES	WL
Rajnandgaon	Rajnandgaon	8	18	15	21	5	15	33	24
	Dongargaon	13	4	8	6	5	8	-	17
	Dongargarh	12	13	12	13	6	10	12	20
	Khairagarh	5	10	16	12	6	15	12	29
	Chuikhadan	8	5	17	7	2	10	12	15
	Chhuria	9	4	-	4	1	29	-	28
	Ambagarh Chowki	23	2	-	2	1	13	-	12
TOTAL		78	56	68	65	26	100	69	145

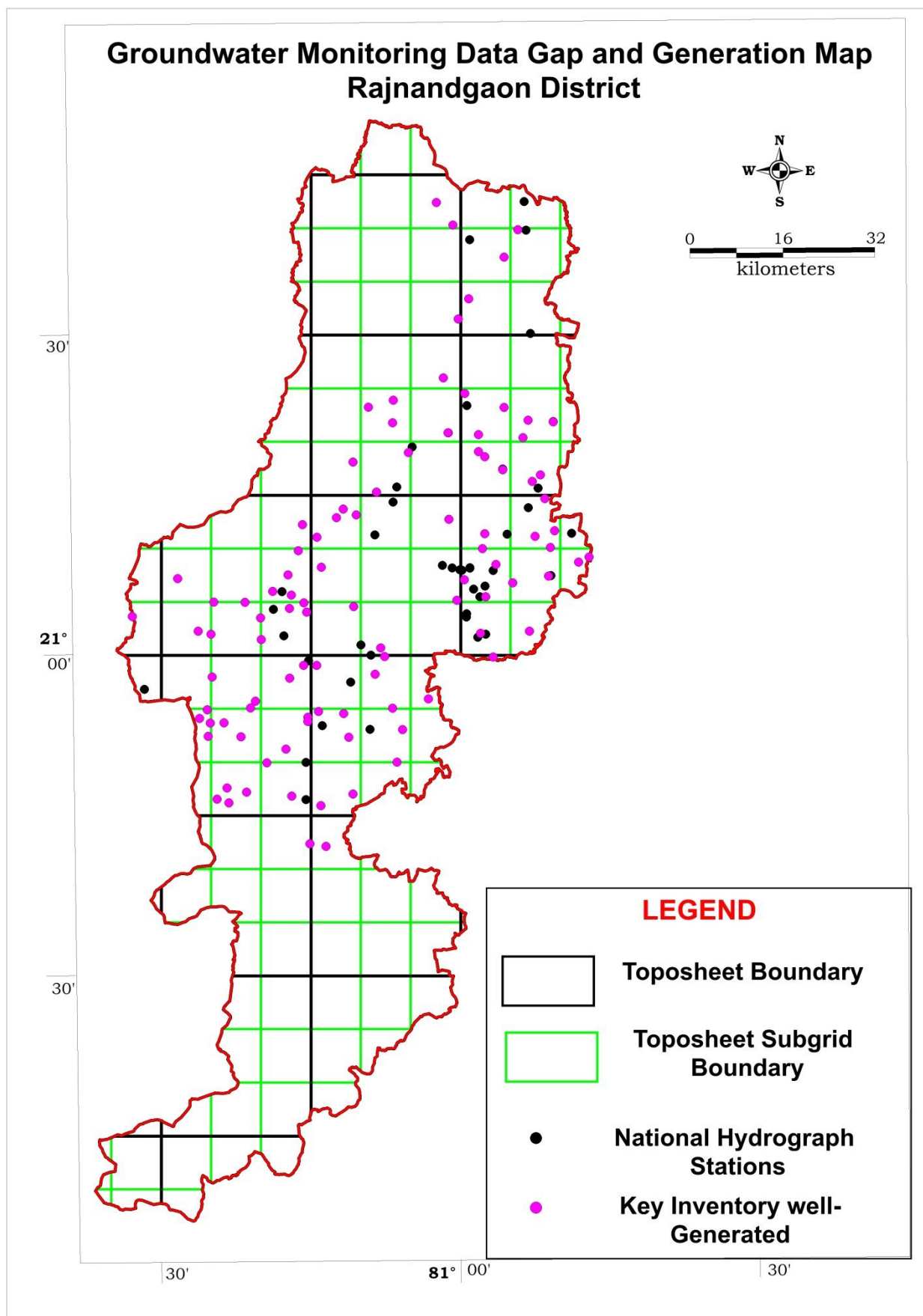


Figure 2 Groundwater monitoring Data Gap and Generation map

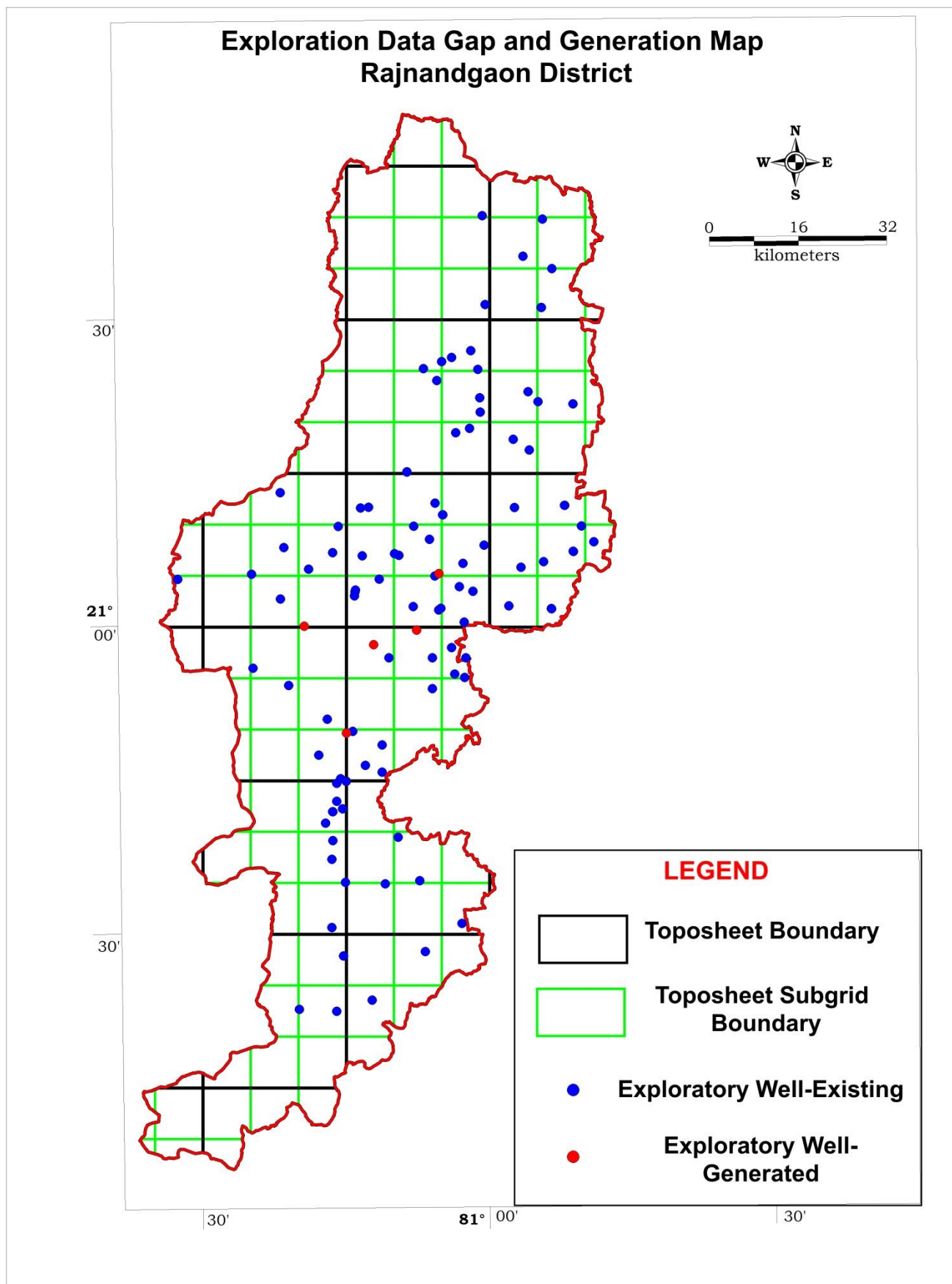


Figure 3 Exploration Data Gap and Generation map

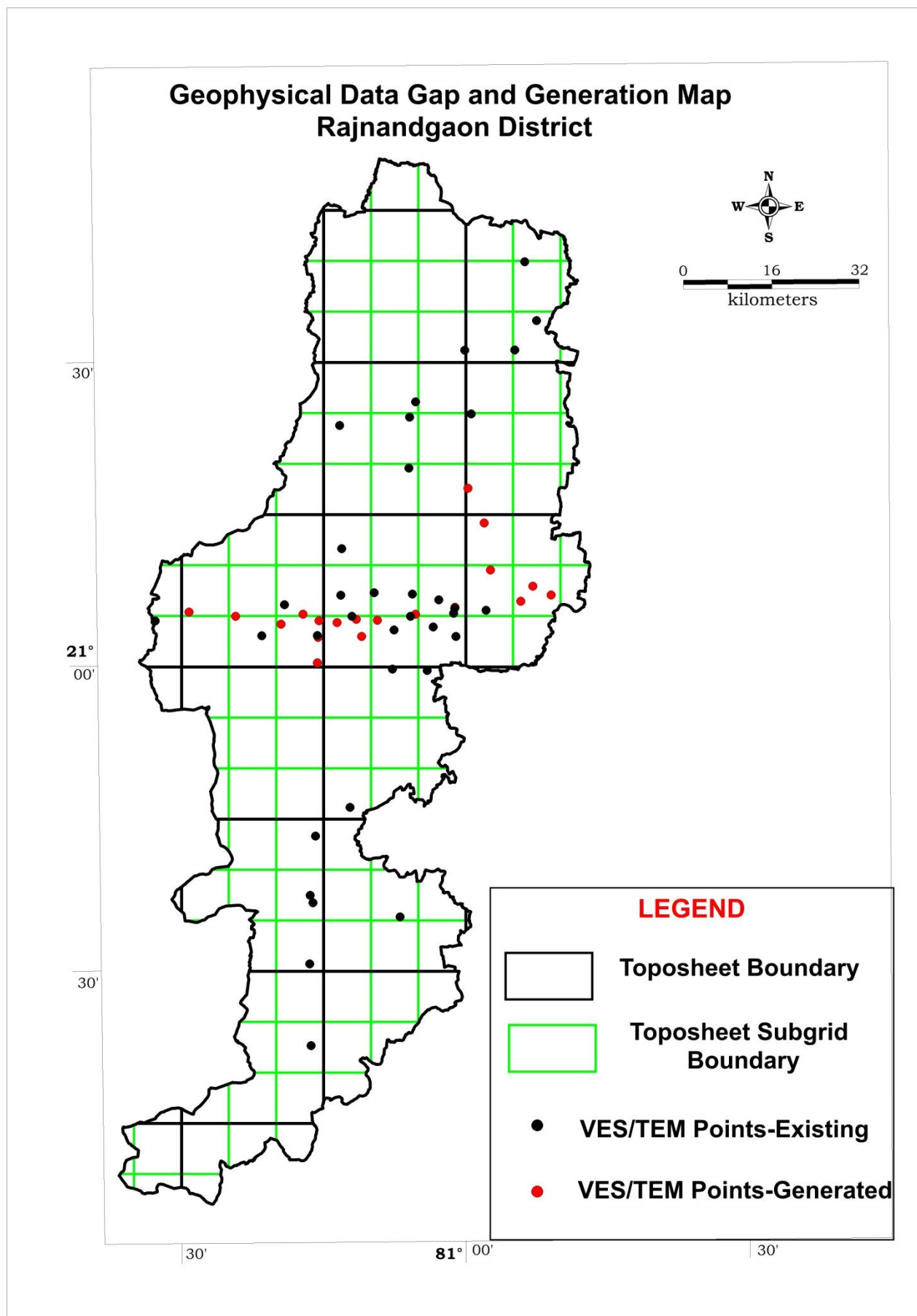


Figure 4 Geophysical Data Gap and Generation map

1.6 Rainfall

The study area receives rainfall mainly from south-west monsoon. It sets in third/fourth week of June and continues till mid-August/September with heaviest showers in the months of July and August and nearly 95% of the annual rainfall is received during this period. The average annual rainfall for the study area is around 1,068 mm (Average rainfall of the ten years available data i.e. 2012 to 2021) which is presented below in Figure 5. *Source: IMD, Raipur.*

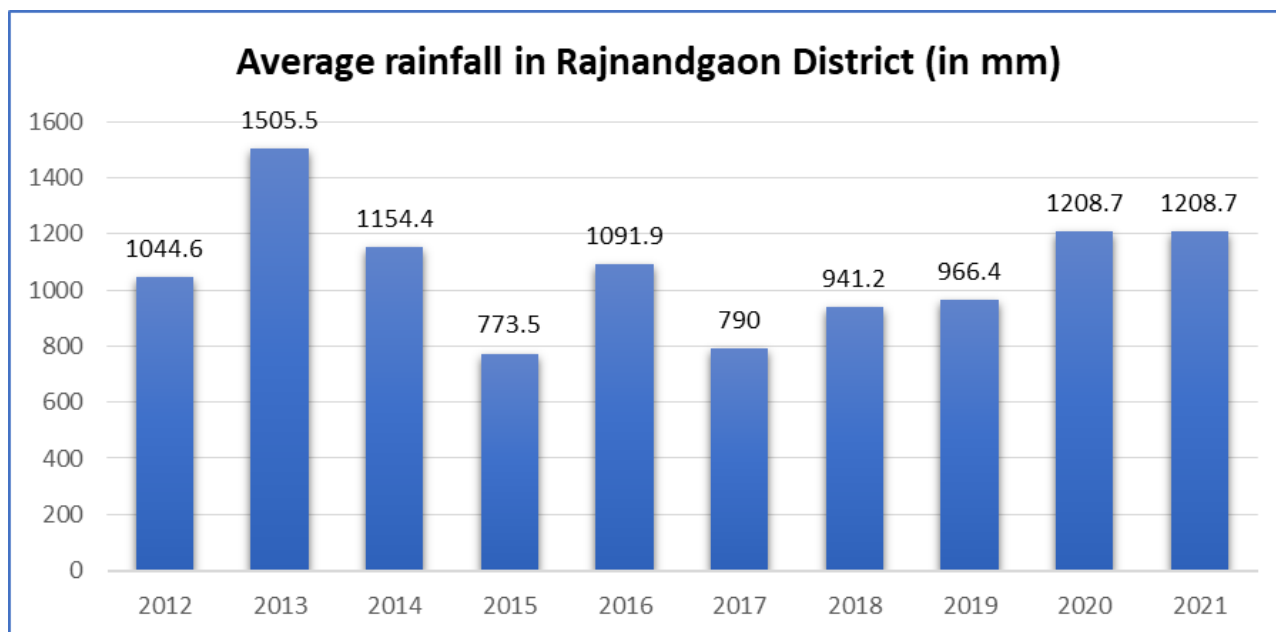


Figure 5 Avg. Rainfall in Rajnandgaon District

1.7 Physiography/Geomorphology

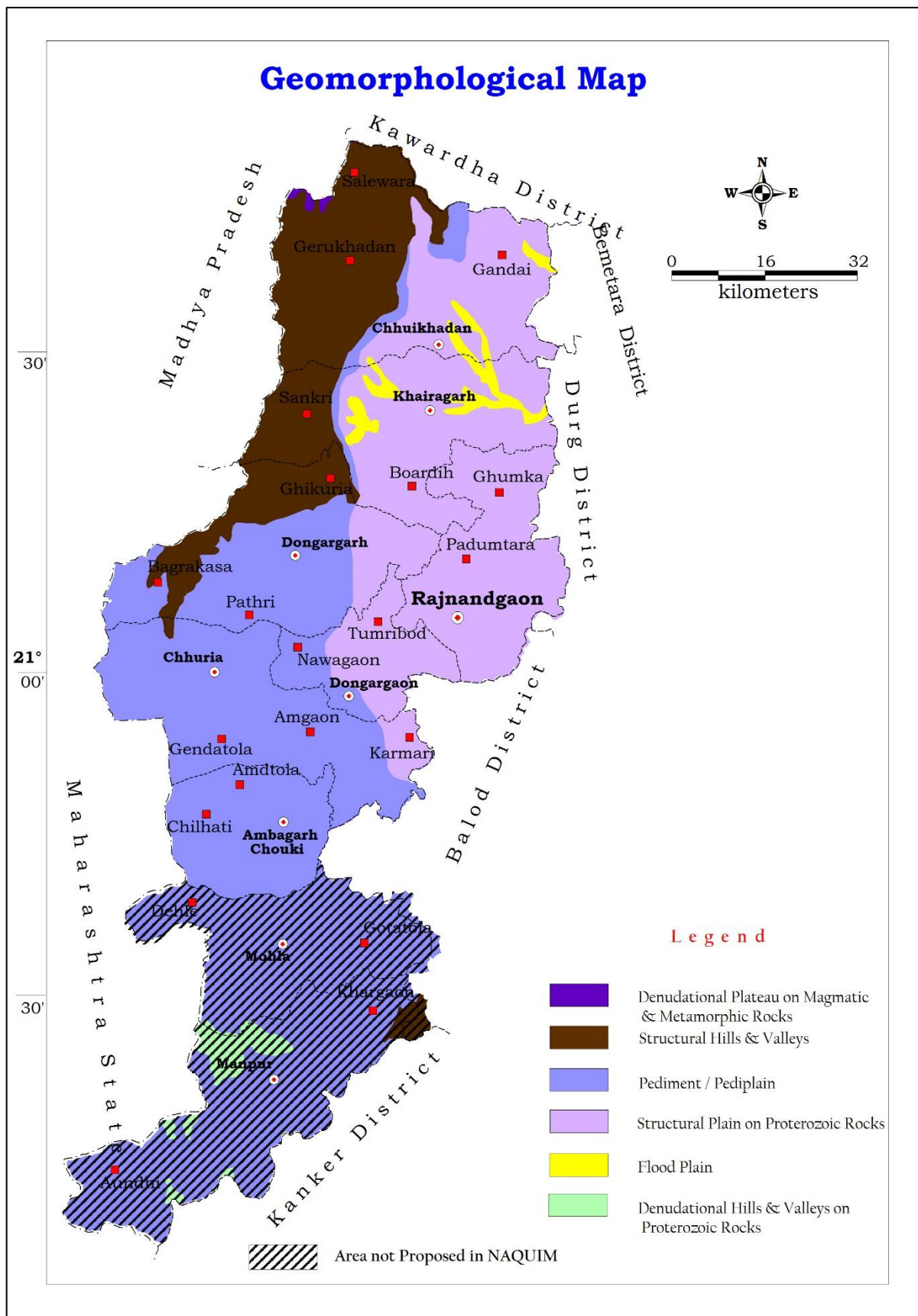


Figure 6 Geomorphology Map of the Study area

Geomorphologically the study area displays:

- Structural Plains and valleys
- Pediment/Pediplain
- Structural plain on Proterozoic rock
- Flood Plain
- Denudational plateau on magmatic and metamorphic rock

All these Geomorphologic structures comes under the physiographic unit which belongs to Chhattisgarh basin area. The Central Chhattisgarh Plain is represented by Structural Plain on Proterozoic rocks which cover major area in the eastern & central part of the district. This unit is developed over rocks of Purana sedimentary basin of Chhattisgarh. This unit has extensive criss-crossed fractures and joints. They are having gently sloping erosional surfaces and thin to moderate cover of soil.

Along with the above-mentioned geomorphic unit, Pediment/Pediplain is also developed in the district especially in Southern part of the study area. The eastern part is covered by structural hills and valleys. Figure 6 shows the Geomorphology in the study area.

1.8 Land use

There is 99,356 ha revenue forest, protected forest and other forest in the district. Area not available for cultivation is 68,814 ha. Details are presented in Table no.2. Figure 7 shows the Landuse pattern in the study area.

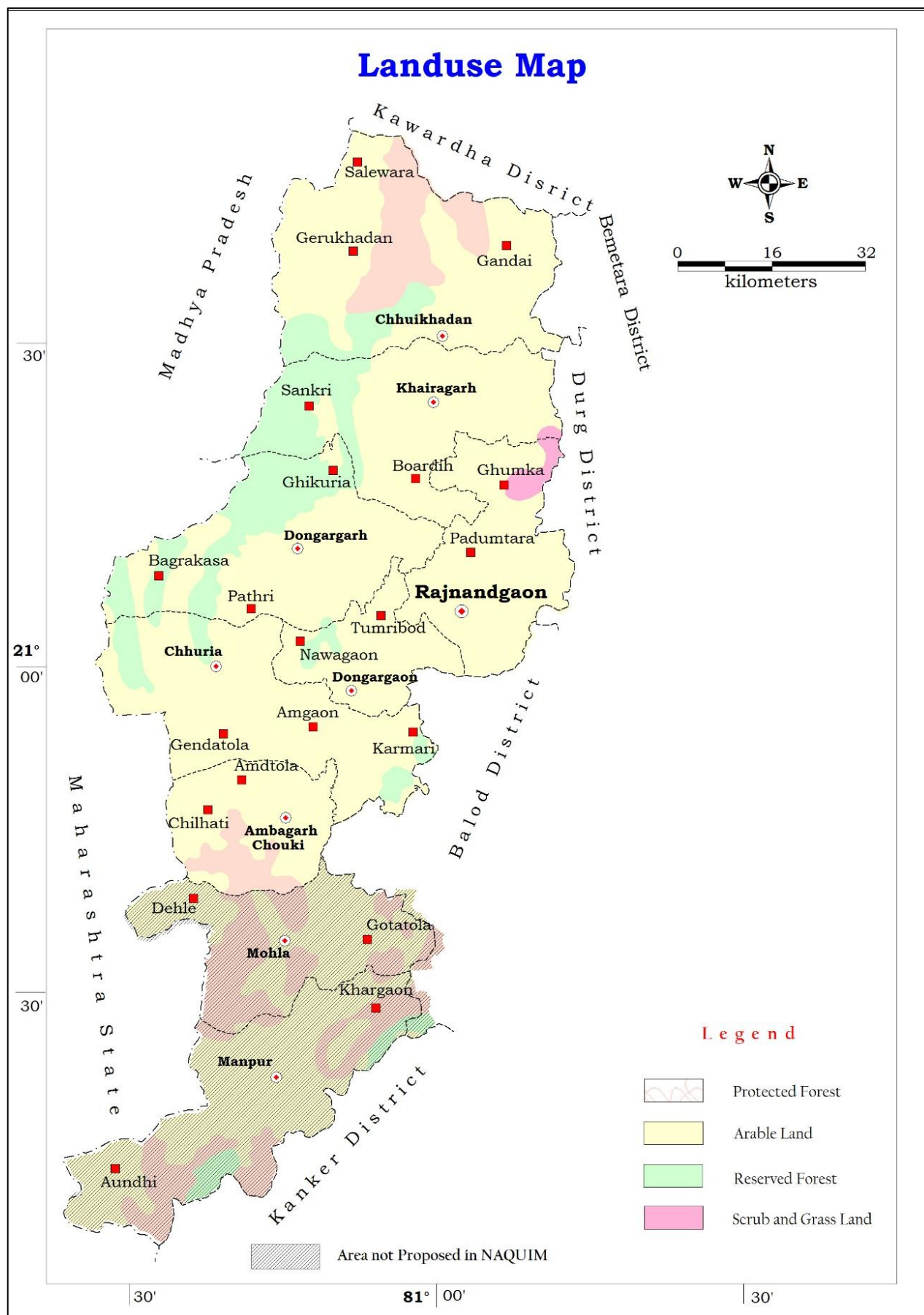


Figure 7 Landuse map of the study area

Table 2 Land use pattern (in ha)

Blocks	Total Geographical Area (In ha)	Revenue forest area (In ha)	Area not available for cultivation (In ha)	Non-agricultural & Fallow land (In ha)	Agricultural Fallow land (In ha)	Net sown area (In ha)	Double cropped area (In ha)	Gross cropped area (In ha)
Chuikhadan	74289	7107	8531	8883	1795	45606	26764	72370
Khairagarh	81095	954	8522	4581	1087	65721	31759	97480
Dongargarh	76732	8767	8222	5220	5663	45411	12385	57796
Rajnandgaon	74261	25	9622	6245	7566	47392	14129	61521
Chhuriya	80214	7075	9146	5950	5387	50975	10368	61343
Dongagaon	41249	607	5444	2648	1409	30445	8347	38792
Ambagarh Chowki	54747	8962	8041	3108	4114	29423	4821	34244
Total	642507	99356	68814	54072	33600	369090	125376	494466

1.9 Soil

The soils in the district are having wide variations. In all four types of soils are abundant in the study area and are mostly insitu in nature.

Alfisol: Alfisol soils are fertile soils found in humid areas where annually dropping leaves form a thick humus layer. These soils cover maximum area in the southern and central parts of the district.

Vertisol: The vertisol are mostly found northern & central and are almost impermeable when saturated. They are sticky in wet season and are very hard in dry season.

Ultisol: The ultisol types of soil are found in eastern parts of the district and are red to yellow in colour. This colour is attained mainly due to the accumulation of iron oxide, which is highly insoluble in water.

In general it can be said that the district is covered by red sandy soils, red loamy soils, medium black soils, deep black soils, lateritic soils. Figure 8 represents the different kind of soil that present in the study area.

Table 3 Details of different kind of soil

Si No	US Soil taxonomy	Indian equivalent
1	Alfisol	Red gravelly soil
		Red sandy soil
2	Vertisol	Deep black soil
		Medium black soil
4	Ultisol	Lateritic soil
		Red and yellow soil

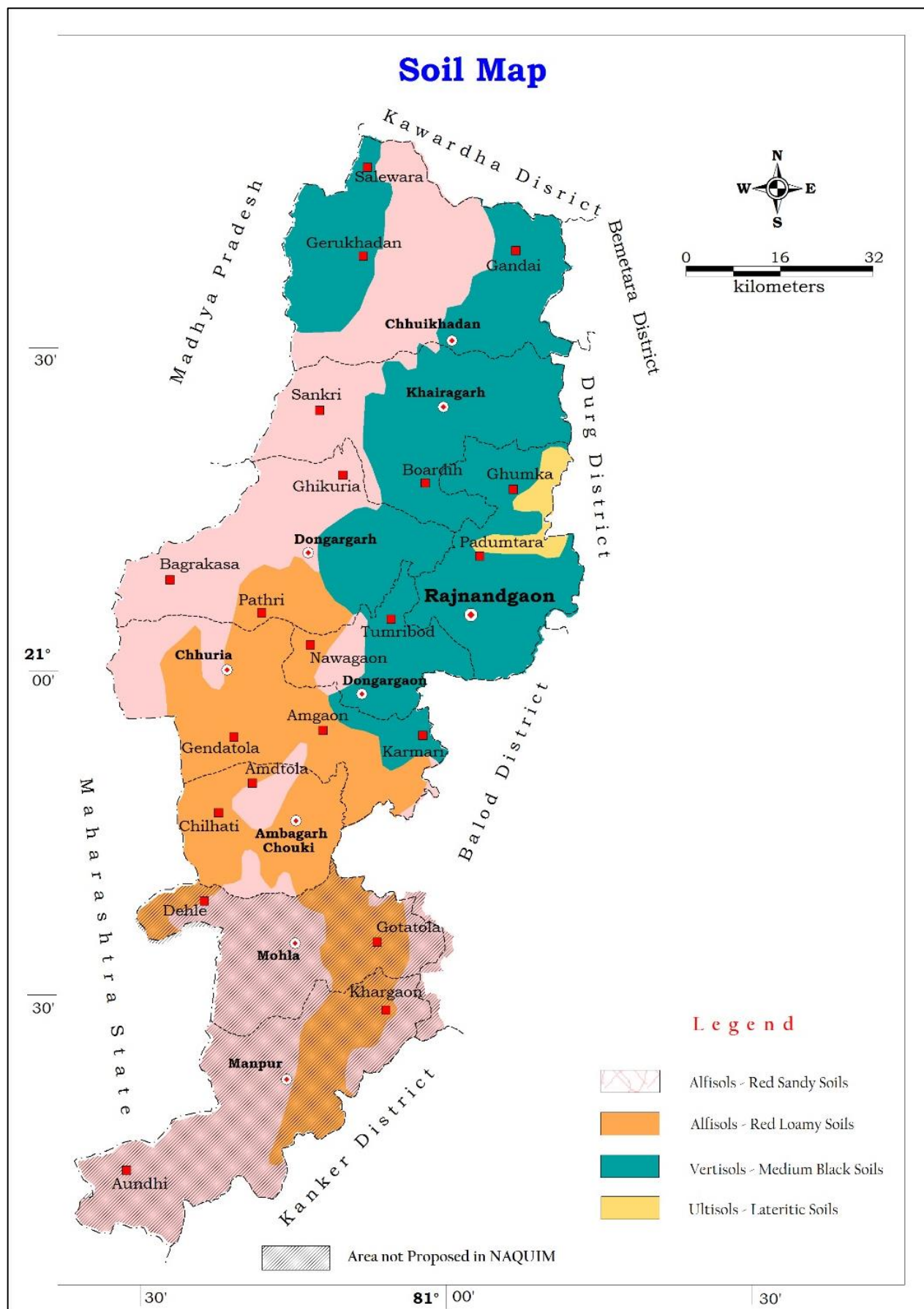


Figure 8 Soil map of the study area

1.10 Hydrology and Drainage

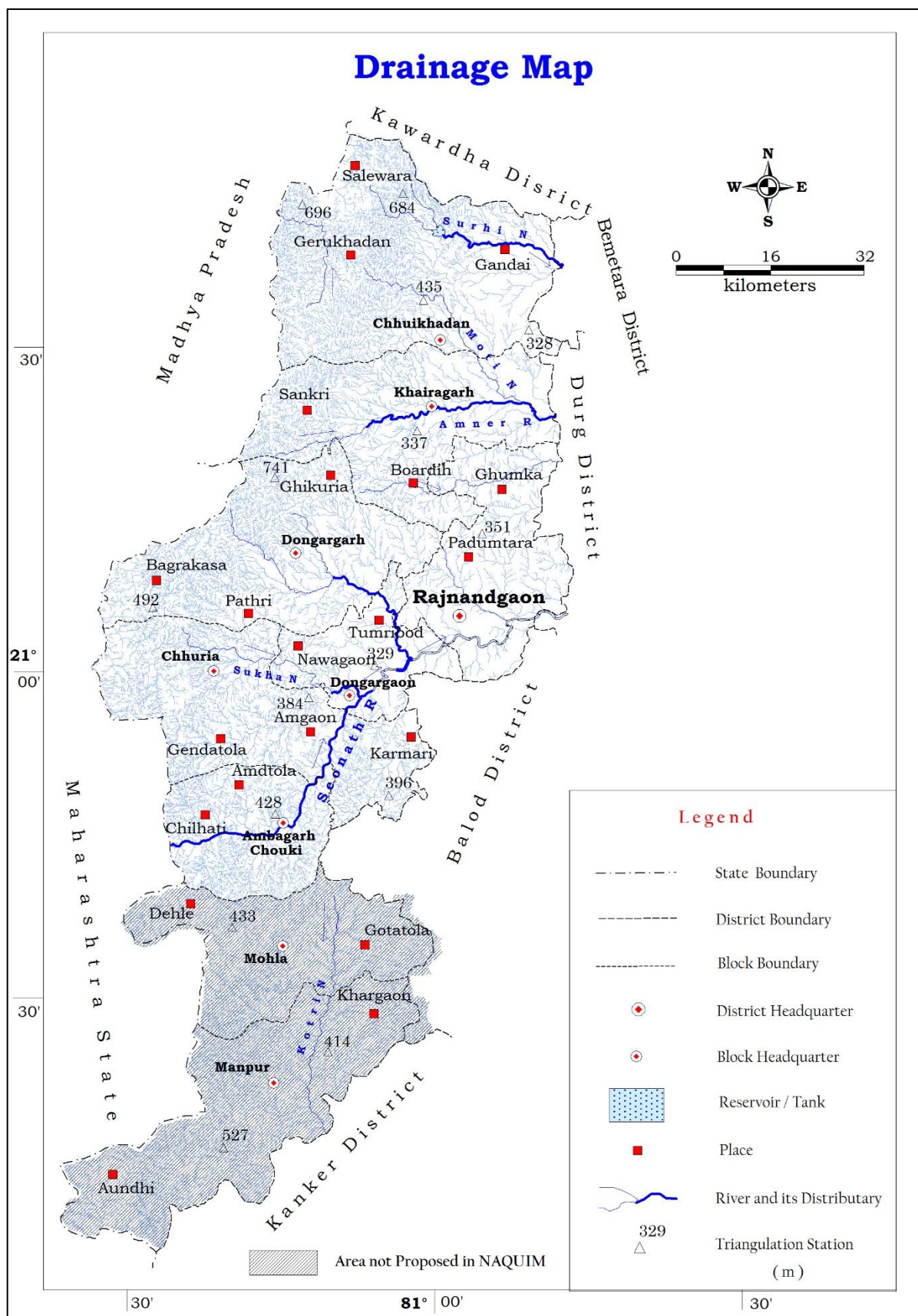


Figure 9 Drainage map of the study area

The general slope of the district is towards east. All the rivers of the district flow in eastern direction. Seonath is the most important river. The important tributaries of the river are Amner, Jonk, Ghumriya, Pairi Zura and Hanf. Nearly 71.8 percent area of the district falls under Mahanadi river basin. The river Seonath which is a tributary of Mahanadi, originates near village Kotgul, Garh-Chiroli district (Maharashtra) on the border of Chowki block and is the principal river of this district and is a fifth order river. The drainage density is very high on the western part of the area and is low on the eastern part. The high drainage density indicates higher run off and less infiltration (Figure 9).

1.11 Geology

Rajnandgaon district is mainly underlain by hard rock which belongs to Precambrian age, part from these alluvium and laterite of Quaternary age occur in very isolated pocket with and limited extension. Hard rock mainly includes granites and its variants, metasediments, rhyolite etc. and also sandstone, shale, limestone / dolomite sequence belonging to Proterozoic Purana rocks of Chhattisgarh super group. The country rocks are intruded by basic and acid intrusive like dolerite dykes and sills and quartz and pegmatite veins. Major part of the district is occupied by granitic rocks belonging to Dongargarh group followed by Purana rocks of Chhattisgarh Supergroup. The laterite occurs as capping over the country rock in pockets particularly in elevated area in limited thickness. The recent alluvium with limited thickness and extension occur along the major river and stream channels (Figure 10).

Chandi Formation -

Chandi formation occupying the central- eastern part of the district covers about 790 sq.km of the area in parts of Khairagarh and Chhuikhadan blocks. It comprises a thick sequence of Stromatolitic limestone, dolomite & shale has a gradational contact with the underlying Gunderdehi shale. The limestone is pink to light grey in color. fine grained with extensive development of stromatolitic structure and is thickly bedded. Minor shale partings are present. Stromatolites are grey to brown in colour with intercolumnar space filled with argillaceous carbonate material. In middle horizon of this formation, stromatolitic limestone and flaggy limestone are associated with green calcareous shale. The green shale is friable and splintery, calcareous and at places itself contains columnar stromatolitic structure inclined to bedding plane. Upper horizon is predominantly pink to purple, medium to coarse grained dolomitic limestone with characteristic development of stromatolites. The rock has a mottled appearance due to dolomite crystals. It is generally massive in look and is associated with purple to grey shale intercalations. Towards upper

part, the rock gradually changes and devoid of stromatalitic structure. The rock is also gypsiferous containing gypsum in cavities.

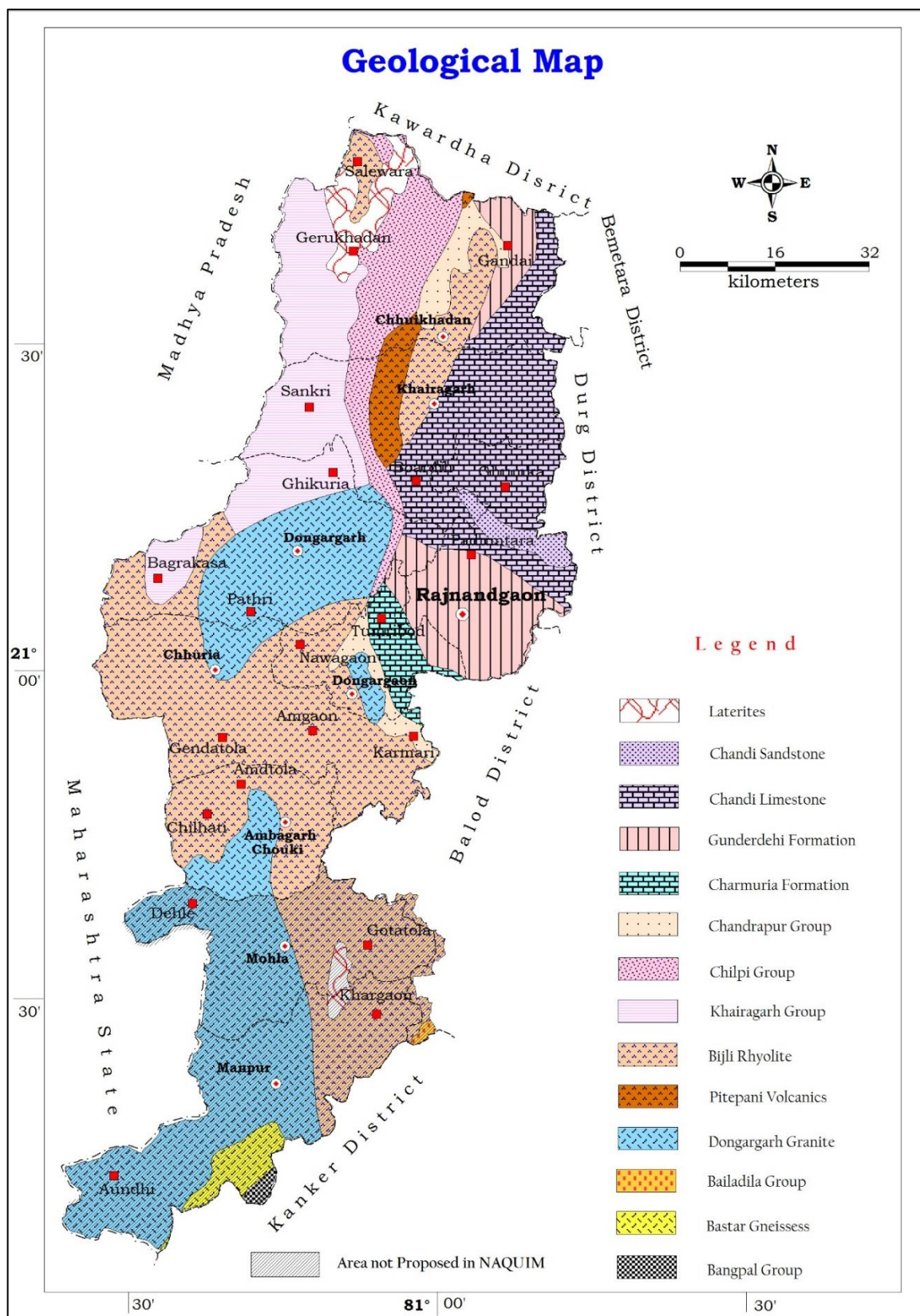


Figure 10 Geological map of the study area

Gunderdehi formation -

Gunderdehi Formation, which occupies the central and southern part of the Rajnandgaon and, some part of Dongargarh block acts as an aquiclude. Only weathered mantle to a depth of 30m is Productive for water.

Charmuria formation -

Charmuria Formation occurring in parts of Dongargaon, Dongargarh, Khairagarh and Chhuhikhadaon blocks is the most prolific aquifer. In Rajnandgaon district the Ranidhar Member comprising of cherty limestone and dolomite is mainly calcareous in nature and is deposited above sandstone of Chandrapur Formation. It is the most prolific aquifer. Due to heterogeneity of the contact and cherty limestone, the development of solution cavities along the bedding plane is very common and these cavernous zones are filled with clay material and intraformational conglomerate.

Chandrapur formation -

Chandrapur Group in the district consists of Orthoquartzitic to subarkosic sandstone and black shale. These sandstones are dominantly orthoquartzite in composition and are highly silicified. Primary sedimentary structures like Ripple marks and cross bedding are common. Mega scale cross bedding in these sandstones is seen. The black shale is occurring low lying area and only can be seen subsurface. These are horizontally bedded and thinly laminated. Fresh rocks are hard and compact. The Chandrapur formation comprises sandstone & shales.

Chilphi formation -

The occurrence of ground water in this formation is mainly in the weathered zone and in the fracture zones.

Dongargarh granite and Bijli rhyolite -

In the case of weathered granite, the depth and intensity of weathering control the occurrence and movement of groundwater but at deeper levels in hard granite rocks controlling factor are occurrence of fractures and joints below the weathered zone and lineaments. It is observed that occurrence of shallow fractures are more common in case of granite, It is also observed that wells located in the topographic low areas are generally having better yield.

1.12 Agriculture, Irrigation, Cropping Pattern

Agriculture is practiced in the area during Kharif and Rabi season every year. During the Kharif, cultivation is done through rainfall while during the Rabi season, it is done through ground water as well as partly through surface water like canals and other sources. The groundwater abstraction structures are generally Dugwells, Borewells /tubewells. The principal crops are paddy, wheat, vegetables and pulses. In some areas, double cropping is also practiced. The agricultural pattern, cropping pattern and area irrigated data of Rajnandgaon district is given in Table No. 4, 5, 6.

Table 4 Cropping pattern (in ha)

Kharif	Rabi	Cereal				Pulses	Tilhan	Fruits Vegetables	Reshe	Mirch Masala	Sugarcane
		Paddy	Wheat	Jowar & Maize	Others						
215728	155627	174603	11789	592	16	86058	19645	14002	7	267	60

Table 5 Area irrigated by various sources (in ha)

No. of canal s (privat e and Govt.)	Irrigate d area	No.of bore wells / Tube wells	Irrigate d area	No. Of dug well s	Irrigate d area	No. of Pond s	Irrigate d area	Irrigate d area by other sources	Net Irrigate d area	% of irrigate d area wrt. Net sown area
123	38285	13366	49710	4295	2544	91	1369	1954	93862	42

Table 6 Contribution of Groundwater in Irrigation Pattern (in ha)

Area Irrigated through Borewells/Tube wells	Area Irrigated through Dug wells	Area Irrigated through Groundwater	Net Area Irrigated through all sources	% Groundwater contribution in Irrigation wrt Net Irrigated Area
49710	2544	52254	93862	55.67

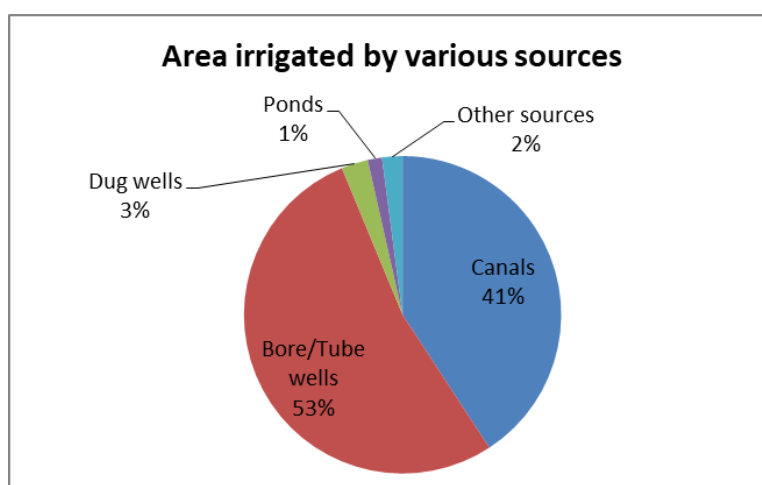


Figure 11 Area irrigated by various sources

2. DATA COLLECTION, DATA GENERATION, DATA INTEGRATION AND DATA INTERPRETATION

2.1 Hydrogeological Data

The semi-consolidated rocks of study area mainly represented by Baster Gneiss, Bijli Rhyolites and Chhattisgarh Super Group of rocks (Predominantly by Charmuria Formation, Gunderdehi Formation & Chandrapur Group), which consists mainly of shale, limestone and granitic rocks. In general two aquifers exist in the area. The depth range of the first shallow unconfined/ phreatic aquifer between 3.85 to 37.8 mbgl and the second fractured aquifer below 03 mbgl. It has been found that within the fractured aquifer, there are 1-6 nos. of water bearing zones are found with different thickness as well as of varying horizontal extent. In the study area, key wells were established during the pre-monsoon period and have been subsequently monitored in the post-monsoon period. The key wells are distributed throughout the study area covering all the geological formations, the details of which are presented in the Figure 12 and Annexure 1.

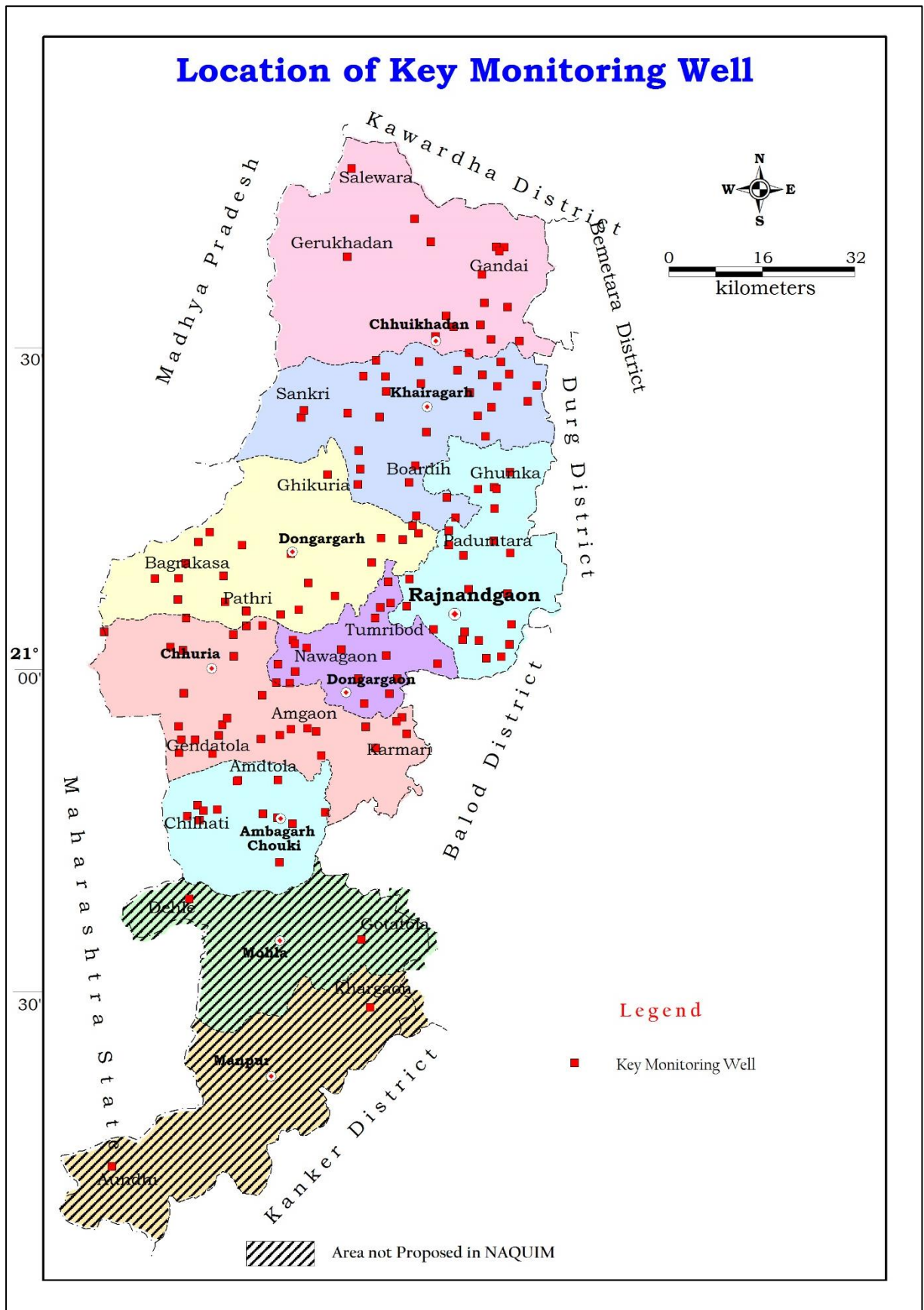


Figure 12 Key Montoring Wells of the study area

2.1.1 Water level behavior

Pre-monsoon depth to water level maps as well as seasonal fluctuation maps have been prepared on the basis of the depth to waterlevel periodically monitored data of the key wells established in the study area.

(i) Pre- monsoon waterlevel

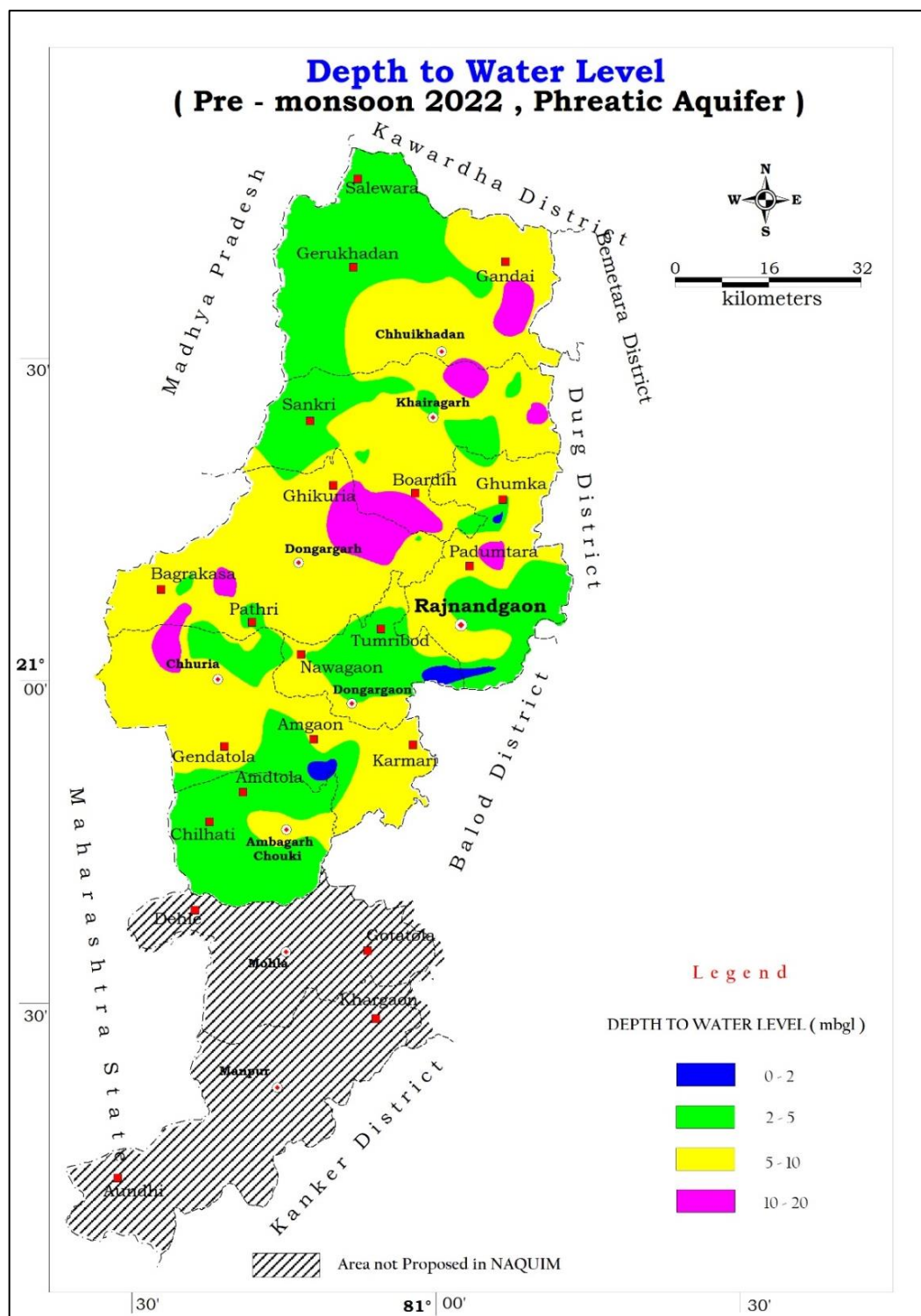


Figure 13 Pre-monsoon Waterlevel Map of Phreatic Aquifer

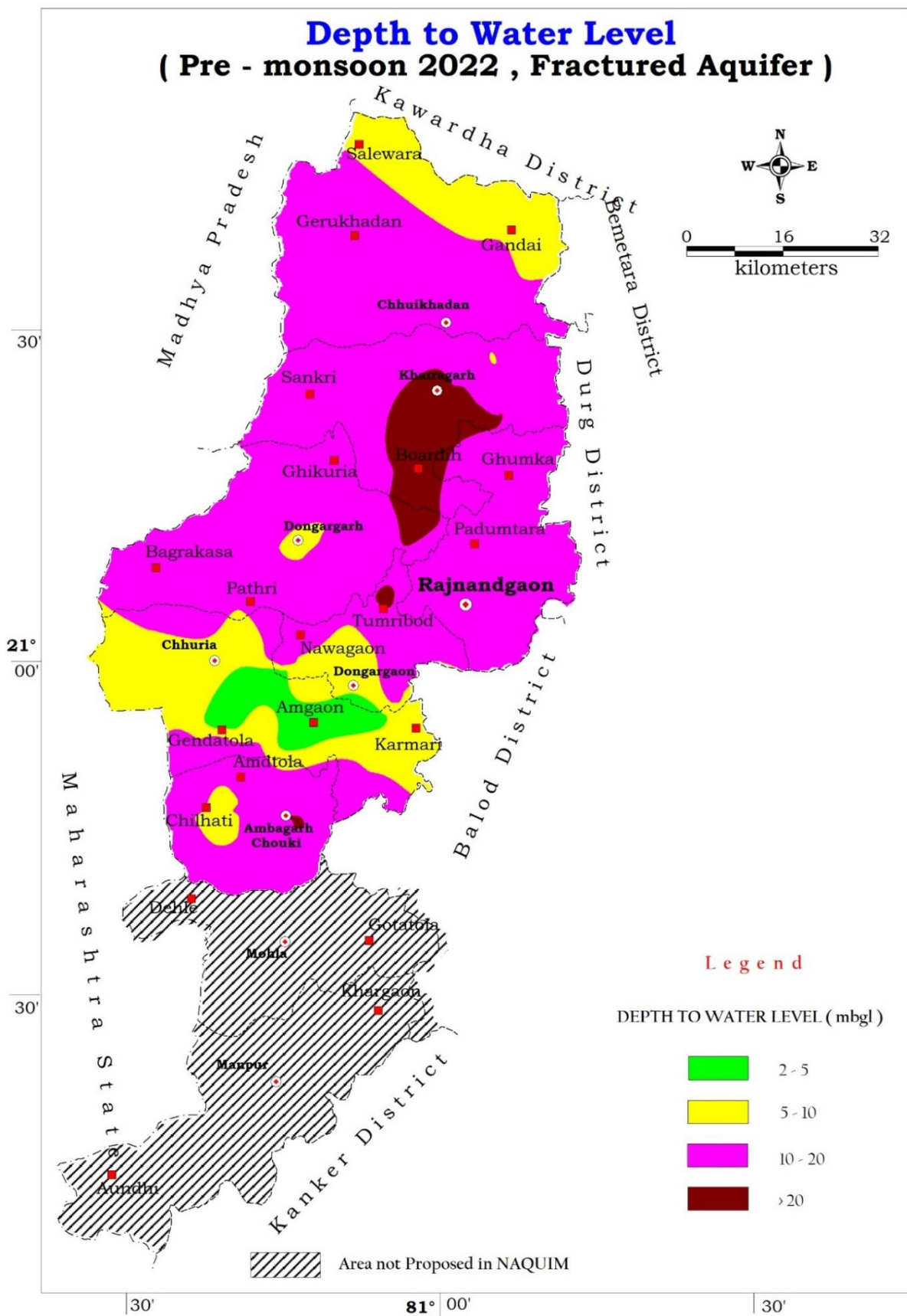


Figure 14 Pre monsoon Water Level Maps of Fractured Aquifer

In the post-monsoon period, it has been observed that in the study area water level in phreatic aquifer vary between 0.4 to 13.7 m bgl with average water level of 4.57 m bgl. In deeper fractured aquifer, water level varies between 1.62 to 19.19 m bgl with average water level of 7.89 m bgl shown in Table 7.

Table 7 Aquifer wise Depth to Waterlevel (Pre-monsoon)

District	Aquifer Type	Min (m. bgl)	Max (m. bgl)	Avg (m. bgl)
Rajnandgaon	Phreatic aquifer	0.4	13.7	4.57
	Fractured Aquifer	1.62	19.19	7.89

(ii) Post- monsoon waterlevel

In the post-monsoon period, it has been observed that in the study area water level in phreatic aquifer vary between 0.4 to 13.7 m bgl with average water level of 4.57 m bgl. In deeper fractured aquifer, water level varies between 1.62 to 19.19 m bgl with average water level of 7.89 m bgl shown in Table 8.

Table 8 Aquifer wise Depth to Waterlevel (Post-monsoon)

District	Aquifer Type	Min (m. bgl)	Max (m. bgl)	Avg (m. bgl)
Rajnandgaon	Phreatic aquifer	0.4	13.7	4.57
	Fractured Aquifer	1.62	19.19	7.89

(iii) Seasonal water level fluctuation: The water level fluctuation data indicates that in the study area, water level fluctuation in phreatic aquifer varies from 0.08 m to 8.70 m with an average fluctuation of 2.53 m. In deeper fractured aquifer, water level varies between 0.25 to 14.65 m bgl with average water level of 5.39 m bgl shown in Table 9.

Table 9 Aquifer wise Depth to Waterlevel (Post-monsoon)

District	Aquifer Type	Min (m. bgl)	Max (m. bgl)	Avg (m. bgl)
Rajnandgaon	Phreatic aquifer	0.08	8.70	2.53
	Fractured Aquifer	0.25	14.65	5.39

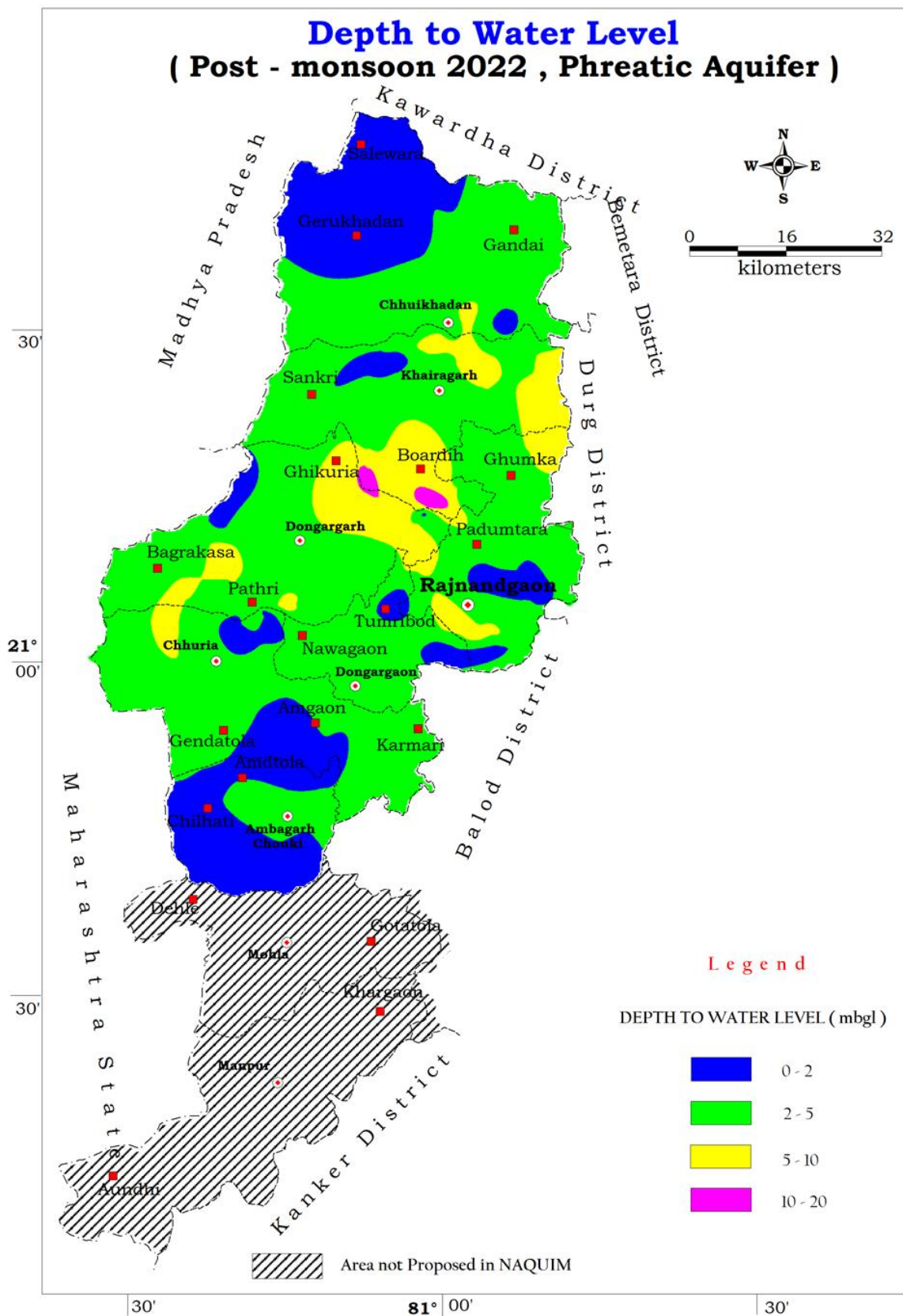


Figure 15 Post monsoon Water Level Map of Phreatic Aquifer

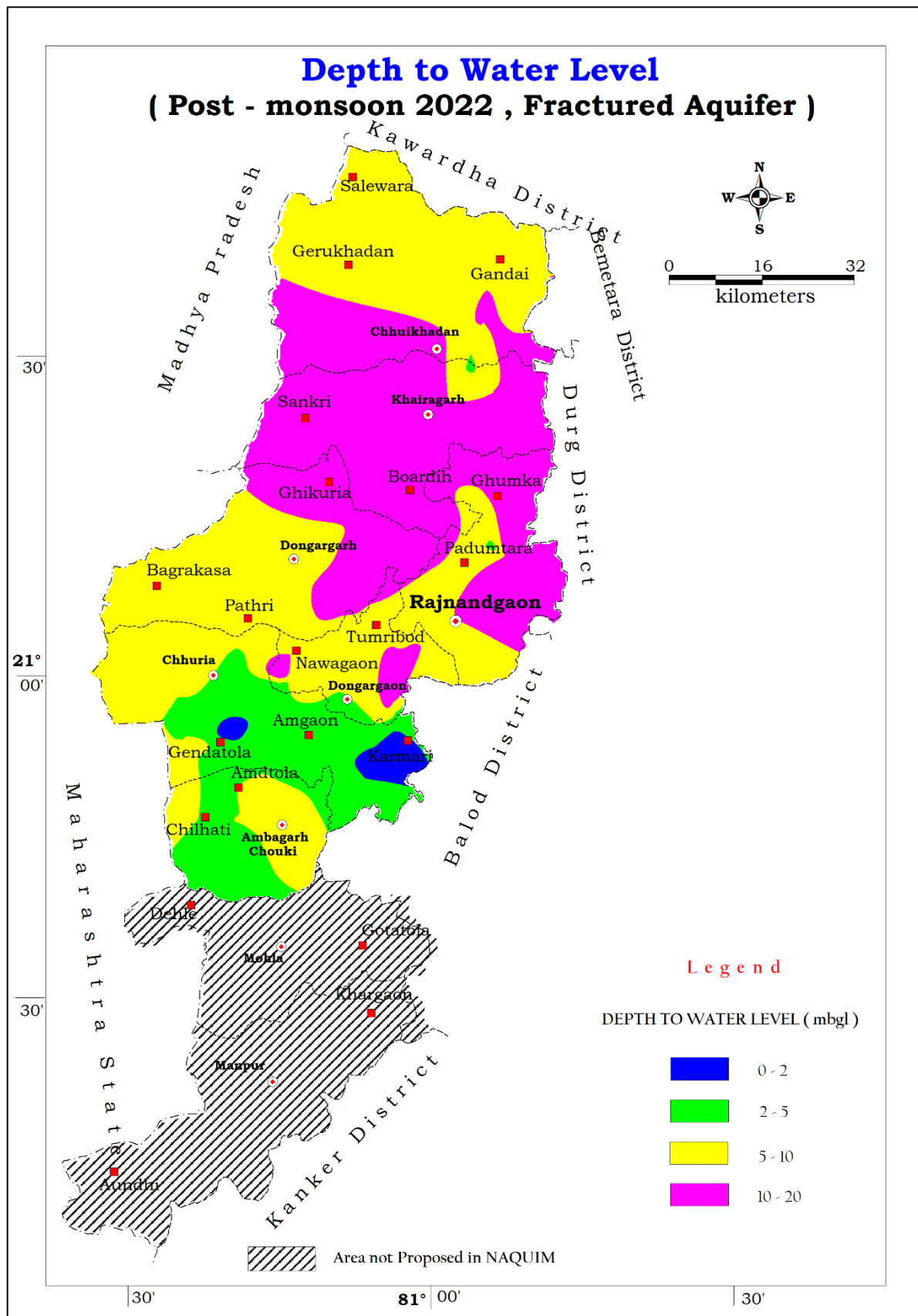


Figure 16 Post monsoon Water Level Maps of Fractured Aquifer

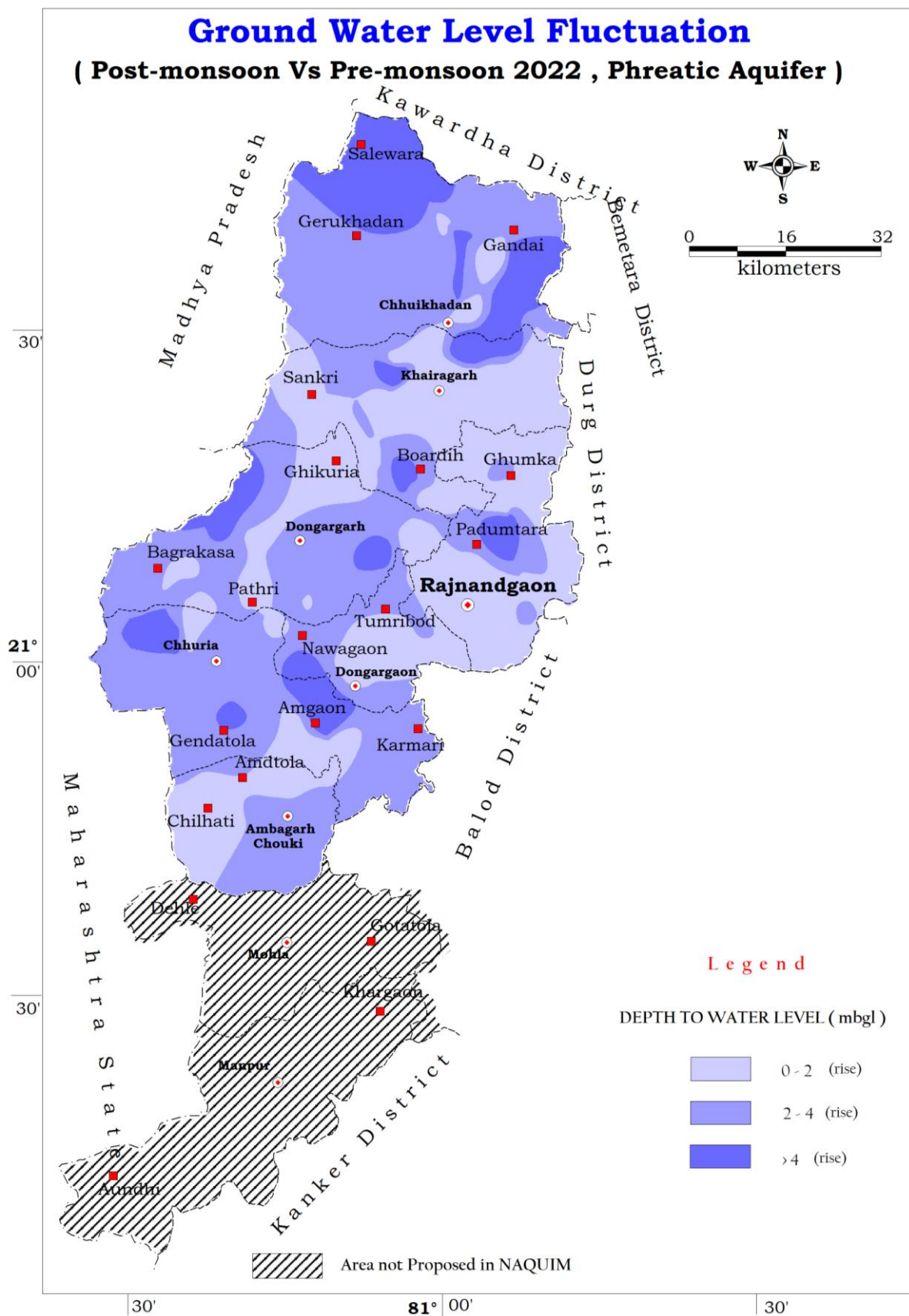


Figure 17 Water level fluctuation of phreatic aquifer

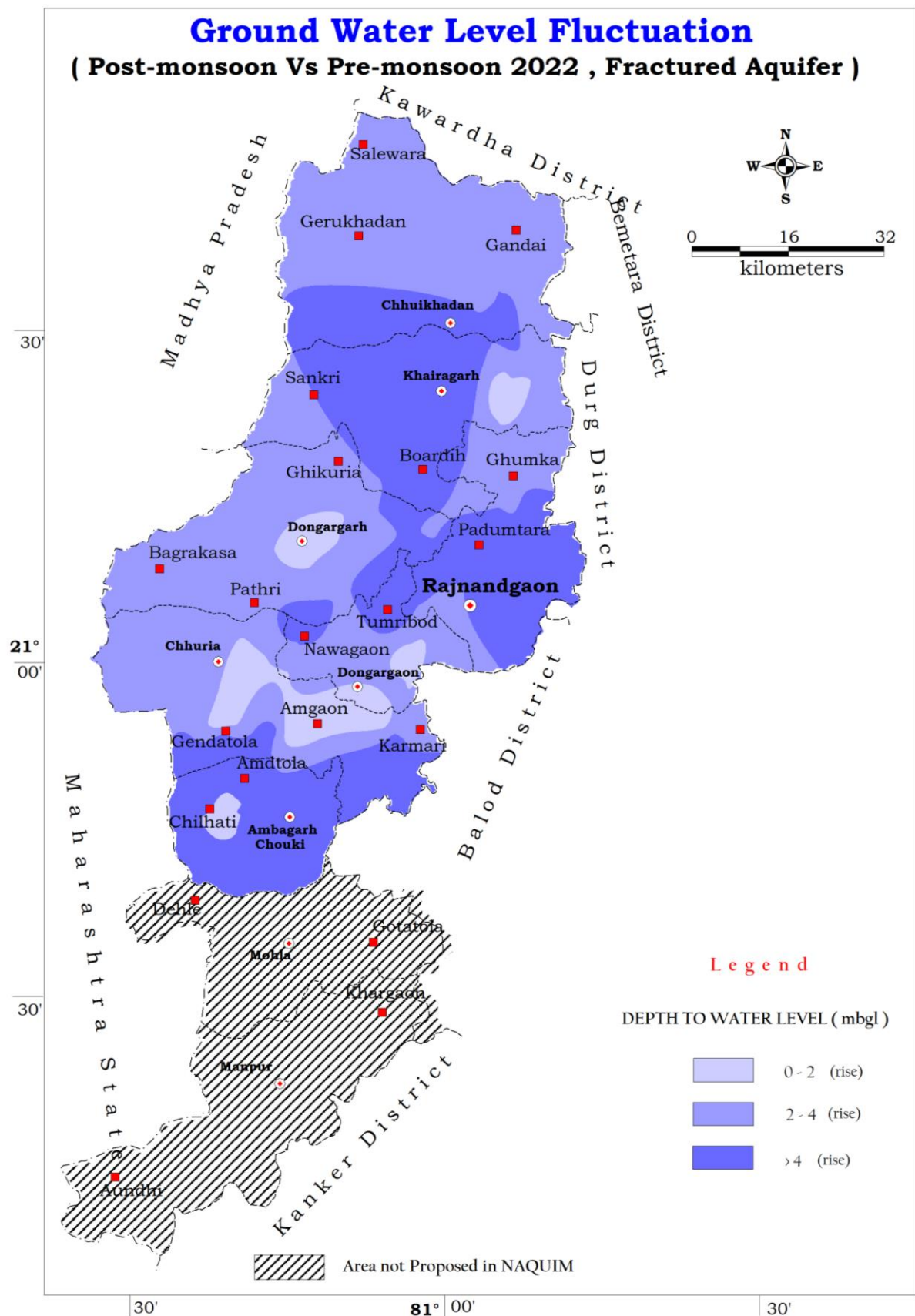


Figure 18 Water level fluctuation of semiconfined aquifer

2.2 Exploratory Data

Total of 133 Exploratory well exist in the study area. Location of the exploratory wells shown in Figure 19. The results and findings are presented in Annexure 2. To know the hydro chemical behaviour of the ground water in the study area, 140 nos. of ground water samples were collected and 6 nos. of water level data from the key wells and (NHNS) during pre-monsoon period were collected (Due to Covid 19 Pandemic). Also water samples were collected from borewells during exploration carried out in the area and analysed in the chemical laboratory of Central Ground Water Board, NCCR, Raipur for determination of various chemical parameters. The results and findings are presented in Annexure 3.

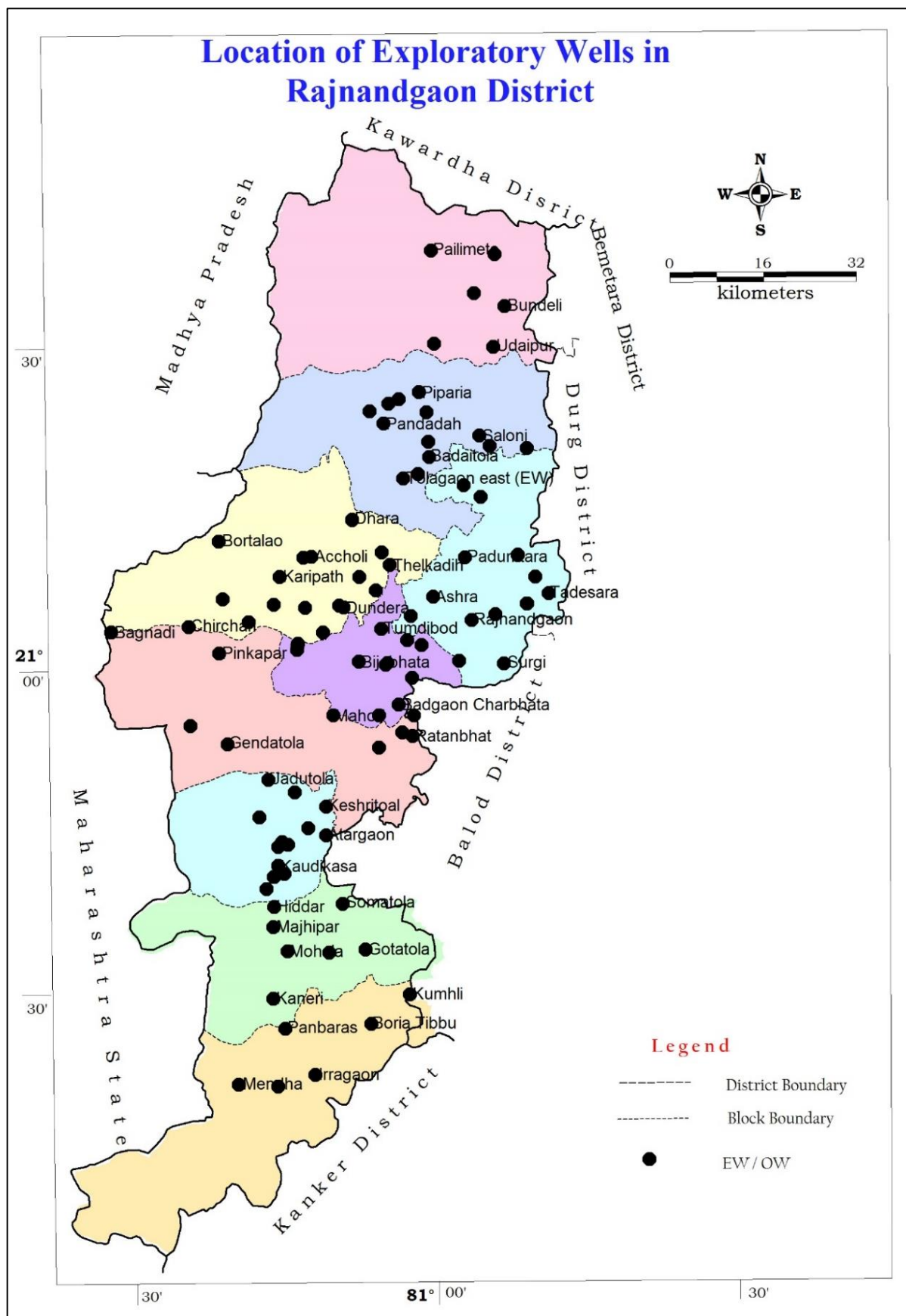


Figure 19 Location of Exploratory wells in the study area

2.3 Geophysical Data

To understand the subsurface hydrogeological conditions, the resistivity survey has been carried out in Gandai and Kaudikasa area of Rajnandgaon district. The basic objective of investigation was to delineate probable groundwater zones to pin point the exploratory drilling sites in the district. The location maps of VESs have been shown in fig. 20. The block wise distribution of VES and Profiling is given in Table 10.

Table 10 Block wise Distributions of VES and Profiling in Rajnandgaon District

S. No.	Block	No. of VES	Profiling
1	A. Chowki	15	1
2	Chhuikhadan	31	
3	Chhuria	4	1
4	Dongargaon	8	
5	Dongargarh	20	
6	Khairagarh	47	1
7	Manpur	1	
8	Mohla	11	
9	Rajnandgaon	17	

In Gandai area of Rajnandgaon district, the Electrical resistivity surveys were carried out to delineate the thickness and also the areal extent of water bearing formation within the Surhi River watershed area. The investigated area lies between the longitude 81° 03' E to 81° 09'E and latitude 21°38'N to 21°43'N, falling in the Survey of India Toposheet No. 64G/2, covering an area of about 30 km² (Fig.-21). The area comes under Chhuihikhadan block of Rajnandgaon district. The area is mainly plain land with hills on the western part. The elevation of the area varies from 310 m to 350 m amsl. The drainage pattern of the area is dendritic. The representative VES curve is shown in fig 22 and the interpreted layer parameters of all the soundings are presented in Table-6(B).

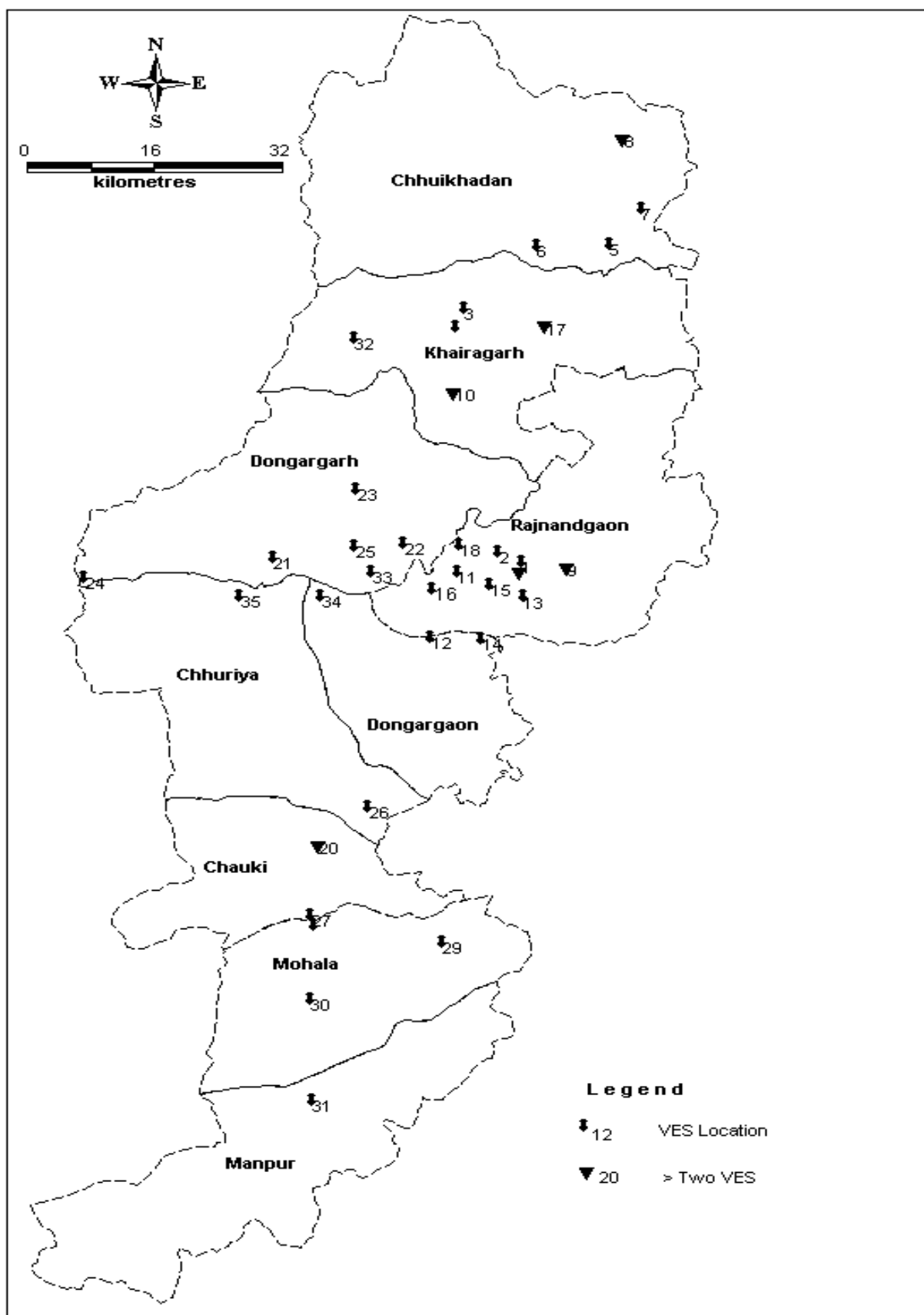


Figure 20 Location map of VESs in Rajnandgaon district

To understand the prevailing subsurface hydrogeological conditions beneath the watershed area, two geoelectrical cross sections along A-A' and B-B', as shown in the location map, have been prepared. These sections provide the the subsurface picture of geological horizon which form the probable aquifer aquifer zone in the area.

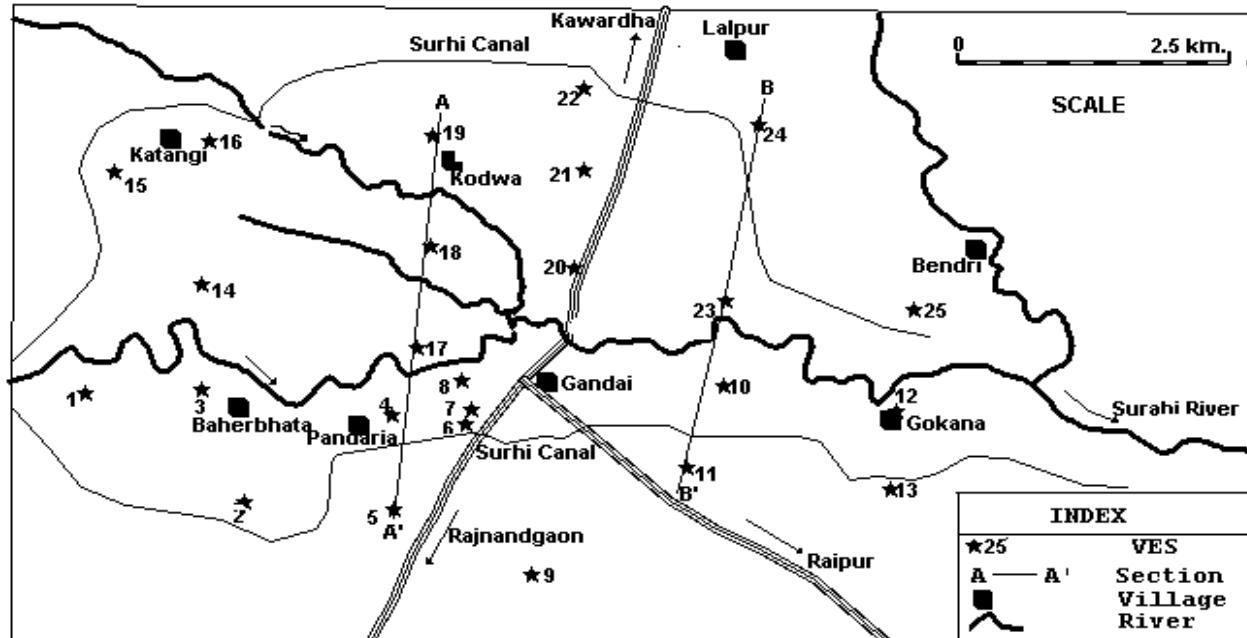


Figure 21 Detailed Location of VESs around Gandai area, Rajnandgaon district

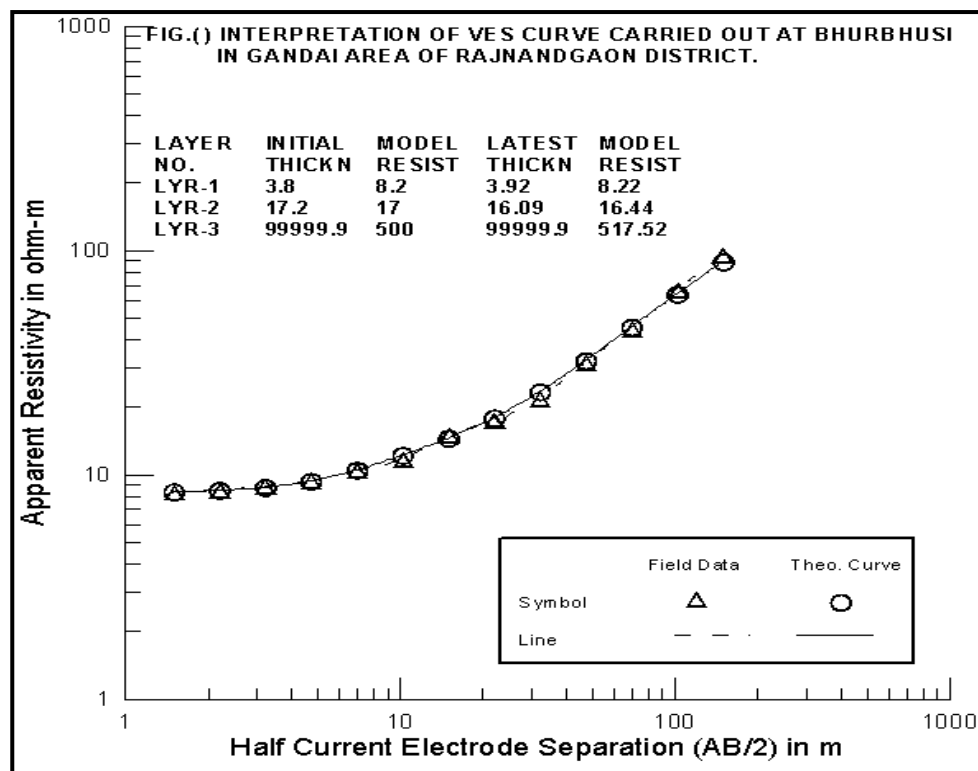


Figure 22 Representative VES curve from Rajnandgaon district

Table 11 Interpreted layer parameters of Soundings in Gandai area, Rajnandgaon.

S. No	Name of the Sites	VES No.	Respective Resistivity (Ohm-m)					Respective layer Depth in (m)			
			ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	D1	D2	D3	D4
1	Baherbhata(W)	1	16	7	135	1240	-	0.8	3	30	-
2	Baherbhata (S)	2	15	10	29	185	-	0.5	7.3	24	-
3	Baherbhata	3	41	10.5	28	500	-	0.45	7.3	46	-
4	Kope Bhata	4	28	12	25	1200	-	1	10	32	-
5	Kope Bhata (S)	5	11	8	60	360	-	0.6	7.5	25	-
6	Gandai(PWD R/H)	6	22	9	127	945	-	0.75	11	21	-
7	Gandai (Hospital)	7	150	22	11	450	-	0.4	5.5	18.5	-
8	Gandai	8	12	6.5	120	1000	-	0.8	8.5	20	-
9	Gandai	9	10	6.3	28	430	-	0.4	7	19	-
10	Bhurbhusi	10	8.2	17	500	-	-	3.8	21	-	-
11	Bhurbhusi (S)	11	30	6	21	133	1040	0.7	3.5	30	50
12	Gokna	12	30	11	33	112	1000	0.7	3.5	16	54
13	Gokna (S)	13	12	6	40	200	1000	0.85	5	13	60
14	Birkha	14	27	9	33	500	-	0.7	4.3	45	-
15	Katangi (SW)	15	12	6.6	12	90	400	0.5	4.5	23	50
16	Katangi	16	27	10.5	43	400	-	0.7	16	48	-
17	Kirtibas	17	23	8	32	500	-	0.8	8	40	-
18	Burhasagar	18	30	8	28	85	500	0.5	7.5	28	50
19	Kodowa	19	9.5	7	18	62	1000	0.7	1.5	9.5	42
20	Devpura	20	29	10	27	120	1000	0.5	3.5	14	40
21	Devpura (N)	21	16	10	6	95	550	0.5	2.5	7.5	38
22	Limon	22	15	4.5	13	160	1000	0.7	2.5	11	38
23	Bhurbhusi (W)	23	30	11	70	1200	-	0.5	10	35	-
24	Lalpur	24	7	5	10	120	1000	0.6	3.5	7.5	28
25	Bhurbhasi (E)	25	12	10	14	45	800	0.9	2.5	15	35

Geoelectrical Cross Section Along A-A' - This section is drawn in north-south direction, (Fig 23) which runs from village Kodwa to south of village Kopebhata. The section is prepared based on the results of five vertical electrical sounding i.e. VES- 19, VES-18, VES-17, VES-4 and VES-5. The length of this section is about 4.0 kms. The resistivity values of first layer vary from place to place possibly due to presence of different nature of surface soil as well as moisture content having uniform thickness throughout the section. Below this layer clayey layer (7-12 ohm-m) is present throughout the section with varying thickness. In next sequential layer except at

sounding location 5, the resistivity observed between 18-32 ohm-m, which represents clay, sand and boulders with maximum thickness of about 32 m at VES location 17.

The fourth layer at VES location 19, 18 and third layer at VES location 5 having resistivity range 60-85 ohm-m indicates the presence of fractured limestone. The maximum thickness of fractured limestone is about 31.5 m at sounding location 19. The last layer having resistivity range between 360-1200 ohm-m represents the hard and massive nature of limestone. This bedrock depth is maximum at sounding location 18 which is about 50 m and this depth is gradually decreasing toward north as well as south. The clayey sand with boulders and fractured limestone constitute the potential zone of Ground water along the section.

Geoelectrical Cross- Section Along B-B' - The second cross section (Fig 23) is prepared based on the result of four vertical electrical soundings ie. VES-24, 23, 10 and 11. The section B-B' runs about 3 kms towards east and parallel to A-A' from south of village Lalpur to Raipur road, covering about 4 kms length. The surface soil has resistivity values of 7-30 ohm-m and thickness of about 3.8 m at sounding location No.10. The resistivity of second layer at sounding location 24 and 11 indicates the presence of clay.

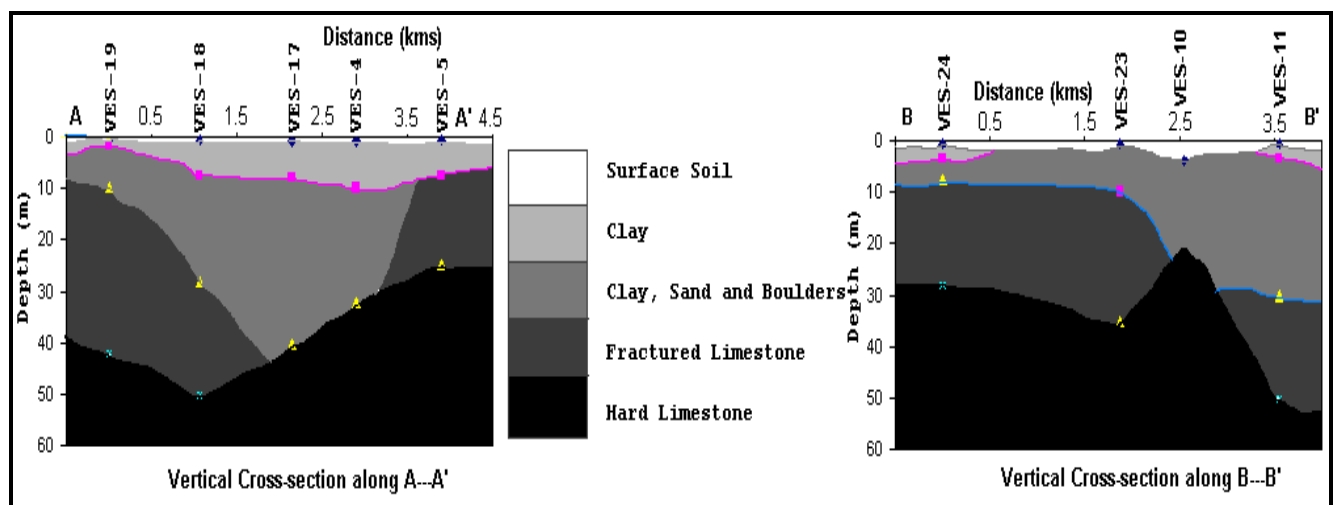


Figure 23 Geoelectrical cross-section of Rajnandgaon district

Iso-Resistivity Section at 30 M Depth - The lithology and distribution of a particular aquifers at a particular depth level throughout the area can be represented from the iso-resistivity section (Yadav and Lal, 1989). In this regard a horizontal cross section (iso-resistivity) at a depth level of 30 m bgl has been presented in Fig-24. This section has been prepared by taking the true resistivity value of the layer for VESs of the area for 30 m depth. It can be inferred from the section that the resistivity value below 50 ohm-m indicates the presence of clay and sand with

boulders whereas resistivity value lying between 50-250 ohm-m indicates weathered and fractured limestone. Resistivity more than 250 ohm-m is suggestive of the presence of compact rock. The area associated with clayey sand with boulders and fractured limestone is forming good ground water potential zones. From the iso-resistivity map one can easily identify the good potential ground water zone in the area under investigation.

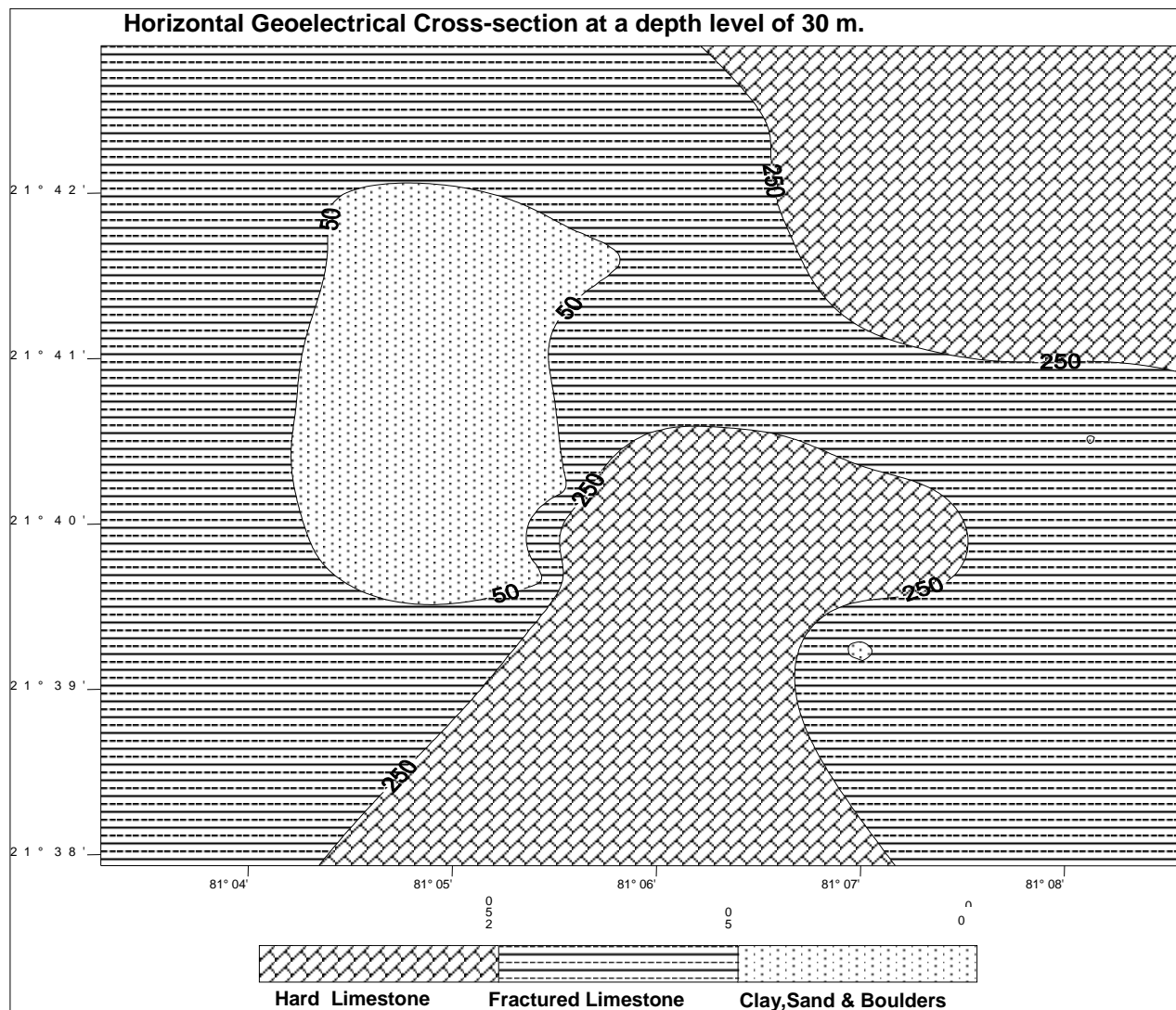


Figure 24 Iso-resistivity map at 30 m depth bgl

It is noticed that the vertical electrical soundings proved to be an effective geophysical tool for delineation of ground water zones in the area around Gandai, Rajnandgaon District. The potential ground water in the area is found in clay, sand with boulders and fractured limestone. The variable depths and thickness of aquifer, exhibiting considerable variation from site to site. It is noticed that the prominent zones of aquifer are located in the southeast, southwest, and north central sides and along both sides of Surhi River.

Kaudikasa Area

To study the nature of subsurface hydrogeological formations 17 Vertical Electrical Soundings (VES) were carried out at and around Kaudikasa village, Rajnandgaon district keeping a maximum AB/2 separation of 200m. Out of 17 VES, 9 VES were carried out within a radius of about 1.25 km of Kaudikasa village itself, 3 VES were conducted at Murethitola village and a VES each at Arajkund, Bhagwantola, Dewarsur, Metapar and Nichekohra village separately.

The area under study falls between the North latitude $20^{\circ} 42' 50''$ - $20^{\circ} 44' 30''$ and East longitude $80^{\circ} 44' - 80^{\circ} 44' 50''$ of survey of India toposheet no. 64 D/10 of Rajnandgaon district of Chhattisgarh State. Table 12 is showing the geoelectrical parameters of all the VES, which have been carried in the study area. The representative VES curve along with its interpretation shown in fig 25.

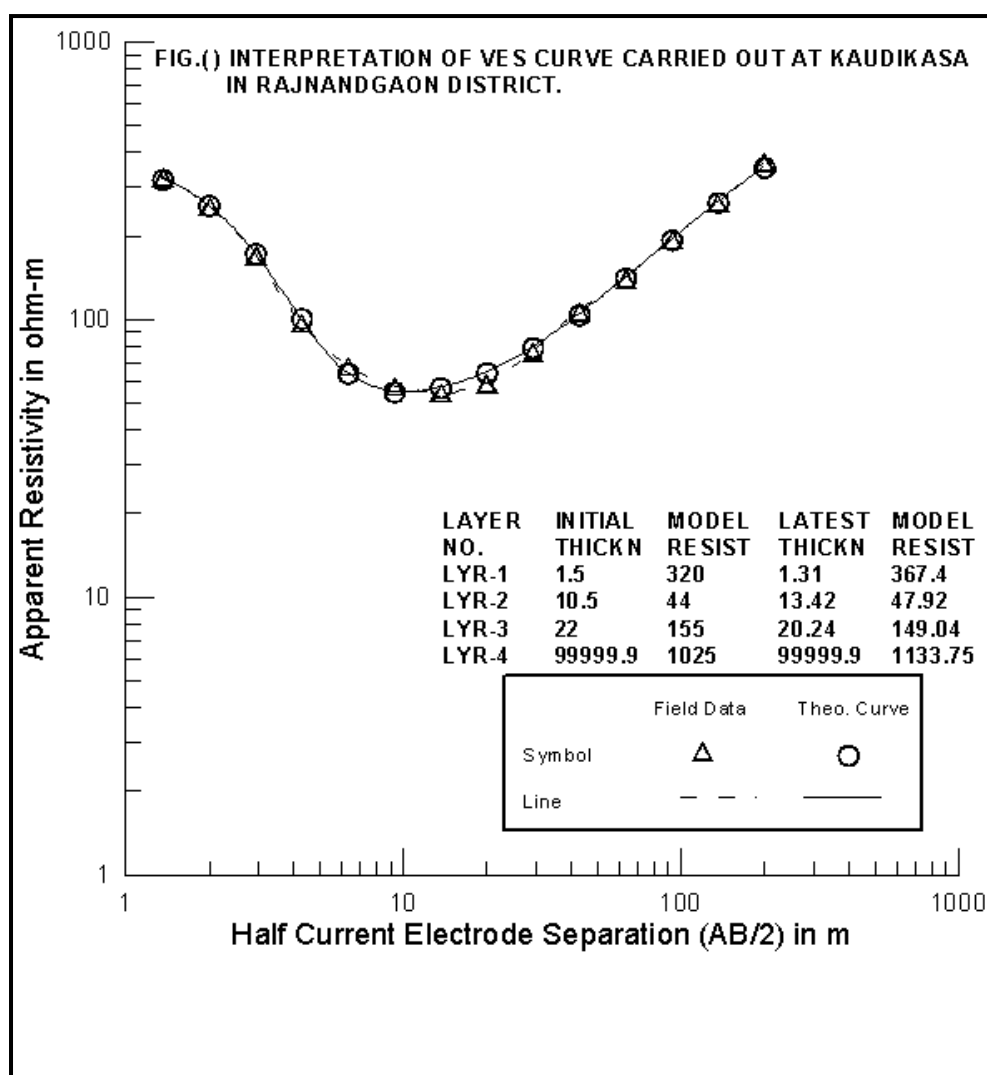


Figure 25 Representative VES curves from Kaudikasa area of Rajnandgaon district.

Table 12 Interpreted layer parameters of Soundings in Kaudikasa area.

Sl no	Name of the site	VES no	Respective resistivity in ohm-m				Respective layer thickness in(m)			Remarks
			ρ_1	ρ_2	ρ_3	ρ_4	D ₁	D ₂	D ₃	
1	Kaudikasa	1	60	7	185	1200	0.9	6.1	22	
2	-do-	2	360	55	175	750	1	3.7	25	Fracture at 85 & 100 m.
3	-do-	3	240	79	298	850	1.5	5.5	38	Fracture at 100 m.
4	-do-	4	140	70	325	1200	2	14	45	
5	-do-	5	320	44	155	1025	1.5	12	34	
6	-do-	6	45	24	68	1050	1.2	4.6	35	Fracture at 80m.
7	-do-	7	160	59	189	550	1.2	18	35	
8	-do-	12	185	65	35	500	1.1	3	35	
9	-do-	13	22	10.5	51	950	1.1	3.8	31	
10	Murethitola	8	40	12	45	850	2.1	14.5	32	
11	-do-	9	88	22.4	110	1760	0.7	17	35	Fracture at 85 m.
12	-do-	10	135	33	185	1200	1.6	21	45	
13	Metapar	11	65	13	240	1000	1.3	17.5	45	
14	Arajkund	14	100	45	255	1250	1.3	6.5	26	
15	Bhagwantola	19	28	13.5	155	750	1	8.5	19	
16	Dewarsur	20	46	14	285	2000	1.1	6	23	
17	Nichekohra	21	55	34	355	1400	1	4.2	18	Fracture at 95m.

To obtain the subsurface hydrogeological condition like disposition of different aquifers and to identify the suitable test site for groundwater exploration 3 geoelectrical cross-sections have been drawn from the area.

A representative NE-SW trending Geo-electrical Cross Section (west of Murethitola village) between VES 8, 9 & 10 along the road has been prepared (Fig-26). The section reveals the presence of four major geo-electric layers systems in the area. The topmost layer is soil cover of resistivity value from 88 to 135 ohm-m and thickness is maximum 2.1 m. The second layer is weathered one with resistivity value of 12 to 33 ohm-m and thickness of 12.4 to 19.4 m. The third layer is fractured with resistivity ranges from 45 to 185 ohm-m and thickness varies from

18 to 24 m. The last layer is hard & massive in nature with a high resistivity value ranges from 850 to 1760 ohm-m.

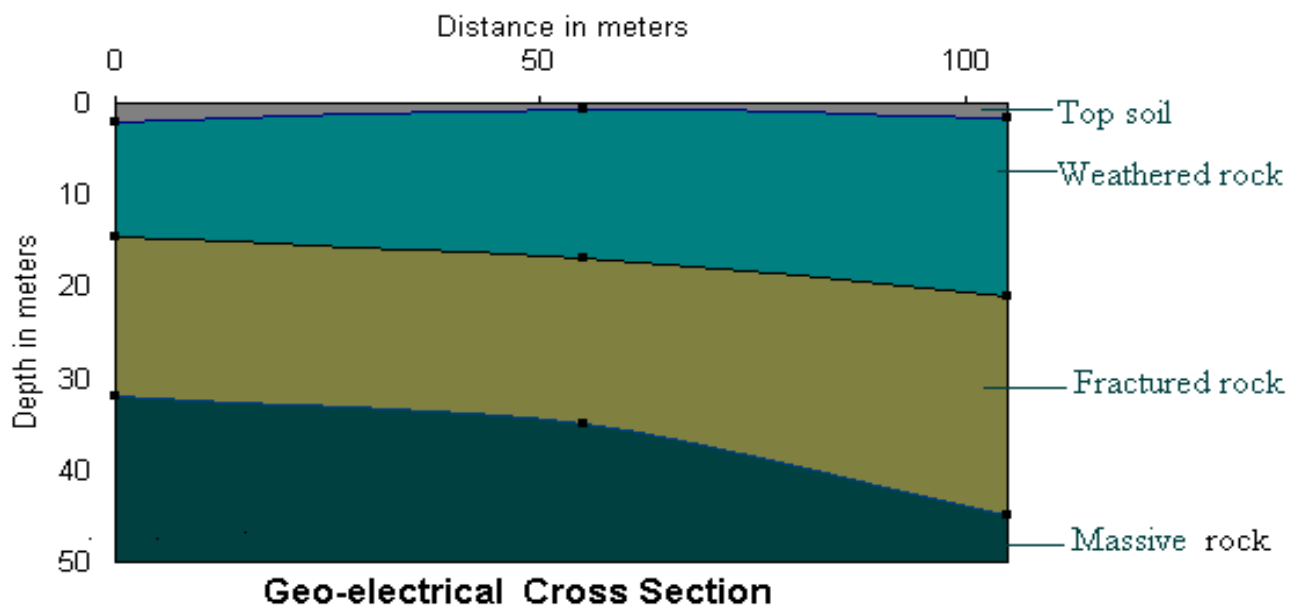


Figure 26 Geoelectrical cross section 1, around Kaudikasa area Rajnandgaon district

Another representative North-South trending Geo-electrical Cross Section (south of Kaudikasa village) between VES 4, 7, 6 & 5 along the main road has been prepared (Fig-27).

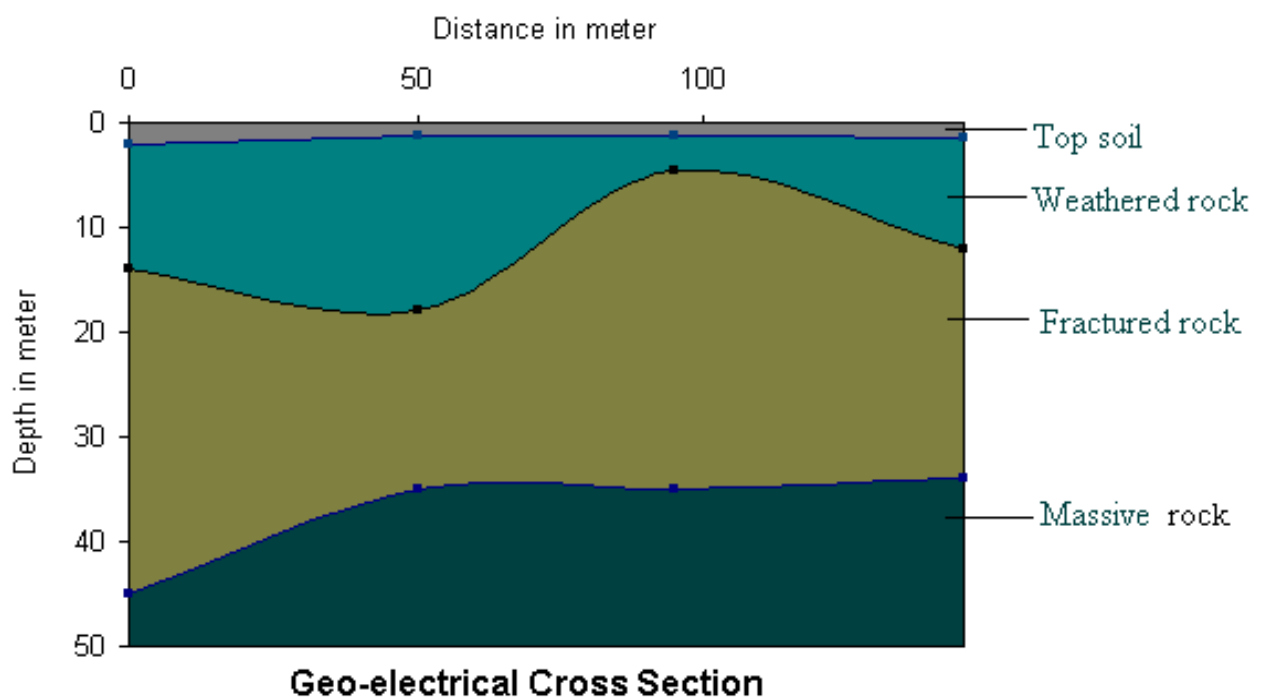
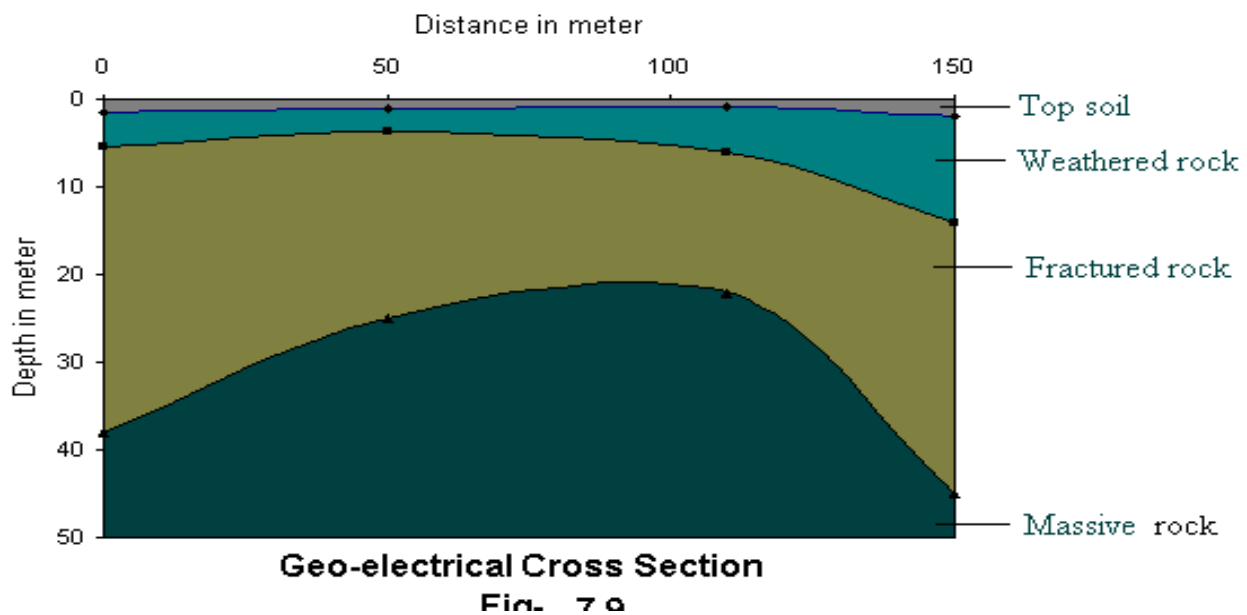


Figure 27 Geoelectrical cross section 2, around Kaudikasa area Rajnandgaon district

The area mainly consists of four geoelectric layers. The topmost soil cover is maximum 2 m thick with a resistivity value 45 to 320 ohm-m. The second layer is weathered one with resistivity value of 24 to 70 ohm-m and thickness of 2.4 to 16.8 m. The third layer is fractured with resistivity ranges from 68 to 325 ohm-m and thickness varies from 17 to 31 m. The last layer is hard & massive in nature with a high resistivity value ranges from 550 to 1200 ohm-m.



Also a representative East-West trending Geo-electrical Cross Section (west of Murethitola village) between VES 3 , 2 , 1 & 4 (Fig-28)

Figure 28 Geoelectrical cross section 3, around Kaudikasa area Rajnandgaon district

The section reveals the presence of four major geo-electric layers systems in the area. The topmost layer is maximum 2 m thick with a resistivity range of 60 to 360 ohm-m. Second layer having resistivity value of 7 to 79 ohm-m and thickness of 2.7 to 12 m is weathered one. The third layer is fractured with resistivity ranges from 175 to 325 ohm-m and thickness varies from 15.9 to 32.5 m. The last layer is hard & massive in nature with a high resistivity value ranges from 850 to 1200 ohm-m.

The interpreted layer parameter of VES obtained from study area indicates the occurrence of shallow aquifer almost at all the locations. But at a few places like VES2, VES 3, VES 6, VES 8 & VES 21 there are clear-cut indication of deeper aquifer zone within a depth range of 70 and 100 m. The results obtained from the VES have been confirmed during the exploratory drilling taken up in the area. The site locations (VES 2, VES 3, VES 6, VES 8 & VES 21) have also been recommended for drilling to tap ground water from the deeper aquifers.

2.4 Groundwater Quality

2.4.1 Drinking Water Quality

Groundwater quality sampling was carried out in 103 locations under National Hydrograph Monitoring in 2021-22. The overall chemical quality of the Rajnandgaon district is good and safe for drinking, except in a few areas where the nitrate concentration was found above the acceptable limits. The minimum and maximum values and overall groundwater quality is summarized in table13.

Table 13 Groundwater Quality Comparison for drinking water

Parameters	Maximum	Minimum	Average	No of wells above acceptable Limit	No of wells above permissible limit	Acceptable Limit	Permissible limit	% of Sample above acceptable Limit	% of Sample above permissible limit	Total No of Samples
PH	8.23	7.01	14.4	103	0	6.5	8.5	100	0.00	103
EC	2019	6.12	416.52	NA	NA	NA	NA	NA	NA	103
Cl	412	7.1	70.75	3	0	250	1000	2.91	0.00	103
SO ₄	335.73	1.9	23.85	3	0	200	400	2.91	0.00	103
CO ₃	0	0	89.75	NA	NA	NA	NA	NA	NA	103
HCO ₃	672	60	89.92	NA	NA	NA	NA	NA	NA	103
F	1.53	0.01	105.4	5	1	1	1.5	4.85	0.97	103
TH	610	22	128.4	45	1	200	600	43.69	0.97	103
Ca	136	3.5	36.32	19	0	75	200	18.45	0.00	103
Mg	121	3.6	39.67	33	1	30	100	32.04	0.97	103
Na	200	6.5	29.77	NA	NA	NA	NA	NA	NA	103
K	78.2	0.1	9.50	NA	NA	NA	NA	NA	NA	103
Si	40.3	0.81	6.37	NA	NA	NA	NA	NA	NA	103
Po ₄	0.8	0	9.33	NA	NA	NA	NA	NA	NA	103
NO ₃	77.25	0.16	17.74	NA	11	NA	45	NA	29.73	37
u	20.1	0	354.1	0	0	30	60	0	0.00	37
TDS	1352.7	3.917	480.8	44	0	500	2000	42.72	0.00	103

2.4.2 Agriculture Water Quality

a) Salinity Hazard

Table 14 Salinity Hazard of Rajnandgaon district

EC	Salinity Hazard	No of Sample	Percentage of sample
100-200	Low	1	0.97
200-750	Medium	57	55.34
750-2250	High	44	42.72
>2250	Very High	0	0.00

b) Sodium Percentage**Table 15** % of Na of Rajnandgaon district

% of Sodium	Criteria	No of Sample	Percentage of sample	% of Sodium
< 20	Excellent	16	15.53	< 20
20- 40	Good	56	54.37	20- 40
40- 60	Permissible	20	19.42	40- 60

c) Sodium adsorption Ratio (SAR)**Table 16** Sodicity Hazard

SAR	Salinity Hazard	No of Sample	Percentage of sample
< 10	Low	88	85.44
10 to 18	Medium	12	11.65
18 to 26	High	3	2.91
> 26	Very High	0	0.00

d) Residual Sodium Carbonate (RSC)**Table 17** RSC of Rajnandgaon District

RSC	Criteria	No of Sample	Percentage of sample
< 1.25	Safe	4	3.88
1.25 - 2.50	Marginal	1	0.97
> 2.5	Unsuitable	98	95.15

e) Mg ratio**Table 18** MAR of the Rajnandgaon District

Mg Ratio	Criteria	No of Sample	Percentage of sample
< 50	Suitable for Irrigation	65	63.11
> 50	Unsuitable for irrigation	38	36.89

f) Permeability Index

Table 19 Permeability Index of the Study area

PI	Criteria	No of Sample	Percentage of sample
> 25	Suitable	96	93.20
< 25	Unsuitable	7	6.80

g) Soluble Sodium Percentage (SSP)

Table 20 Soluble Sodium percentage

SSP	Criteria	No of Sample	Percentage of sample
< 60	Good	96	93.20
> 60	Poor	7	6.80

h) Kelly ratio

Table 21 Kelly ratio

Kelly Ratio	Criteria	No of Sample	Percentage of sample
< 1	Suitable for irrigation	88	85.44
> 1	Unsuitable for irrigation	15	14.56

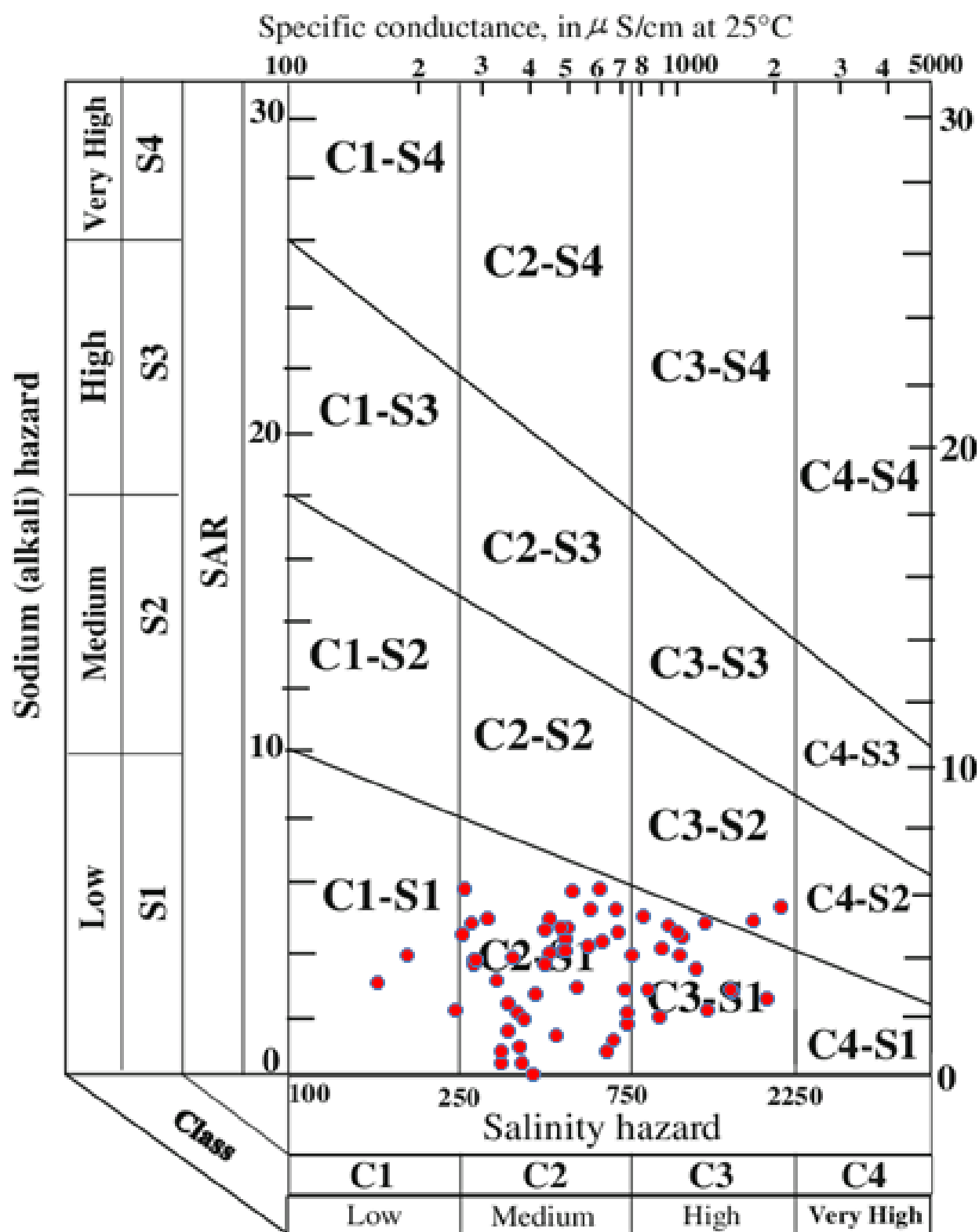


Figure 29 US salinity diagram

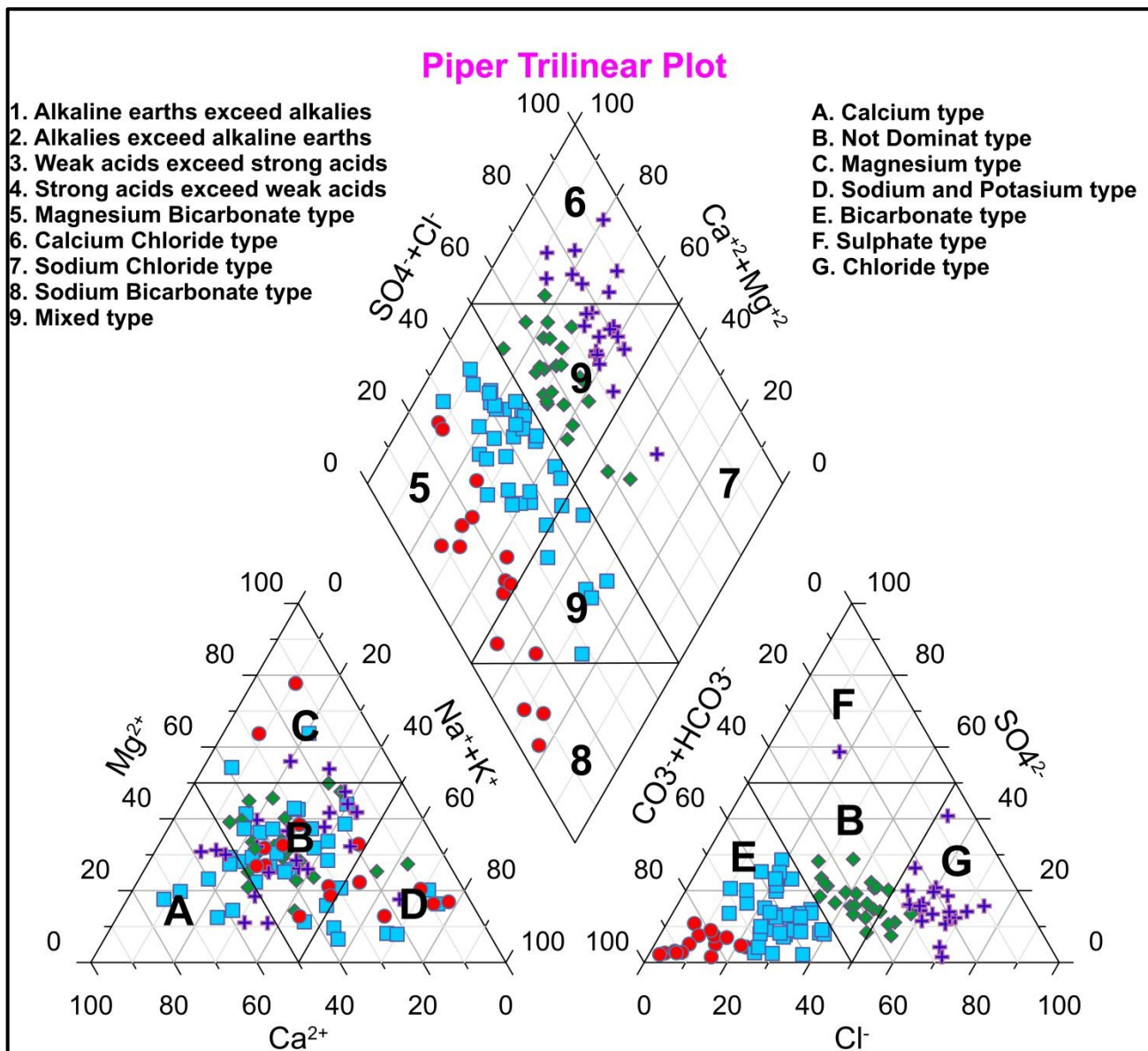


Figure 30 Piper Trilinear Plot

The chemical samples analyzed for Agriculture water quality reveal that the Sodium adsorption ratio is less than 10 meq/L and the Kelly ratio is less than one, which means that the groundwater is suitable for irrigation. Sodium hazard is low and Salinity Hazard ranges from medium to high. The percent sodium plot in all the samples falls under the excellent to permissible field.

The piper trilinear diagram (figure-30) reveals that the groundwater is magnesium bicarbonate type and mixed type. The US salinity diagram (figure-29) shows most of the samples comes under C2S1 and C3S1 box. It is showing medium to high salinity hazard and low Sodium Hazard.

2.4.2 GEOGENIC ARSENIC CONTAMINATION IN GROUND WATER OF CHOWKI BLOCK OF RAJNANDGAON CHHATTISGARH

1.	Year in which first reported	1997
2	Extent of the problem (as on 31.03.2005)	30 villages in Chowki block of Rajnandgaon
3.	Name of the district	Rajnandgaon
4.	Area effected	265 sq.km
5	People actually affected	21294, Total population of the 30 affected Villages
6	Population at risk	200000, Total population of the three blocks, (Mohla, Chowki and Dongargaon)
7	Symptoms : Epidemiological	(a) Pigmentation (b) Keratosis (c) Anaemia (d) Respiratory disorders (e) Weakness (f) Paresthesia (h) Pain in abdomen
8.	Geological Horizon	Rhyolite, Rhyolitic-tuff, Tuffite, Granite, and Gabro,
9.	Nature of aquifer	Hard rocks with unconfined aquifer
10.	Depth range of arsenic concentration	5-75 m below ground level
11.	Origin of problem	Geogenic
12.	Mobilisation of arsenic	Prevailing concept- Oxidation –Reduction theory. At this location the arsenic mobilisation follows the “oxidation- reduction theory” where the arsenic originates from the Arsenopyrite oxidation and the arsenic thus mobilized forms the minerals and gets reduced underground in favorable Eh conditions.
13.	Composition of the arsenic contamination in Ground Water.	Arsenite (Trivalent): Arsenate (Pentavalent) 40 to 80% : 60 to 20 %
14.	Characteristic of arsenic occurrence.	Spread and concentration in ground water increases in post monsoon
15.	Arsenic removal- Types	West Bengal model.
16.	Total no. of wells in affected areas.	870 (515 DW and 355HP + BW)
17.	Total number of samples analyzed.	2000
18	Concentrated range of arsenic.	0.05 to 6.0 ppm
19.	Recorded cases of arsenic dermatosis	150 persons

Geogenic Arsenic Contamination in Ground Water of Ambagarh Chowki Block of Rajnandgaon district of Chhattisgarh State.

I Demarcation Of Area Affected By Arsenic Contamination

The Arsenic Contamination has been found in Ground water of Chowki block of Rajnandgaon district, Chhattisgarh. Dug wells and shallow bore wells (maximum 75 m depth) were found to be affected in 30 villages of the block. Arsenic contamination has also been reported from pond and river water in the area. It has been established that the spread of Arsenic contamination in ground water is maximum during October to January. The worst affected village is Kourikasa, where maximum ground water source are found contaminated in post monsoon. The core arsenic-affected zone, where arsenic concentrations exceed 0.05 ppm (50 µg/l), covers an area of 265 square kilometers in the Ambagarh Chowki block of Rajnandgaon district. As per revised BIS (2015), the present permissible limit of As is 0.01 ppm. (10µg/l). 30 villages with a population is 21493 are directly exposed to Arsenic contamination as the Ground water is the only source of drinking water in these villages.

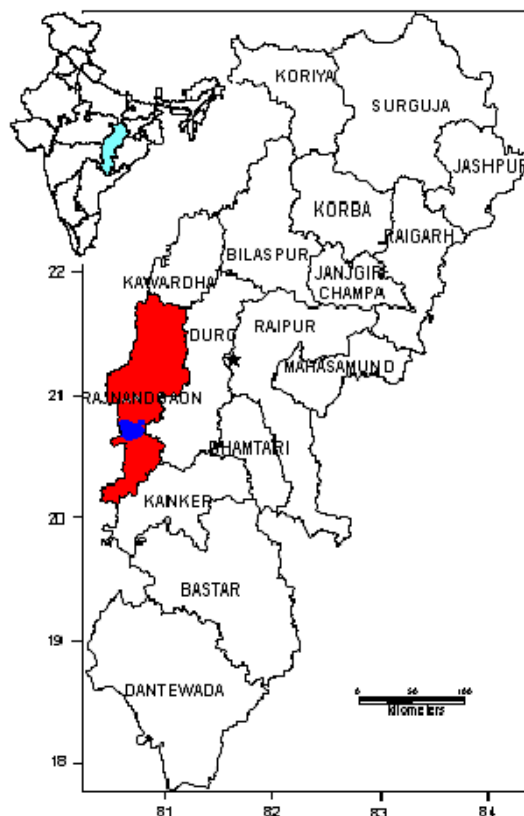


Figure 31: Rajnandgaon District Map

The Ambagarh Chowki block (537 sq.km) of Rajnandgaon is situated in the South central part of Chhattisgarh state and sharing boundary with Maharashtra. The block is bounded by North latitude 20°39'20" to 20° 51'58" and East longitude 80° 33' 10" to 80° 49' 35". The arsenic effected area falls under Survey of India Toposheet No. 64 D-9, 10,13 and 14 (**fig 31**). The present population of tribal dominated Chowki block is 94883 (Census 2011).

Out of total 154 village and 1 township of Chowki block, groundwater of 30 villages are found Arsenic contaminated by one or other agency working in the area. NEERI, Nagpur after analyzing of 813 samples of ground water from 154 villages have detected Arsenic contamination in the range of 0.06 to 1.86 ppm in 45 samples of 11 villages where as Pandey et.al. (2001) have identified nearly 28 villages affected with Arsenic in Ground Water (0.05 to 6.0 ppm). Study of Ground Water quality by Central Ground Water Board so far have confirmed Arsenic contamination in only 5 villages.

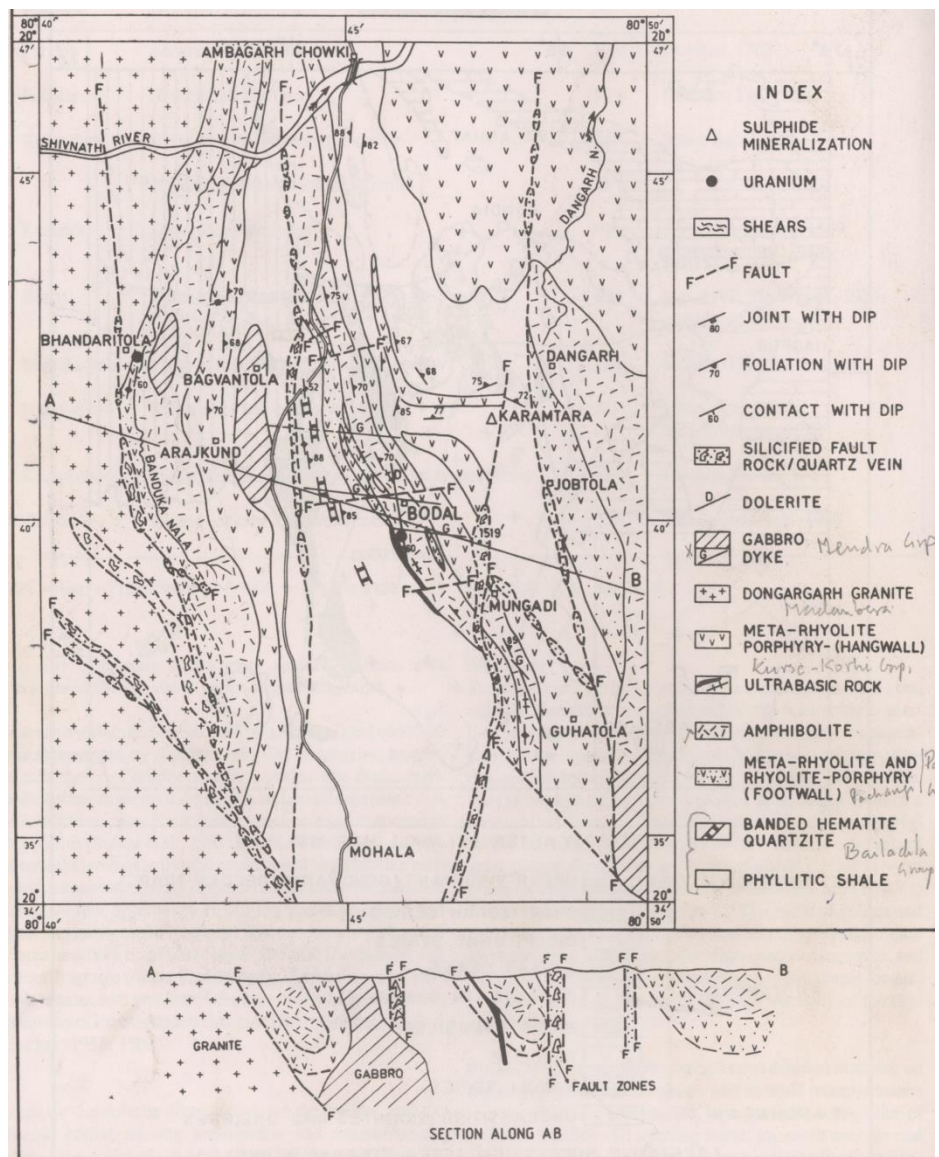


Figure 32: Geological Map of Arsenic affected area

The area is having complex geological sequence dominated by bimodal volcanics. The area forms the northern part of Kotri lineament that extend in the N-S direction for a length of 80 km. Five well defined shear zone have been identified in the area having Au-Ag-Pb-Radioactive mineralisation. Arsenic has been reported from Rhyolite, Rhyolite-tuff, Tuffite, Gabbro, Amphibolite, Basalt, Andesite and Granite.

State Government has reviewed the situation by constituting a high level committee headed by the Principal Secretary, Dept. of Environment and forest. Government of Chhattisgarh. Regional Director, CGWB, Director, GSI, State Pollution Control Board Chhattisgarh Council of Science and Technology (CCOST) and SGW Division to look into the problem of Arsenic contamination in Groundwater in the state. Several rounds of meetings were

held to discuss the status and finding of various investigation and on providing relief to the affected villagers.

Local press and Electronic media have published articles and personal interviews of affected people and helped in creating awareness amongst this tribal dominated forest cover backward population of Chowki block

Efforts of Central Ground Water Board, NCCR, Raipur.

Central Ground Water Board, NCCR, Raipur has taken initiatives towards finding an alternative solution to the higher As contaminated water in Chowki block of Rajnandgaon district. A proposal of delineation of Arsenic free deeper aquifer zone has been forwarded to CHQ vide this office Letter No. 16-9/NCCR/TS-645 dt. 7-6-2000. Regional Director, Central Ground Water Board, North Central Chhattisgarh Region, being one of the members of high level committee of State Government has started scientific investigations during AAP 2000-01.

A detailed surface geophysical investigation to identify the deeper fractures in the most affected Koudikasa village and its surrounding has been carried out which reveal presence of deeper fracture zone between 70 and 100 mbgl. Out of 21 VES sites selected on the basis of surface geophysical profiling in the area shows indication of deeper fracture at 8 location.

Subsequently under accelerated drilling programme 40 exploratory wells were constructed in Rajnandgaon district during AAP 2001-02, 2002-03 to determine if fractures were available in deeper zone. The host for the arsenopyrite “Rhyolite” and “Rhyolite tuff” were explored in detail down to a depth of 150 m, by constructing 13 exploratory wells. Out of which 7 EW showed deeper fracture zones between 70 and 135 mbgl.

Encouraged by these findings a focused scientific investigation was initiated during AAP 2002-03 where additional 4 exploratory wells were constructed in the most severely effected Kaudikasa village. It was planned to delineate various fracture zones and depth wise distribution of Arsenic contamination in this Arsenopyrite mineralized Kotri lineament. With the help of cement sealing, efforts were taken up to obtain ground water from various depth zone. Samples were collected from these exploratory wells depth wise along with other samples collected from the area.

Mean while strategic sampling of ground water in close spacing was carried out during premonsoon of both years. These samples were sent for analysis in different laboratory of Eastern

Region, Calcutta, NGRI, Hyderabad, Central Region, Nagpur and North Central Region, Bhopal. The analytical results confirm presence of Arsenic contamination both in time and space in Chowki block.

1. Out of 30 sample collected during July 1999 from various dug wells, HP and rivers only 3 ground water samples from 2 villages shows Arsenic more than 50 µg/l (0.057 to 0.256 ppm).
2. Out of 65 samples collected during December 2001 from Kourikasa and surrounding villages. 11 samples from 3 villages are found contaminated. Out of total 18 sample from Kourikasa 14 were collected from dug well and 4 from H.P. All the 4 H.P and 10 dug well sample are found contaminated where as 8 other ground water sample of dug wells were found safe during December.
3. Out of 9 samples collected during April 2002, only one sample of Kourikasa was found contaminated
4. Out of 68 sample collected in May/June 03 in and around Kourikasa only one sample of Kourikasa have shown Arsenic beyond permissible limit i.e. 50 µg/l is (101 µg/l).
5. Out of 45 samples collected during May 2005 in the area, only in 2 samples of Kourikasa having Arsenic Contamination beyond safe limit is reported.
6. Depth wise sampling down to 150 m bgl. during exploratory has indicated reduce in Arsenic concentration with depth during drilling.

Further studies with focused objectives are going on for obtaining detailed information and correctly identifying the zones responsible for Arsenic problems occurring in the deeper fracture zones.

➤ **II. Collection of Available data**

1. Regional Geological and Hydrogeological data of Rajnandgaon district. (Table 1 to 3)
2. Geophysical and Geochemical data. (Table 4 to 9)
3. Preliminary demarcation of Arsenic affected area by PHED, NEERI, Nagpur, Bhilai Institute of Technology Bhilai, Jadavapur University, GSI, Raipur and Central Ground Water Board, Raipur.
4. Demography, Land use, Irrigation Pattern, Forest cover and Hydrometeorology

(Table 10 to 14)

5. Published Research papers on Arsenic Contamination in Kourikasa area.

III Gaps in the Available Data

1. Relation of Geology in Arsenic Contamination has yet to be established. The area is having complex geological setup. The available geological maps of GSI and AMD for the area need thorough revision in 1: 50,000 or even in 1:25,000 scale to evolve proper theory of Arsenic contamination in the area.
2. The highly folded and faulted rocks of Precambrian age need thorough structural mapping to establish chronostratigraphic juxtaposition in the area.
3. The area is a part of Kotri lineament where the hydrothermal deposition of Au, Ag, Pb and Radioactive mineralization is very prevalent. The mineralization along shear zone need proper investigation to understand the Arsenic Contamination and its mobilization.
4. The temporal and spatial variation of Arsenic in Groundwater has to be established with micro level study of hydrogeological condition in the area.
5. The entire linear stretch of Kotri lineament which is nearly 80 km in length and 50-500 m wide in N-S strike need analysis of ground water to establish Arsenic contamination in this tribal dominated forest cover area of Rajnandgaon and Kanker district of Chhattisgarh.
6. Preliminary study of the area shows the Arsenic Concentration in space increases just after rainy season, which need proper investigation of soil profile (both insitu and colluvial) for Arsenic concentration.
7. Delineation of aquifer geometry for identification of Arsenic free zone, if any in the area. Deeper fractures in Rhyolite beyond 90 m depth has been identified during the exploration for Ground Water in the district. The relationship of deeper fractures and Arsenic contamination has to be established by proper well design/ construction.
8. 100 percent inventory of ground water abstraction structures is essential to identify the contaminated source and extent of the area.
9. Seasonal variation of Arsenic Contamination need proper investigation to identify permanent Arsenic contaminated ground water source

IV Remedial measures taken up

1. PHED has already sealed few identified Arsenic Contaminated borewells in the area.
2. Piped water supply scheme from alternative source has been provided by PHED in the worst affected Kourikasa village.
3. Arsenic removal plant has been installed at few places in Kourikasa village.
4. Sign board showing the Arsenic affected source have been put up in the area.
5. Tapping of the deeper aquifer by the Central Ground Water Board, Raipur for providing Arsenic free water is being taken up in the area.
6. Awareness campaigns are being organised by Government and Non Government Organisations in the area.

V Proposed Work plan

1. Since the Arsenic contamination is noticed on the northern end of auriferous Kotri lineament and Arsenopyrite has also been reported by GSI in the southern end of Kotri lineament, the entire Kotri lineament stretch has to be investigated properly for Arsenic Contamination in these tribal districts. The linear extent of which is more than 80 km.
2. All the other area of gold minearalization reported from the state has to be investigated through reconnaissance survey as Arsenic is pathfinder to Au and invariably associated with Au.
3. It has been reported from the area that when a fresh well is drilled tapping ground water initially there is no contamination of higher Arsenic subsequently the well shows Arsenic contamination. In the light of scientific knowledge available, that Arsenic only comes to ground water from solid aquifer material under Oxidizing condition. This is to be investigated whether drilling of borewells facilitated additional opportunities of oxidation to insitu Arsenic of aquifer material. To begin with one of the drilling rig of the NCCR is being deployed for the further exploration.

Remedial actions

The high arsenic concentration is recorded only at Kaudikasa village of Ambagarh Chowki block in Rajnandgaon district. Earlier two methods are used for the removal of arsenic from ground water as given below in table 22.

Table-22: *Details of Arsenic Removal Plant*

<i>District</i>	<i>Block</i>	<i>Village</i>	<i>Nos of plants (Used Technology)</i>	
			<i>Adsorption (Cost)</i>	<i>RO (Cost)</i>
Rajnandgaon	Ambagarh Chowki	Kaudikasa	01	01
			Rs. 15.00 lakh	Rs. 9.00 lakh

Remark

1. Cost of *Adsorption method* Rs. 15 .00 lakh.
2. Cost of *reverse osmosis method* Rs. 9.00 lakh.

Following de-arsination methods are used for removal of arsenic.

- **Arsenic Removal Chemical Method**

Developed by the Department of Occupational and Environmental Health of NIPSOM, which is based on the principle of iron coagulation with a pre-oxidation step. Removal of arsenic by this method is almost 99%.

- **Alum Method**

This cheap method allows 70% removal of arsenic. 300-500 grams of alum wrapped in a clean cloth is sinked in a bucket full of arsenic contaminated water for 12 hours. Upper 2/3rd of the water is separated using decantation or two layered clean cloth. Lower third of water contains arsenic and not suitable for drinking.

- **Ferric oxide-manganese dioxide clay based filter columns**

This earthen column packed with the above substances is attached to the tube well outlet. The method is claimed to remove significant amount of arsenic at the water flow rate of 90-110 mL/minute and the system can filter up to 5000 L of water before disposal.

Membrane Technologies

Microfiltration

Ultrafiltration

Nanofiltration

Reverse Osmosis

In all above procedure accumulation of arsenic in sludge (non-arrested part) and filter media (arrested part).The sludge handling and operational practices and disposal and management of sludge another environment issue.

State PHED department has started a scheme as follows

- Find out long term **alternate source** of safe drinking water.
- Launch effective water management scheme for encouraging people ensure **rational use of ground water**.
- Include media people in the prevention of arsenic contamination program.

Present Situation

In 2015 report, CGWB has done intense survey and collected 245 ground water samples for affected and near by villages. The chemical analysis results reveals at five locations Kaudikasa, Joratari, Sonsytol, Jadutola and Mangtatola high arsenic was observed in groundwater.

RGI has done a R&D study in 2017 to find out the source sand releasing mechanism. The study concluded the Ryolite rock is main sources to release arsenic by the oxidation- reduction process.

In 2017 the state PHED department has started to supply water from Seonath river to the village under the drinking water scheme, Saansad Adarsh Gram Yojana (SAGY). The photos of the preventive action taken under the scheme are as follows. The arsenic affected wells are sealed in the

area. A water pretreatment plant was established in the bank of Seonath river to supply arsenic free water to the local population.



Figure 33: Seonath River Flowing near the village



Figure 34: Filter Plant installed near the Village by State Government

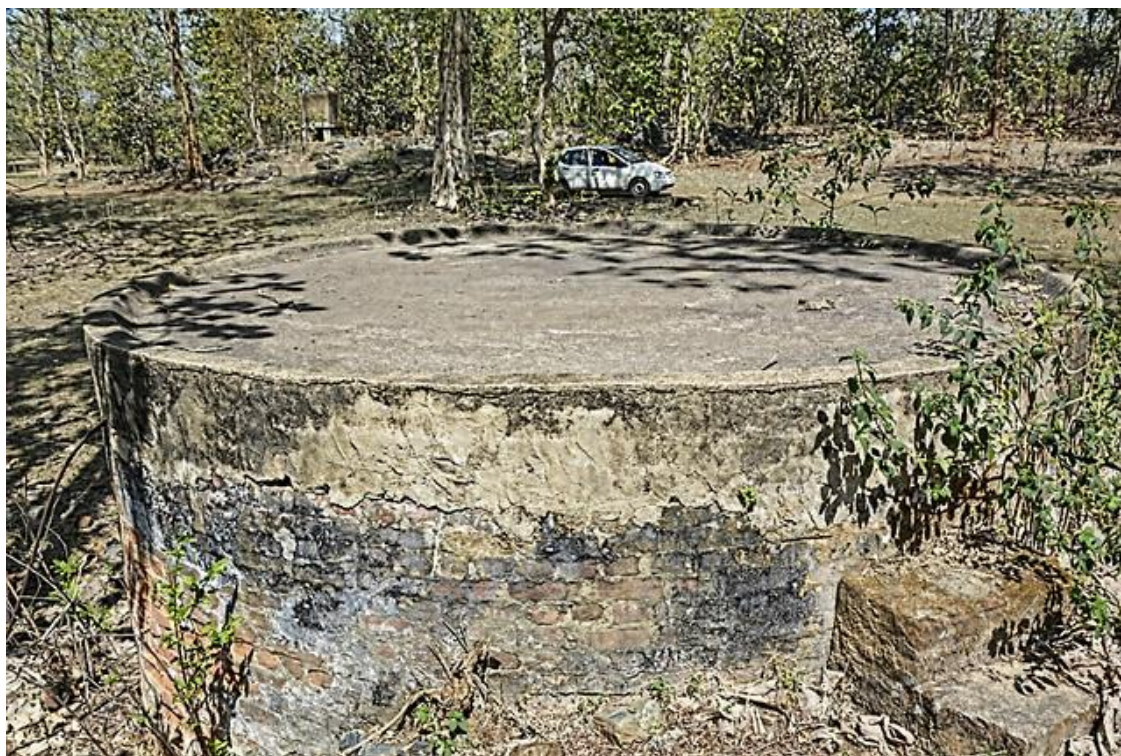


Figure 35: Groundwater Arsenic Removal Plant Kaudikasa Rajnandgaon



Figure 36: Yuvraj Singh, a former sarpanch of Kaudikasa near the tube well reported to have the highest level of arsenic contamination.

3. AQUIFER DISPOSITION AND GROUND WATER RESOURCES

3.1 Aquifer Geometry and Characterization

Based on the exploratory drilling data generated for the blocks, the existing aquifer systems in the area may be divided into two namely phreatic and deeper fractured aquifer. The major aquifers present in the study area are (1) Chandi Limestone (2) Gunderdehi shale (3) Charmuria limestone (4) Chandrapur sandstone with shale interbedded (5) Chilpi metasedimentary (6) Dongargarh granite and granitic gneiss. Details are represented in Table no. 22.

Table 23 Aquifer Characteristics of Rajnandgaon District

Major Geological Formation	Major Rock type	Transmissivity (m ² /day)	Discharge (lps)	Storativity
Chandi Formation	Limestone	8.5-396	0 to 3	2.5X10 ⁻⁵
Gunderdehi formation	Shale	0.4-0.92	0 to 3	1.02 x 10 ⁻³
Charmuria formation	Limestone	37.14-132.35	1 to 5	9X10 ⁻⁷ to 2.24 x 10 ⁻⁴
Chandrapur formation	Sandstone and Shale	15.1-922.9	1 to 3	
Chilpi formation	Metasedimentary	63.28-266.34	1 to 3	2.25 x 10 ⁻⁵
Dongargarh granite and Bijli rhyolite	Crystalline acidic rock (Granite and Rhyolite)	2.7	3 to 10	

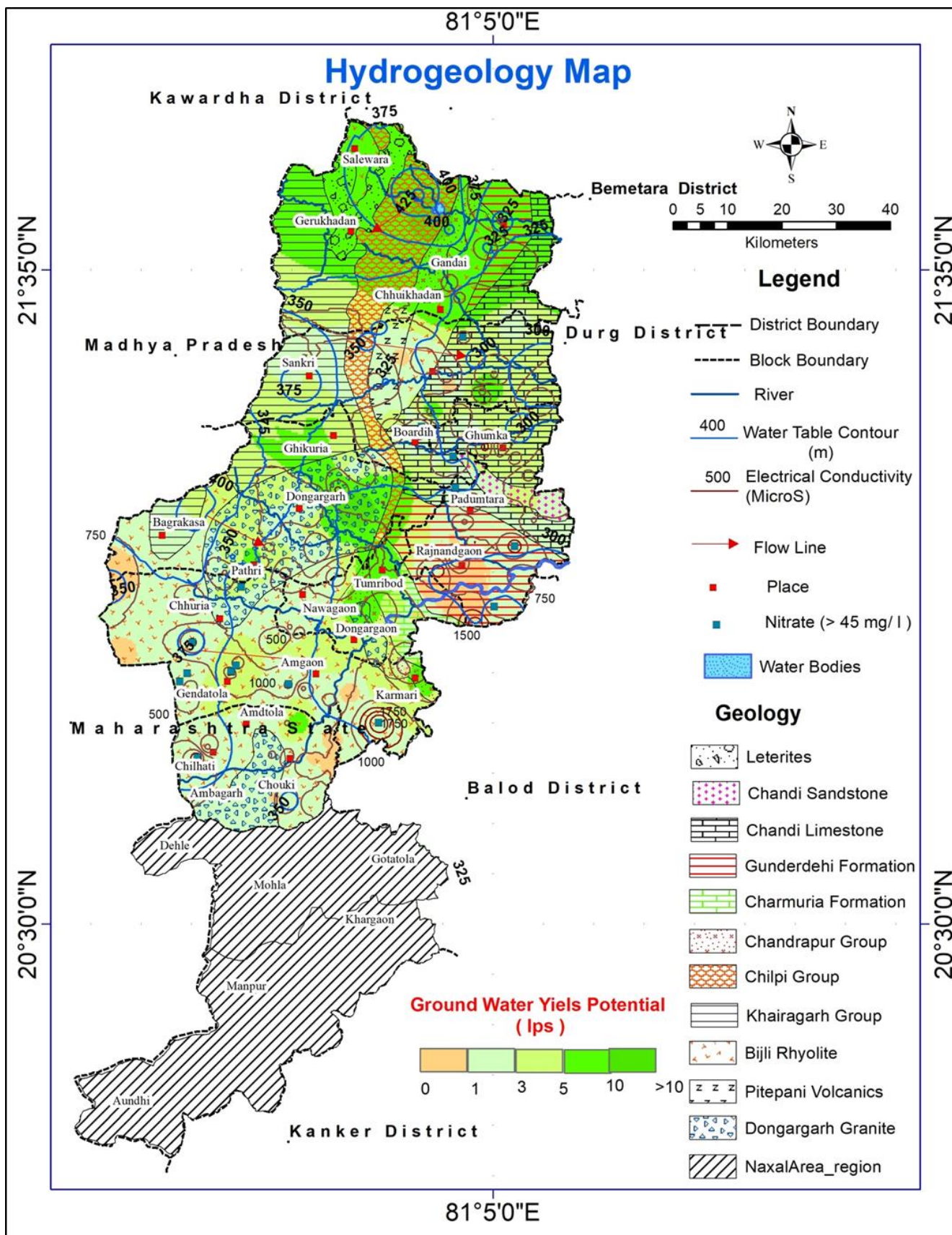


Figure 32 Aquifer Map of Study Area

3D Disposition of Study Area

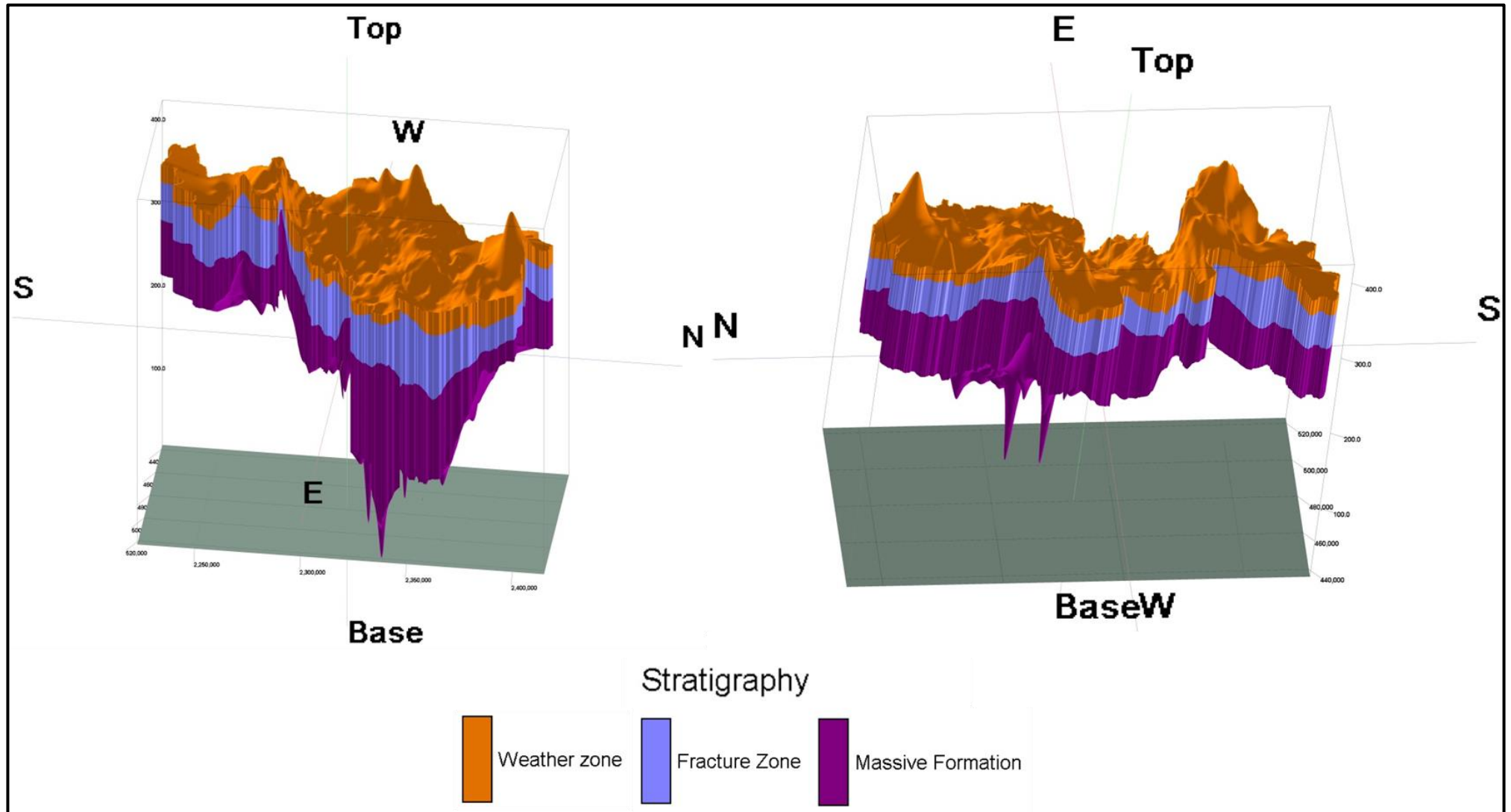


Figure 33 3D Disposition of Study Area

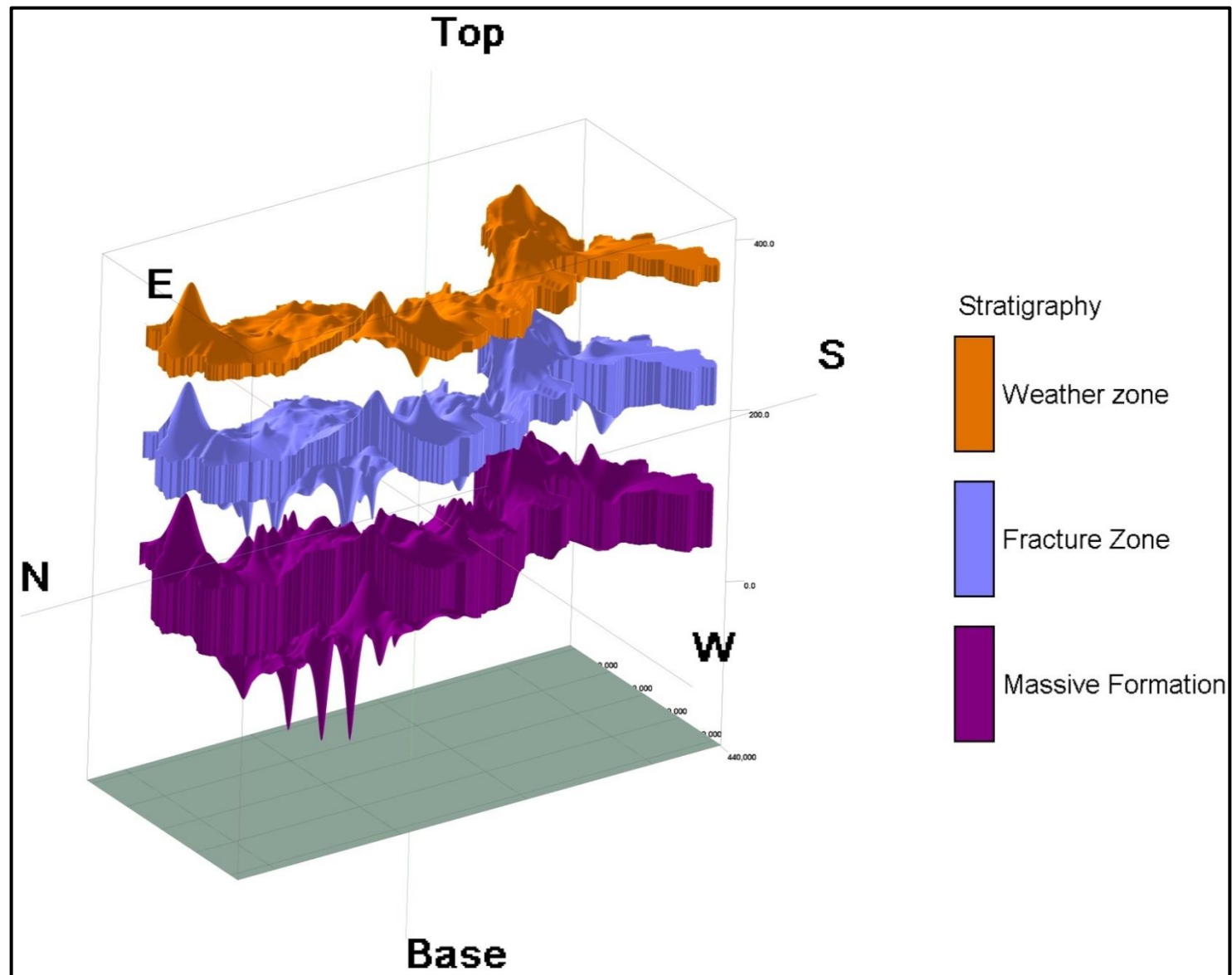


Figure 34 3D Explode Map of Study Area

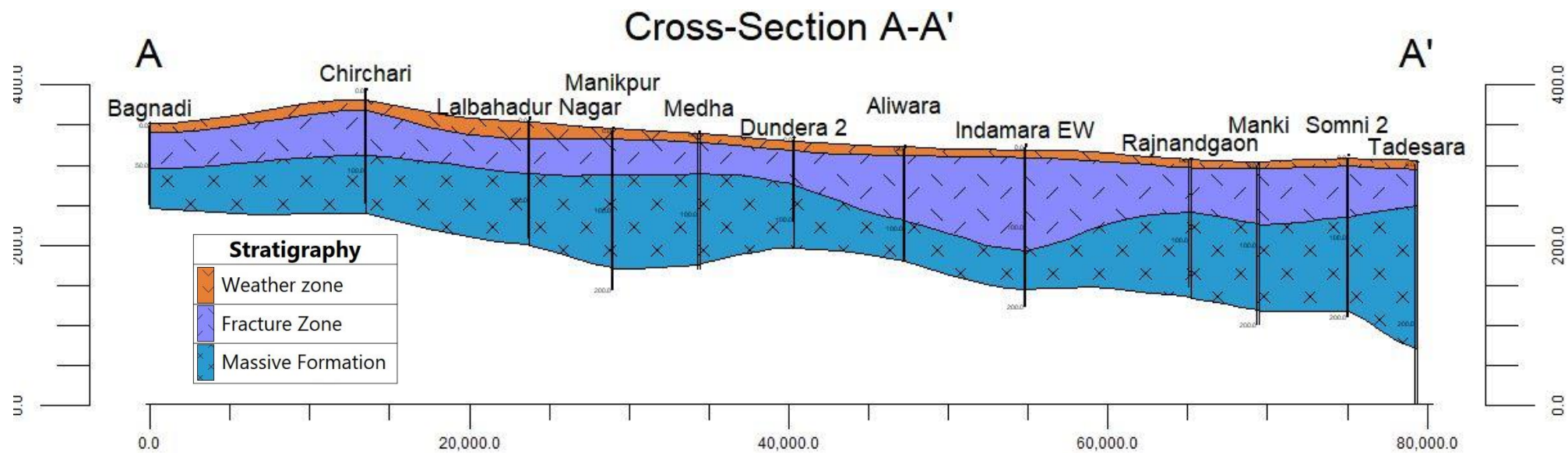


Figure 35 2D Section of Study Area

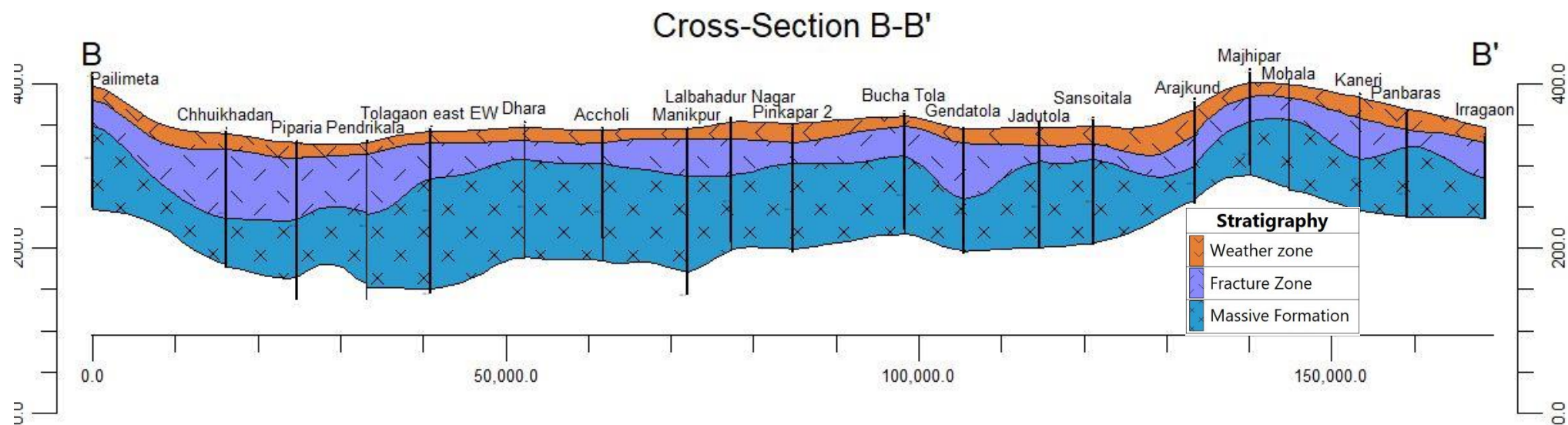


Figure 36 2D Section of Study Area

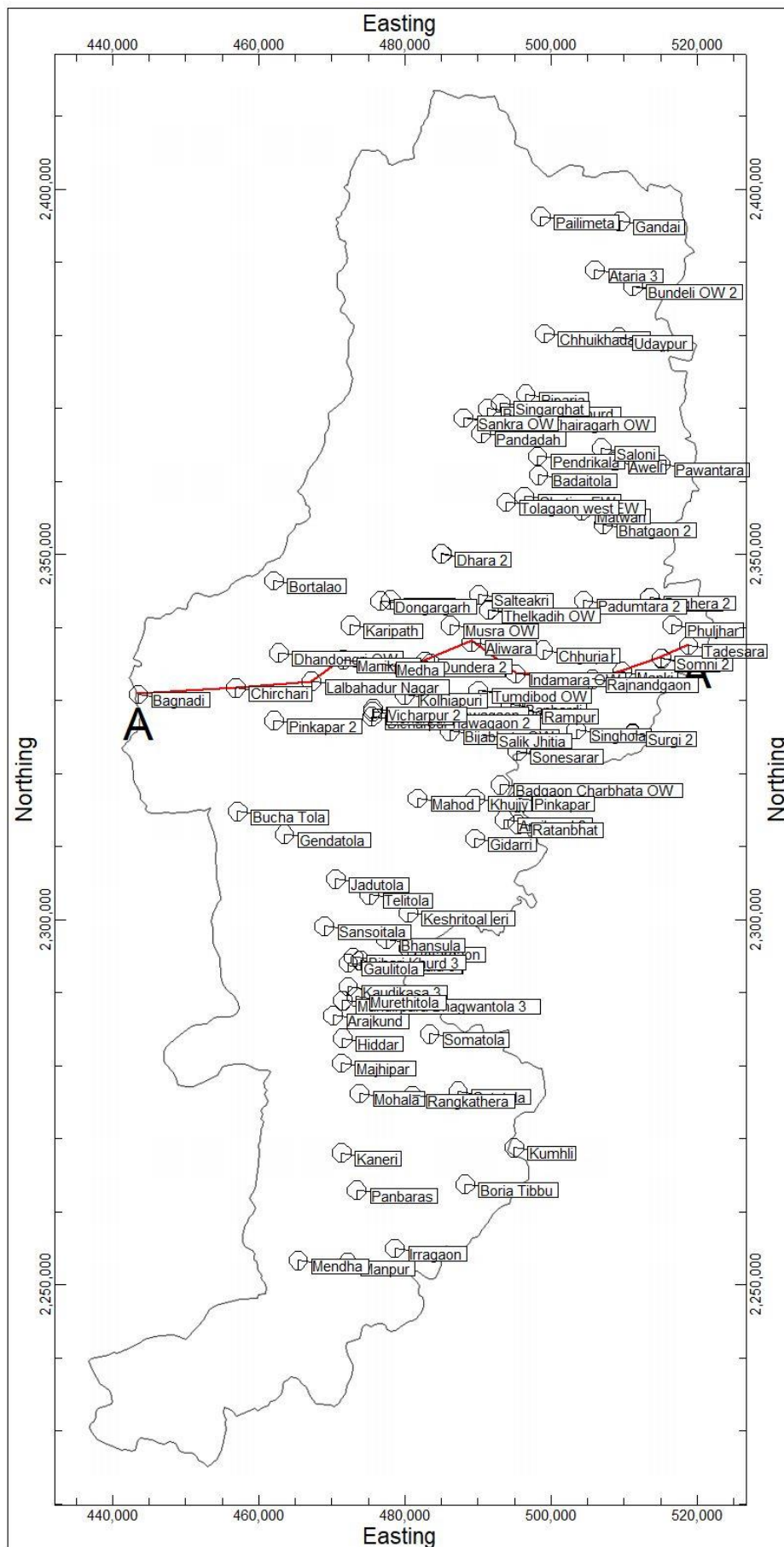


Figure 37 2D Section of Study Area

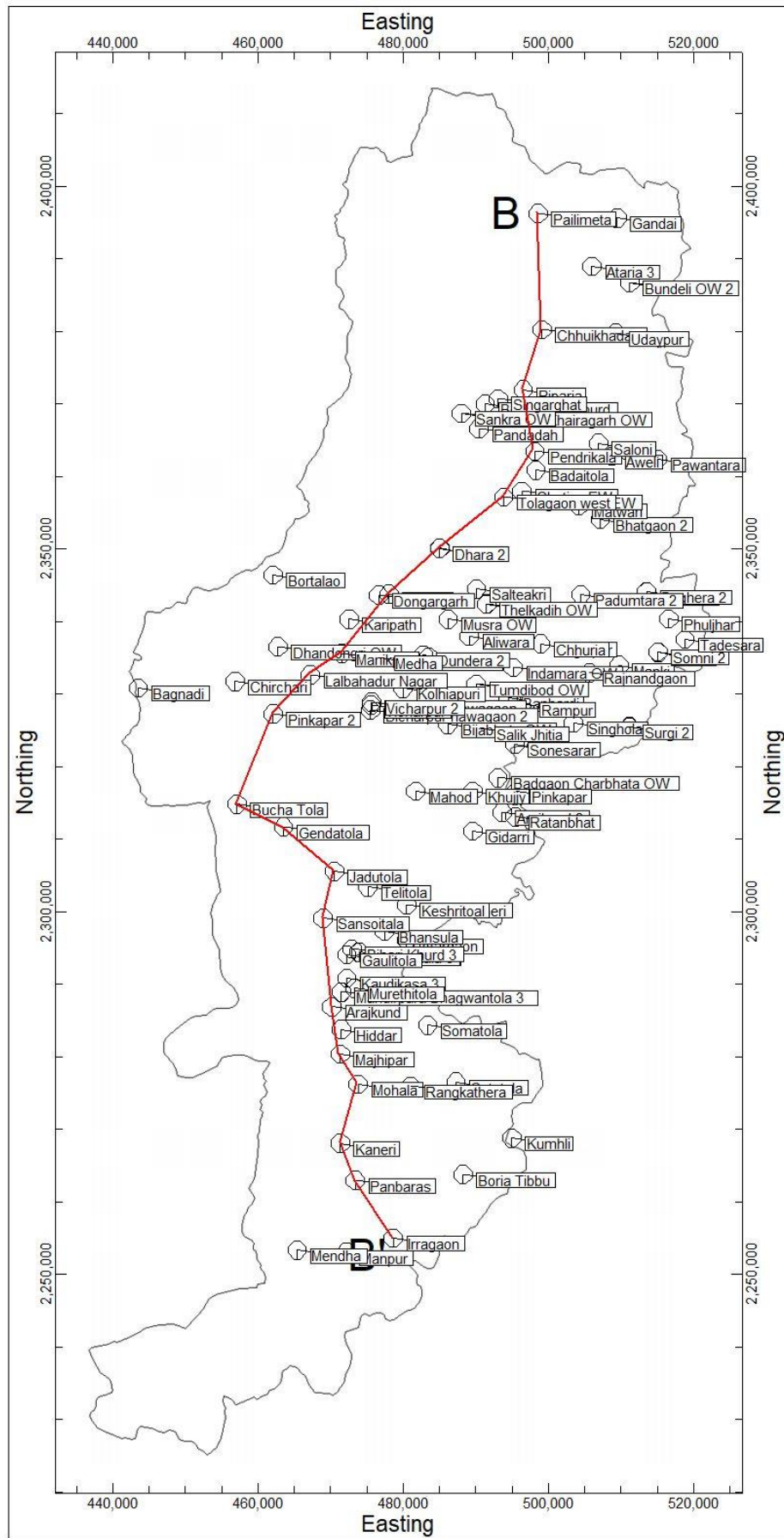


Figure 38 2D Section of Study Area

Cross-Section C-C'

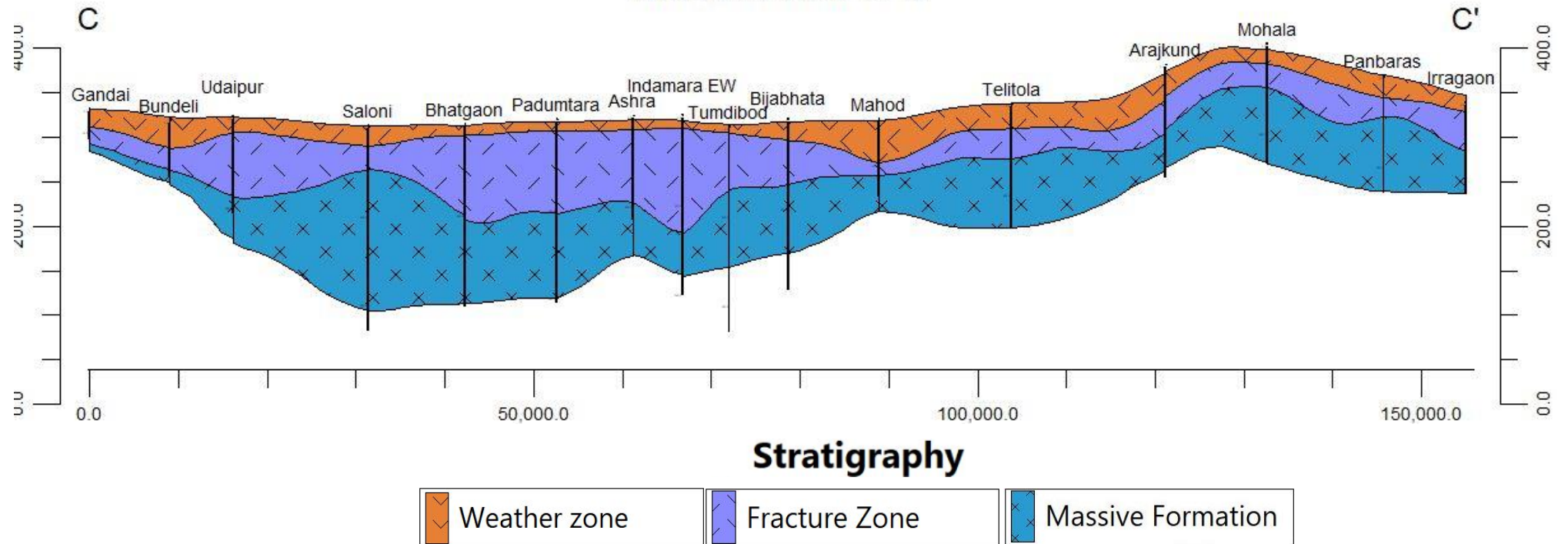


Figure 39 2D Section of Study Area

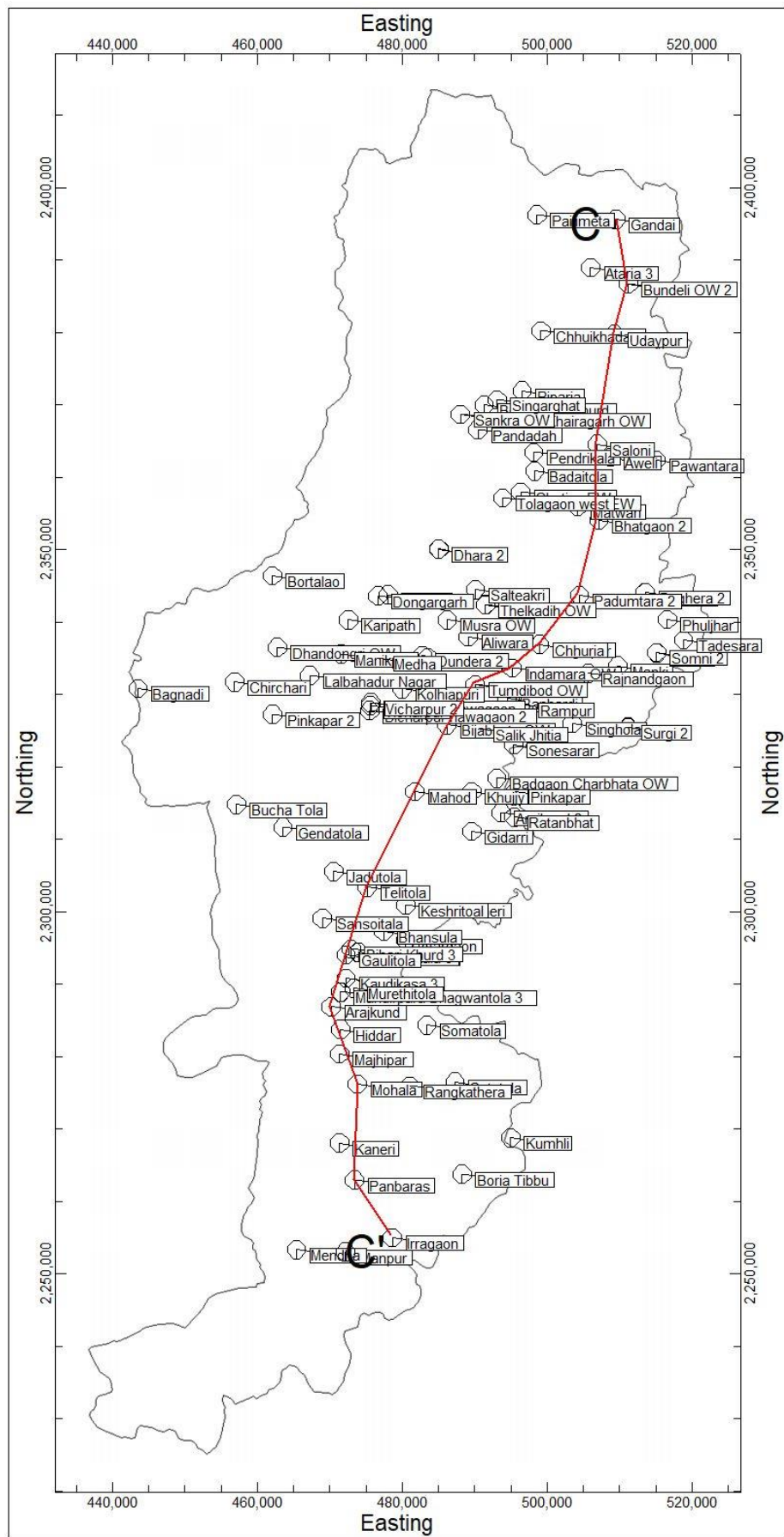


Figure 40 2D Section of Study Area

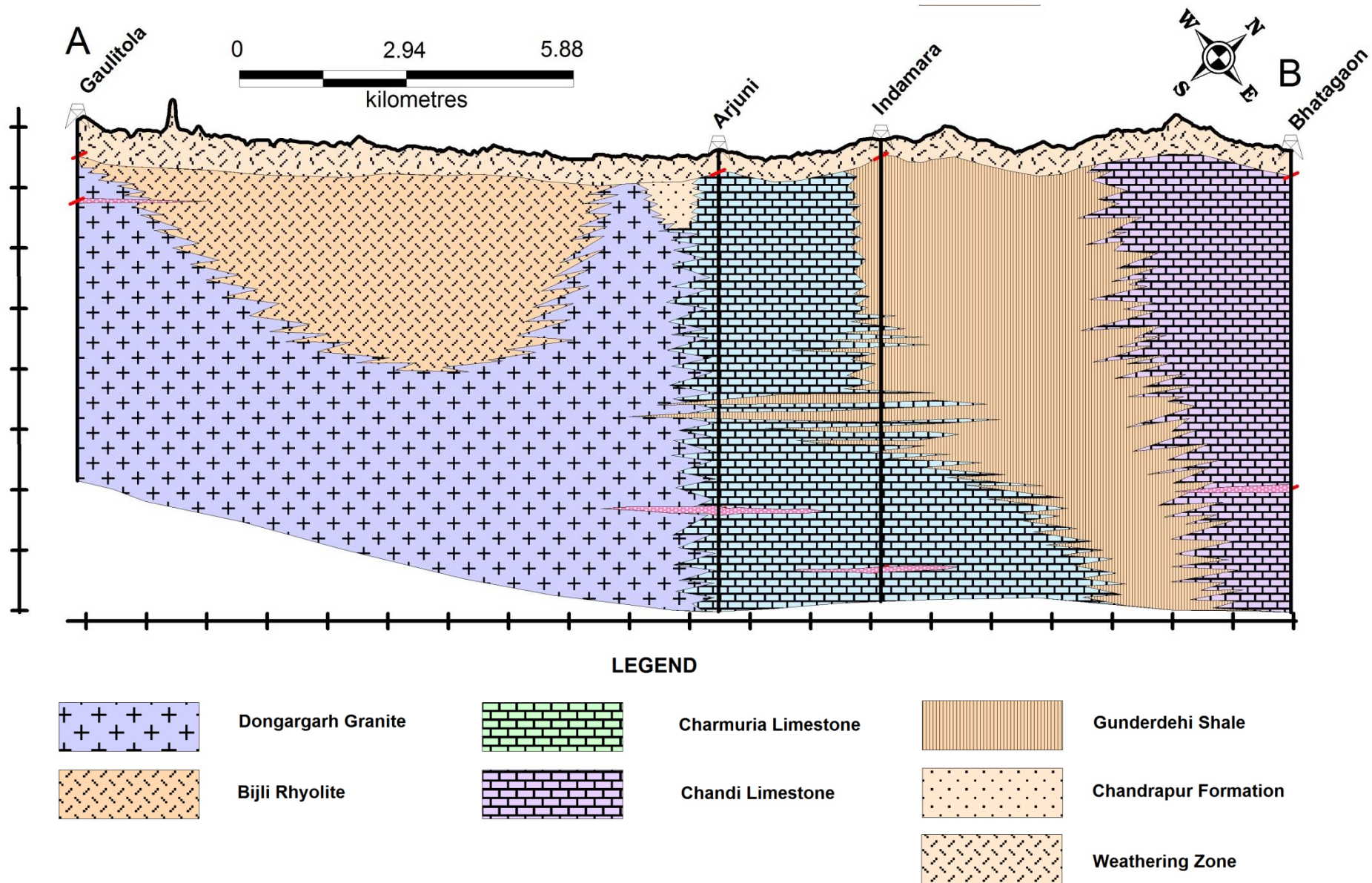
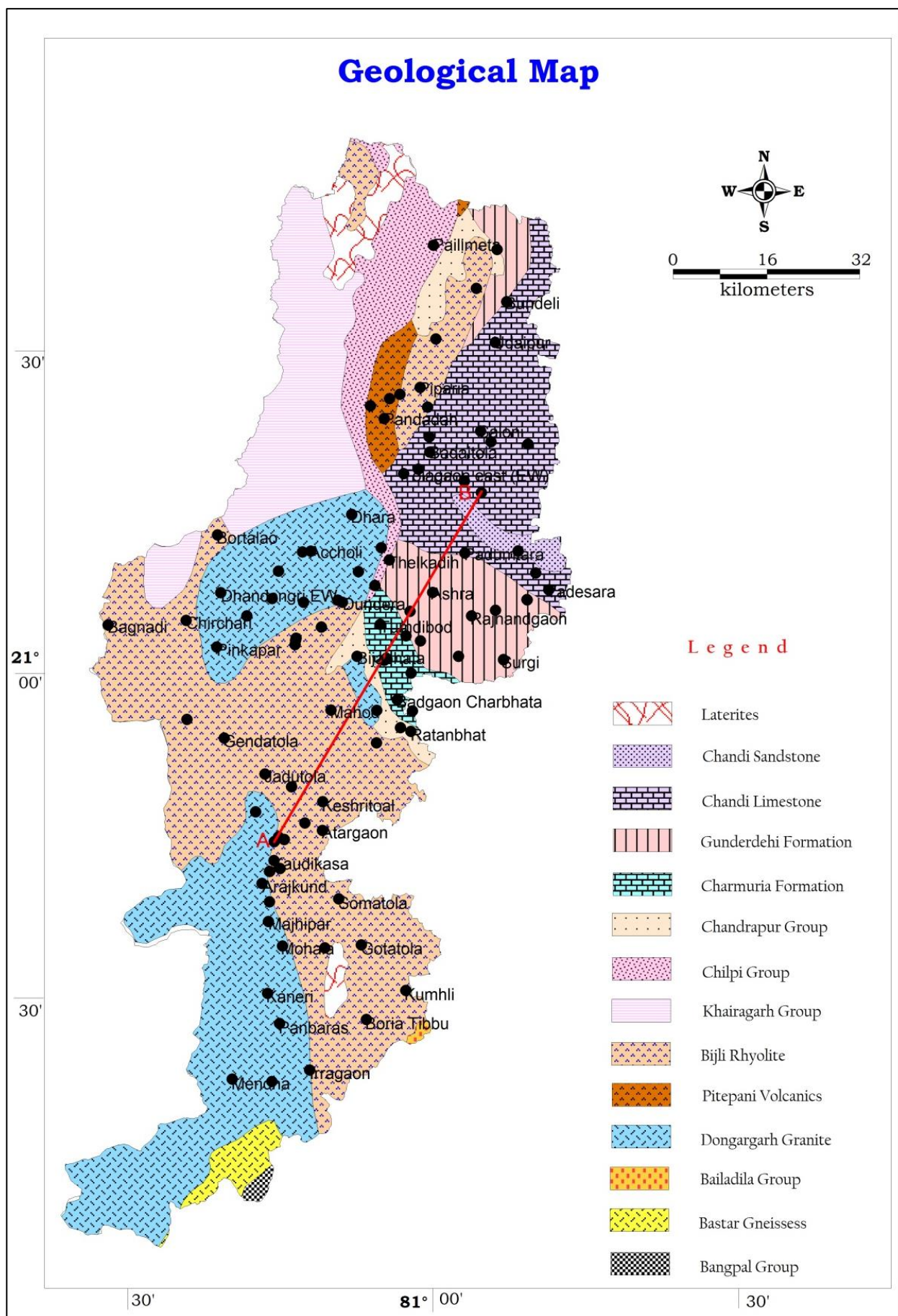


Figure 41 2D Section of Study Area



Disposition of Aquifer in Rajnandgaon District

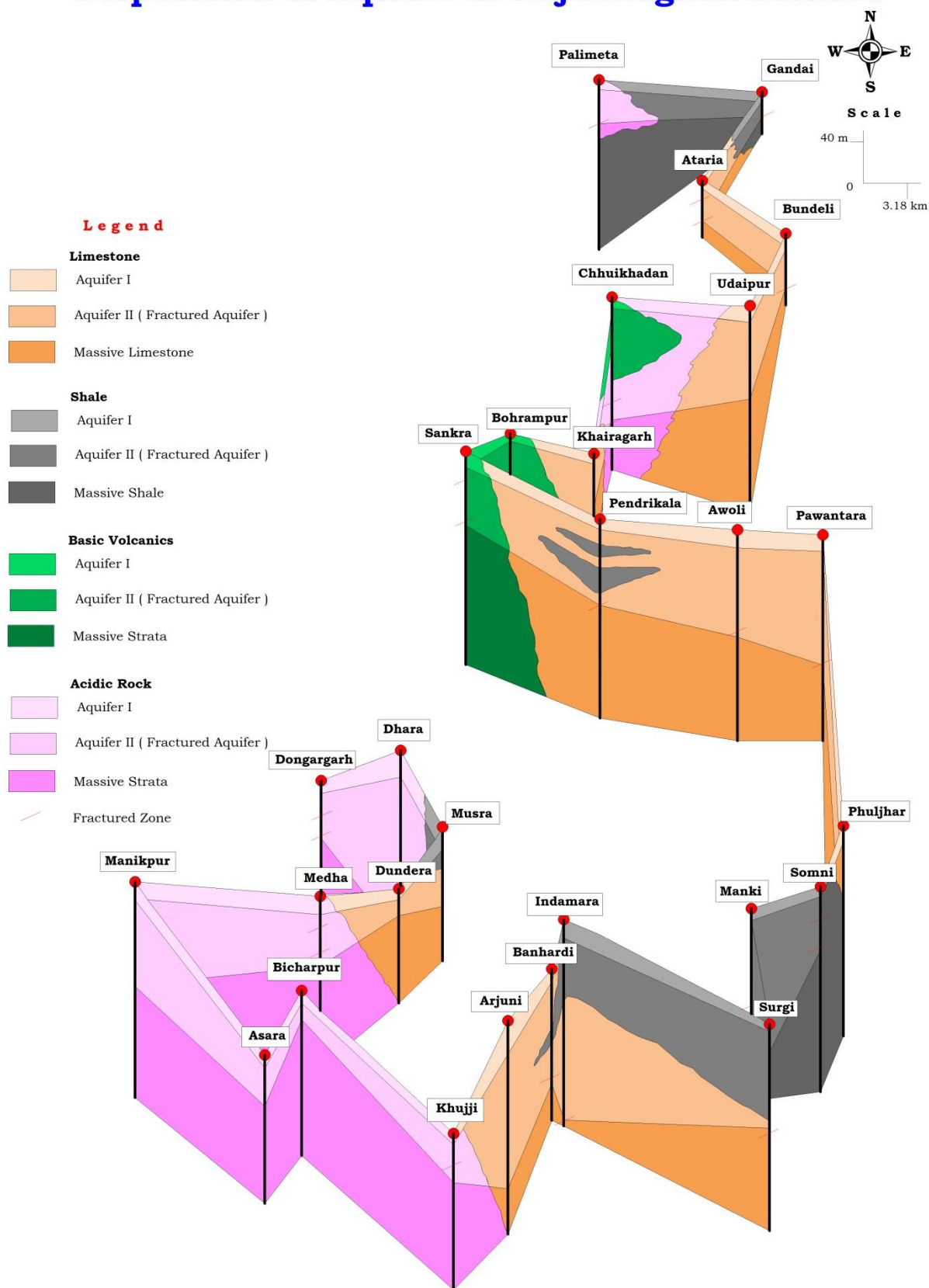


Figure 38 3d Disposition of Aquifer in Study area

4. Groundwater Resources Availability and Extraction

In the ground water resource estimation, the unit of assessment to ground water resources has been taken as the smallest administrative unit i.e. Block. The hilly areas (slope greater than 20%) have been excluded from the computations. The assessment unit has been divided into command and non-command areas and ground water resources have been estimated separately for command and non-command areas. The ground water recharge in the monsoon season and non-monsoon season has also been estimated separately.

The water level data collected by CGWB through NHS monitoring and from state ground water survey, has been utilized for resource estimation. The rainfall data from Indian Meteorological Department has been incorporated in the assessment. The irrigation data for tube wells and dug wells were provided by Water Resources Department. The state could not get success to obtain the stream data from the concern department. The domestic dug wells & bore wells data are not available, therefore per capita consumption of 60 liters per day per person for rural areas and 100 liters per day per person for urban areas have been taken into consideration. The data of ground water withdrawal for industries incorporated from the NOC issued by CGWA and from State Industries Department.

Stage of ground water extraction of the Rajnandgaon district is 65.24%. The category and stage of ground water extraction of all the blocks in the district are given below. Based on the resource assessment made, the resource availability in Block wise in Rajnandgaon district upto 200m depth is given in Table 24.

Table 22 Blockwise stage of extraction and Category

District	Block Name	Stage of Ground Water Extraction (%)	Category
Rajnandgaon	AMBAGARH CHOWKI	51.21	safe
	CHHUIKHADAN	67.15	safe
	CHHURIA	46.54	safe
	DONGARGAON	86.34	semi_critical
	DONGARGARH	78.32	semi_critical
	KHAIRAGARH	88.76	semi_critical
	RAJNANDGAON	73.81	semi_critical

Table 23 Groundwater Resource up to 200m bgl (MCM)

District	Block	Dynamic Resources (MCM)		Insitu Resources (MCM)		Total Resources (MCM)
		Aquifer I	Aquifer II	Aquifer I	Aquifer II	
Rajnandgaon	AMBAGARH CHOWKI	27.54	99.30	175.84	2170.46	2473.14
	CHHUIKHADAN	57.30	106.30	210.90	3154.80	3529.3
	CHHURIYA	57.03	80.03	244.87	3533.63	3915.56
	DONGARGAON	18.94	43.49	144.10	1862.61	2069.14
	DONGARGARH	48.19	72.11	204.30	3175.80	3500.4
	KHAIRAGARH	44.55	86.92	238.69	3590.03	3960.19
	RAJNANDGAON	21.92	105.20	254.97	3398.07	3780.16

4.1 Existing and Future Water Demand (2025)

Table 24 Ground Water Resources of the Study area in Ham

Block	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water (Ham) (3=1-2)	Current Annual Ground Water Extraction (Ham)				Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use (9=3-4-5-8)	Stage of ground water development in % (7/3 *100)
				Irrigation Use	Industrial Use	Domestic Use	Total Extraction (7=4+5+6)			
	1	2	3	4	5	6	7	8	9	
AMBAGARH CHOWKI	5431.24	543.13	4888.11	2224.19	0.6	278.426	2503.22	294.67	2368.65	51.21
CHHUIKHADAN	11513.19	916.68	10596.51	6607.985	0.03	507.592	7115.6	569.12	3419.38	67.15
CHHURIA	9880.59	988.06	8892.53	3650.052	2.161	486.4961	4138.73	532.99	4707.31	46.54
DONGARGAON	7029.09	702.91	6326.18	5009.514	80.1147	372.3956	5462.03	407.98	828.57	86.34
DONGARGARH	11895.62	749.18	11146.44	8157.66	1.8122	570.1541	8729.62	618.04	2368.93	78.32
KHAIRAGARH	11078.3	720.43	10357.87	8653.02	3.132	537.5979	9193.74	592.46	1109.27	88.76
RAJNANDGAON	7474.59	747.46	6727.13	1116.25	150.15	225.7124	1492.12	239.55	5221.19	73.81
Total	64302.62	5367.85	58934.77	35418.67	238.00	2978.37	38635.06	3254.81	20023.30	70.30

Total annual ground water recharge and annual extractable ground water resource of the district have been estimated to be 64,302.62 Ham and 58,934.77 Ham respectively. Gross ground water Extraction for all uses in the district is 38,635.06 Ham. The existing demand for irrigation in the area is 35,418.67 Ham while the same for domestic use is 2,978.37 Ham and for industrial field is 238 Ham. To meet the future demand for ground water, a total quantity of **20,023.30** Ham of ground water is available for future use.

5. GROUND WATER RELATED ISSUES

- ✓ **Drying of Dugwells and handpumps during summer-** During summer, Dugwells in villages are dry except in few locations several hand pumps also stop yielding water. Drying Dugwells and depletion of ground water level during premonsoon in Rajnandgaon and Dongargaon blocks is due to excessive ground water withdrawal.
- ✓ **Inherent hydrogeological character of aquifer-** The fractures are also very localised which results very low yield and less transmissivity in aquifers. Good potential zone confined in structurally low laying areas whereas in higher elevation, it is poorly yielding.
- ✓ **Fluoride concentration-** Fluoride is observed in granitic terrain but it is in safe limit in the district.
- ✓ **Nitrate contamination-** Nitrate is found in the district but it is in safe limit.
- ✓ **Arsenic Contamination-** High arsenic concentration in ground water of Kaudikasa village of Ambaghar chowki block of the state has been reported by CGWB in year 2015-16. A total of five villages are found severely affected with high Arsenic groundwater namely Kaudikasa, Joratarai, Sonsaytola, Muletitola and Jadutola.

6. GROUND WATER MANAGEMENT STRATEGY

- It has been observed during fieldwork, there is colossal wastage of groundwater through private well and public water supply system. So, Information, Education and Communication (IEC) activities need to be organized to sensitize people on the issues of depleting groundwater resource. Massive awareness campaigns are essential to aware people about the importance of community participation in saving water.
- Desiltation of existing Tanks and Talabs to be carried out for efficient storage of rainwater. Also Rain water harvesting structures may be constructed in villages to reduce stress on groundwater.

- It has been observed that the demand of ground water is increasing for irrigation, industrial and domestic uses. At locations where water level is declining, we have to go for artificial recharge on a long-term sustainability basis. Artificial Recharge structures may be constructed at suitable locations especially in the areas where the water level remains more than 3m in the post-monsoon period in the district to arrest the huge noncommitted run-off and augment the ground water storage in the area. The different types of artificial recharge structures feasible in the block are described in Table 27.

Table 25 Types and number of Artificial Recharge structures feasible

Block/District	Area Identified for Artificial recharge (sq.km)	Vol. of Sub Surface Potential for Artificial recharge (MCM)	Types of Structures Feasible and their Numbers			
			Percolation tank	Nalas bunding cement plug/ check dam	Gravity head /Dug well/ tube well/Recharge shaft	Gully plugs Gabion structures
Recharge Capacity - (MCM)/structure			0.2192	0.0326	0.00816	0.0073
AMBAGARH CHOWKI	8.01	0.180	1	2	4	3
CHHUIKHADAN	115.52	4.340	14	48	108	82
CHHURIYA	161.60	3.962	13	44	99	75
DONGARGAON	50.44	1.211	4	13	30	23
DONGARGARH	252.94	9.085	30	101	227	173
KHAIRAGARH	122.96	7.237	24	80	180	138
RAJNANDGAON	230.83	10.04	33	111	250	191
Total	942.30	36.06	119	399	898	685

- Abandoned tube well and dug well may be used for the recharge through shaft especially in urban and water stressed areas.
- In urban areas STP may be installed for the treatment of sewage water in proper numbers to avoid contamination of ground water. Treatment of sewage water in village through soak pit for the individual houses and Seechewal model or similar model for community level may be adopted to avoid contamination of ground water. Treated water may also be reused for irrigation and other industrial purposes.
- Since the stage of development in the district is 65.24 %. There is limited scope of utilizing more ground water for future irrigation purpose. Additional number of Ground water

abstraction structure may be developed in Ambagarh Chowki, Chhuria and Chuikhadan block for the effective utilization of ground water resources in the district (Figure 44). The ground water is presently developed through dug wells and tube wells. Yield potential for the block has been shown in Aquifer map (Figure 32). Sites for wells need to be selected only after proper scientific investigation. The ground water quality also needs to be ascertained and the wells used for water supply should be first checked for Iron, Fluoride and other pollutants.

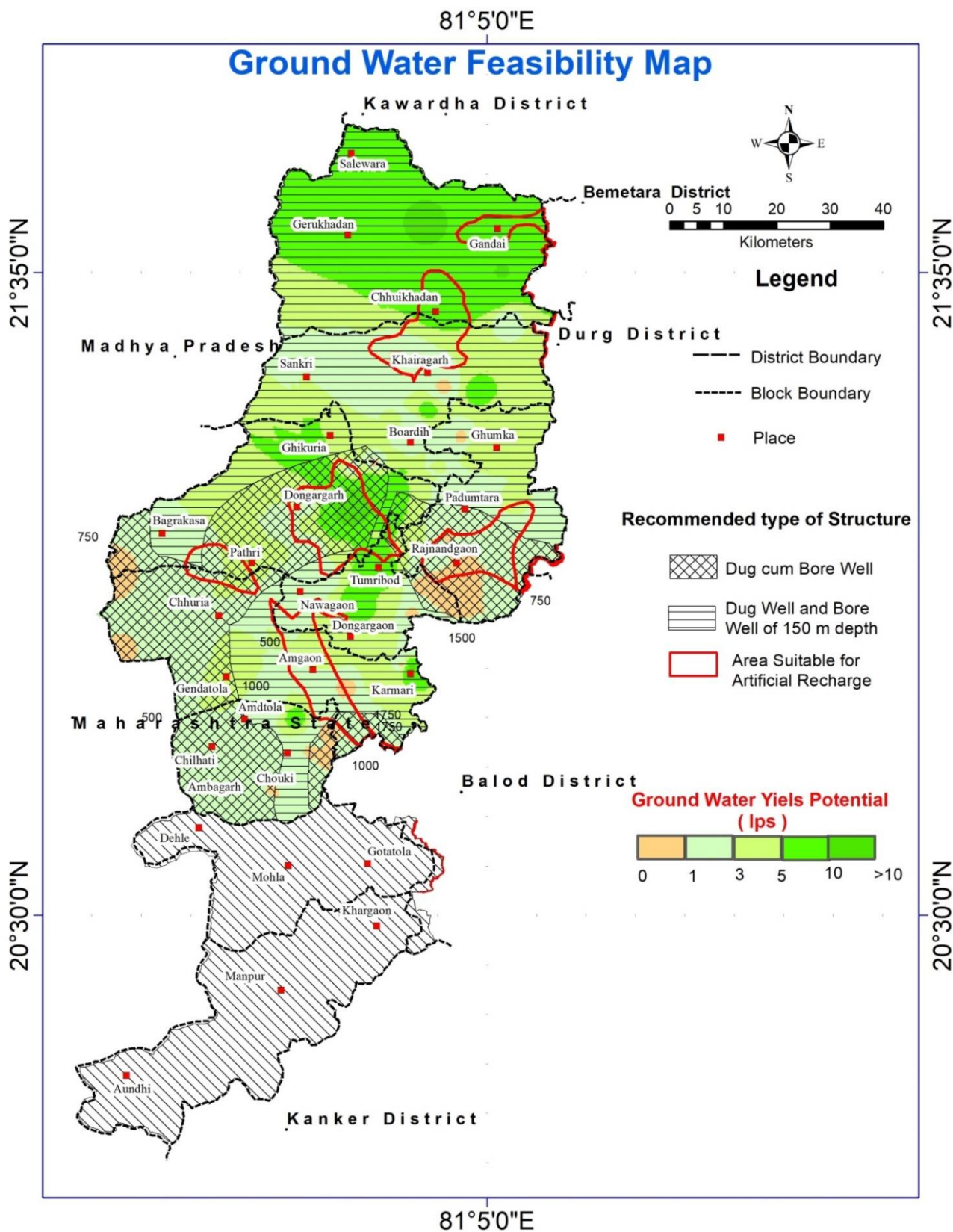


Figure 39 Feasibility of GW Abstraction and Area Identified for Artificial Recharge Map

Table 26 Additional groundwater abstraction structure proposed

Block	Annual Extractable Ground Water Resource (ham)	Stage of ground water Development (%)	Present ground water draft (ham)	Ground water draft at 60% stage of development (ham)	Surplus ground water at present Stage of Development (ham)	Number of TW Recommended in each block (Assuming unit draft as 1.6 ham/structure/year)	Number of DW Recommended in each block (Assuming unit draft as 0.72 ham/structure/year)
AMBAGARH CHOWKI	4888.11	51.21	12.2	2932.87	429.65	161.12	238.69
CHHURIYA	8892.53	46.54	26.48	5335.52	1196.79	448.80	664.88

7. CONCLUSION:

For effective utilization of Ground water existing draft for irrigation may be coupled with micro irrigation system. Change in irrigation pattern, optimum use of available resource, use of ground water potential created after artificial recharge can lead to groundwater savings and increase in gross cropped area of the district.

Table 27 Detail of groundwater saved through change in cropping pattern and other interventions

Block	Existing Gross Ground Water Draft for Irrigation in Ham	Additional Saving of GW After using Micro Irrigation methods in Ham(Assuming 30 % saving)	GW Potential created after Artificial recharge structure in Ham	Total GW Resource Enhancement	Stage of Ground Water Extraction (%) As per 2022 GWRE	Expected Stage of Ground Water Extraction (%) after intervention
AMBAGARH CHOWKI	2224.1903	667.25709	18	685.25709	51.21	44.91
CHHUIKHADAN	6607.9852	1982.39556	434	2416.39556	67.15	54.68
CHHURIYA	3650.0521	1095.01563	396.2	1491.21563	46.54	39.86
DONGARGAON	5009.5137	1502.85411	121.1	1623.95411	86.34	68.70
DONGARGARH	8157.6596	2447.29788	908.5	3355.79788	78.32	60.19
KHAIRAGARH	8653.02	2595.906	723.7	3319.606	88.76	67.22
RAJNANDGAON	4374	1312.2	1004	2316.2	73.81	57.51
TOTAL	41254.10	12376.23	3734.10	16110.33	70.21	56.15

Annexure 1 Details of key wells established in Rajnandgaon District

Sl. No	Village	Block	District	Longitude	Latitude	WL Pre M May (m)	WL Post M Nov (m)	Fluctuation	Year	Source
1	Nallutola	Chhuriya	Rajnandgaon	80.6656079	21.0587764	5.50	2.05	3.45	2022-23	DW
2	Gopalpur	Chhuriya	Rajnandgaon	80.5828684	21.0333533	5.55	3.55	2.00	2022-23	DW
3	Khobha	Chhuriya	Rajnandgaon	80.5617185	21.0379863	11.85	7.17	4.68	2022-23	DW
4	Bamni	Chhuriya	Rajnandgaon	80.5848217	20.9665494	8.40	5.85	2.55	2022-23	DW
5	Hat Banjari	Chhuriya	Rajnandgaon	80.5816329	20.8945162	6.21	3.06	3.15	2022-23	DW
6	Jangalpur	Chhuriya	Rajnandgaon	80.6570117	20.9285173	7.30	3.18	4.12	2022-23	DW
7	Telgaon	Chhuriya	Rajnandgaon	80.7141713	20.964613	5.55	2.92	2.63	2022-23	DW
8	Jantar	Chhuriya	Rajnandgaon	80.7594221	20.9844329	9.35	3.85	5.50	2022-23	DW
9	Bhandari Bharda	Chhuriya	Rajnandgaon	80.8044994	20.9093249	8.7	2.88	5.82	2022-23	DW
10	Bijepar	Chhuriya	Rajnandgaon	80.7623796	20.9126472	2.78	0.95	1.83	2022-23	DW
11	Dhangaon	Chhuriya	Rajnandgaon	80.8129201	20.8722136	2.05	1.8	0.25	2022-23	DW
12	Pandutola	Ambagarh Chowki	Rajnandgaon	80.6098266	20.7931305	3.72	2.1	1.62	2022-23	DW
13	Hathikonhar	Ambagarh Chowki	Rajnandgaon	80.7179535	20.7804865	6.65	4.1	2.55	2022-23	DW
14	Warchakutum	Ambagarh Chowki	Rajnandgaon	80.7455038	20.7058891	4.3	1.7	2.60	2022-23	DW
15	Mahud Machandur	Ambagarh Chowki	Rajnandgaon	80.8201624	20.7837929	5.8	2.78	3.02	2022-23	DW
16	Umarwahi	Ambagarh Chowki	Rajnandgaon	80.8201624	20.7837929	5.8	2.8	3.00	2022-23	DW
17	Maharum	Chhuriya	Rajnandgaon	80.946121	20.9324571	8.6	4.92	3.68	2022-23	DW
18	Bandhabazar	Ambagarh Chowki	Rajnandgaon	80.7417	20.8333	3.3	1.95	1.35	2022-23	DW
19	Chirchari	Chhuriya	Rajnandgaon	80.5875	21.0833	4.12	3.9	0.22	2022-23	DW
20	Rampur	Chhuriya	Rajnandgaon	80.7138	21.0734	3.5	1.8	1.70	2022-23	DW
21	SadakBanjari	Chhuriya	Rajnandgaon	80.4517	21.0607	8.1	4	4.10	2022-23	DW

22	Chichola	Chhuriya	Rajnandgaon	80.6872	21.0722	9.55	5.65	3.90	2022-23	DW
23	Gathula	Rajnandgaon	Rajnandgaon	81.054212	21.132714	2.93	1.75	1.18	2018-19	DW
24	Domhatola	Rajnandgaon	Rajnandgaon	81.020983	21.200712	8.1	5.5	2.60	2018-19	DW
25	Dumardih kala	Rajnandgaon	Rajnandgaon	81.020675	21.223485	9.03	9.03	0.00	2018-19	DW
26	Awardha/Aurda	Rajnandgaon	Rajnandgaon	81.12121	21.314544	6.76	6.3	0.46	2018-19	DW
27	Ghumka	Rajnandgaon	Rajnandgaon	81.095279	21.29157	6.38	3.4	2.98	2018-19	DW
28	Harduwa	Rajnandgaon	Rajnandgaon	81.096359	21.258493	2	5.3	-3.30	2018-19	DW
29	Kaladabri	Rajnandgaon	Rajnandgaon	81.095155	21.20828	12.4	5.7	6.70	2018-19	DW
30	Singdai	Rajnandgaon	Rajnandgaon	81.048504	21.066376	6.34	6.34	0.00	2018-19	DW
31	Mohad	Rajnandgaon	Rajnandgaon	81.071766	21.053162	7.52	6.72	0.80	2018-19	DW
32	Haldi	Rajnandgaon	Rajnandgaon	81.045479	21.053789	8.87	8.17	0.70	2018-19	DW
33	Malpuri	Rajnandgaon	Rajnandgaon	81.0848	21.025631	2.3	1.67	0.63	2018-19	DW
34	Surgi	Rajnandgaon	Rajnandgaon	81.109611	21.028336	3.37	3.07	0.30	2018-19	DW
35	Arla	Rajnandgaon	Rajnandgaon	81.123009	21.04721	4.6	3.01	1.59	2018-19	DW
36	Bharregaon	Rajnandgaon	Rajnandgaon	81.125616	21.078413	5.4	3.02	2.38	2018-19	DW
37	Thakurtolla	Rajnandgaon	Rajnandgaon	81.11904	21.126014	3.6	1.76	1.84	2018-19	DW
38	Sukul daihan	Rajnandgaon	Rajnandgaon	80.956476	21.147824	7.05	6.65	0.40	2018-19	DW
39	Pharhad	Dongargaon	Rajnandgaon	80.996852	21.069722	8.85	7.7	1.15	2018-19	DW
40	Karamtara	Dongargaon	Rajnandgaon	81.004036	21.01654	1.52	1.43	0.09	2018-19	DW
41	Khujji-Karethi	Dongargaon	Rajnandgaon	80.883019	20.953262	7.5	3.9	3.60	2018-19	DW
42	Ari	Dongargaon	Rajnandgaon	80.873289	20.991986	4.45	3.9	0.55	2018-19	DW
43	Arjuni	Dongargaon	Rajnandgaon	80.918994	21.028825	3.1	2.7	0.40	2018-19	DW
44	Rampur	Dongargaon	Rajnandgaon	80.965235	21.052668	5.5	3	2.50	2018-19	DW

45	Hardi	Dongargaon	Rajnandgaon	80.921216	21.143048	9.27	6.3	2.97	2018-19	DW
46	Bankal	Dongargaon	Rajnandgaon	80.925448	21.110064	4.95	2.2	2.75	2018-19	DW
47	Tilairawara	Dongargaon	Rajnandgaon	80.787168	21.038946	5.4	2.44	2.96	2018-19	DW
48	Kolihapur	Dongargarh	Rajnandgaon	80.89326	21.173041	9.6	5	4.60	2018-19	DW
49	Sahaspur	Dongargarh	Rajnandgaon	80.908768	21.210516	13.2	10.07	3.13	2018-19	DW
50	Purena	Dongargarh	Rajnandgaon	80.944653	21.208701	7.78	7.7	0.08	2018-19	DW
51	Visnupar	Dongargarh	Rajnandgaon	80.960432	21.230296	5.08	2	3.08	2018-19	DW
52	Murmunda	Dongargarh	Rajnandgaon	80.788884	21.139973	7.7	4.38	3.32	2018-19	DW
53	Patpar	Dongargarh	Rajnandgaon	80.773802	21.098519	7.1	5.15	1.95	2018-19	DW
54	Jhandatalao	Dongargarh	Rajnandgaon	80.743547	21.090667	10	7.1	2.90	2018-19	DW
55	L B Nagar	Dongargarh	Rajnandgaon	80.686005	21.096062	3.9	3	0.90	2018-19	DW
56	Muglani	Dongargarh	Rajnandgaon	80.651173	21.109227	7.05	4.05	3.00	2018-19	DW
57	Madiyan	Dongargarh	Rajnandgaon	80.648464	21.149417	11.8	8.9	2.90	2018-19	DW
58	Pitepani	Dongargarh	Rajnandgaon	80.585548	21.168436	5.45	2.95	2.50	2018-19	DW
59	Piparkharkala	Dongargarh	Rajnandgaon	80.605834	21.201776	9.3	5.9	3.40	2018-19	DW
60	Bortalao	Dongargarh	Rajnandgaon	80.624433	21.217205	8.4	1.6	6.80	2018-19	DW
61	Panijob	Dongargarh	Rajnandgaon	80.678774	21.197404	6.1	4.05	2.05	2018-19	DW
62	Bagrekasa	Dongargarh	Rajnandgaon	80.574143	21.144907	4.85	4.36	0.49	2018-19	DW
63	Mohanpur	Dongargarh	Rajnandgaon	80.572979	21.112362	12.74	8.98	3.76	2018-19	DW
64	Singarpur	Khairagarh	Rajnandgaon	81.017338	21.27484	7.17	6.2	0.97	2018-19	DW
65	Thelkadih	Khairagarh	Rajnandgaon	81.031641	21.243403	4.8	2.7	2.10	2018-19	DW
66	Sisahi	Khairagarh	Rajnandgaon	80.966181	21.245859	14.37	13.7	0.67	2018-19	DW
67	Chichola	Khairagarh	Rajnandgaon	80.928137	21.29059	12.8	8.3	4.50	2018-19	DW

68	Bhandarpur	Khairagarh	Rajnandgaon	80.869398	21.293415	12.27	10.6	1.67	2018-19	DW
69	Mudhipar	Khairagarh	Rajnandgaon	80.870385	21.3463	5.33	3.15	2.18	2018-19	DW
70	Parsahi	Khairagarh	Rajnandgaon	80.873074	21.317444	8.38	7.9	0.48	2018-19	DW
71	Gatapar	Khairagarh	Rajnandgaon	80.774095	21.396578	4.8	2.9	1.90	2018-19	DW
72	Itar	Khairagarh	Rajnandgaon	80.851535	21.404043	8.19	6.07	2.12	2018-19	DW
73	Pandadah	Khairagarh	Rajnandgaon	80.904566	21.398651	6.3	5.9	0.40	2018-19	DW
74	Pipariya	Khairagarh	Rajnandgaon	80.97231	21.45131	5.3	5.1	0.20	2018-19	DW
75	Amlidihkala	Khairagarh	Rajnandgaon	80.968748	21.485244	8.5	7.35	1.15	2018-19	DW
76	Bahitola	Khairagarh	Rajnandgaon	80.913299	21.4615	2.6	1.2	1.40	2018-19	DW
77	Deori	Khairagarh	Rajnandgaon	80.876992	21.462196	4.3	0.4	3.90	2018-19	DW
78	Singarbhadd	Khairagarh	Rajnandgaon	80.914767	21.438489	9.07	2.47	6.60	2018-19	DW
79	Parikal	Khairagarh	Rajnandgaon	80.89758	21.486551	6.9	4.15	2.75	2018-19	DW
80	Pandaka	Khairagarh	Rajnandgaon	81.067076	21.40186	4.7	4.5	0.20	2018-19	DW
81	Mandla	Khairagarh	Rajnandgaon	81.053281	21.437588	10	9.2	0.80	2018-19	DW
82	Dograbhata	Khairagarh	Rajnandgaon	81.033082	21.472525	13.1	6.75	6.35	2018-19	DW
83	Ataria	Khairagarh	Rajnandgaon	81.118412	21.466846	4.3	3	1.30	2018-19	DW
84	Sonpuri	Khairagarh	Rajnandgaon	81.104506	21.485994	9.5	3.3	6.20	2018-19	DW
85	Maroda	Khairagarh	Rajnandgaon	81.149846	21.425087	10.8	9	1.80	2018-19	DW
86	Bidauri	Chuikhadan	Rajnandgaon	81.025749	21.539731	7.7	7.45	0.25	2018-19	DW
87	Udaypur	Chuikhadan	Rajnandgaon	81.08789	21.520826	7.7	1.2	6.50	2018-19	DW
88	Borai	Chuikhadan	Rajnandgaon	81.135204	21.518889	6.2	4.07	2.13	2018-19	DW
89	Bundeli	Chuikhadan	Rajnandgaon	81.115212	21.571128	13.9	5.2	8.70	2018-19	DW
90	Jangalpur	Chuikhadan	Rajnandgaon	81.011022	21.650358	9.2	4.7	4.50	2018-19	DW

91	Bhorampur	Chuikhadan	Rajnandgaon	81.0132	21.5568	7.5	3.47	4.03	2018-19	DW
92	Chuikhadan	Chuikhadan	Rajnandgaon	80.9958	21.525	7.08	4.94	2.14	2018-19	DW
93	Gandaipandaria	Chuikhadan	Rajnandgaon	81.0953	21.6644	8.72	5.7	3.02	2018-19	DW
94	Mohgaon	Chuikhadan	Rajnandgaon	80.9592	21.7069	4.99	0.8	4.19	2018-19	DW
95	Narmada	Chuikhadan	Rajnandgaon	81.0724	21.6216	5.01	4.7	0.31	2018-19	DW
96	Pailimeta	Chuikhadan	Rajnandgaon	80.9869	21.6716	5.12	3.66	1.46	2018-19	DW
97	Khalakosa	Chhuriya	Rajnandgaon	80.6668410	21.0249858	6.04	4.5	1.54	2018-19	BW
98	Kallubanjari	Chhuriya	Rajnandgaon	80.5765528	20.915351	7.47	4.85	2.62	2018-19	BW
99	Churia Dongri	Chhuriya	Rajnandgaon	80.5782584	20.8738918	18.50	6.45	12.05	2018-19	BW
100	Metepar	Chhuriya	Rajnandgaon	80.6046456	20.8948924	9.30	6.58	2.72	2018-19	BW
101	Aliwara	Chhuriya	Rajnandgaon	80.6331471	20.8732941	14.44	3.75	10.69	2018-19	BW
102	Sitakasa	Chhuriya	Rajnandgaon	80.6489872	20.9183062	2.89	1.90	0.99	2018-19	BW
103	Arsitola	Chhuriya	Rajnandgaon	80.737596	20.9845062	4.00	2.30	1.70	2018-19	BW
104	Munjalkala	Chhuriya	Rajnandgaon	80.7445235	20.9034501	3.75	2.7	1.05	2018-19	BW
105	Harratola	Chhuriya	Rajnandgaon	80.7129703	20.8971175	9.85	2.41	7.44	2018-19	BW
106	Amatola	Ambagarh Chowki	Rajnandgaon	80.6763494	20.8323288	13.1	5.2	7.90	2018-19	BW
107	Aatebandha	Ambagarh Chowki	Rajnandgaon	80.5930129	20.7757876	15.6	5.9	9.70	2018-19	BW
108	Marartola	Ambagarh Chowki	Rajnandgaon	80.6127358	20.7698963	6.32	2.6	3.72	2018-19	BW
109	Jhitia	Ambagarh Chowki	Rajnandgaon	80.6424074	20.7865673	8.1	3.28	4.82	2018-19	BW
110	Pangri	Ambagarh Chowki	Rajnandgaon	80.7665682	20.7657078	20.45	5.8	14.65	2018-19	BW
111	Chandia	Chhuriya	Rajnandgaon	80.9027349	20.8842943	7.95	1.62	6.33	2018-19	BW
112	Jodhra	Chhuriya	Rajnandgaon	80.8862745	20.9177907	4.1	3.75	0.35	2018-19	BW
113	Kaldabri	Chhuriya	Rajnandgaon	80.9370454	20.9267436	6.9	2.14	4.76	2018-19	BW

114	Ambagarh chowki	Ambagarh Chowki	Rajnandgaon	80.7417	20.7750	20.38	10.1	10.28	2018-19	PZ
115	Kaladabri	Rajnandgaon	Rajnandgaon	81.095155	21.20828	12.85	4.87	7.98	2018-19	HP
116	Indamara	Rajnandgaon	Rajnandgaon	80.952248	21.105286	12.34	6.4	5.94	2018-19	HP
117	Bhatagaon	Rajnandgaon	Rajnandgaon	81.0689	21.2883	11.61	9.34	2.27	2018-19	PZ
118	Baghera	Rajnandgaon	Rajnandgaon	81.1231	21.1892	19	12.14	6.86	2018-19	PZ
119	Kirgi	Dongargaon	Rajnandgaon	80.937285	20.992537	12.75	12.5	0.25	2018-19	HP
120	Khursipar	Dongargaon	Rajnandgaon	80.92444	20.969134	13.8	11	2.80	2018-19	HP
121	Argaon	Dongargaon	Rajnandgaon	80.90861	21.103199	21.22	9.23	11.99	2018-19	HP
122	Bicharpur-Nawagaon	Dongargaon	Rajnandgaon	80.764174	21.050735	16.43	9.38	7.05	2018-19	HP
123	Assra	Dongargaon	Rajnandgaon	80.73982	21.01367	16.55	14.35	2.20	2018-19	HP
124	Bamhani-bhatt	Dongargaon	Rajnandgaon	80.768699	21.002291	9.44	6.78	2.66	2018-19	HP
125	Margaon	Dongargaon	Rajnandgaon	80.844813	21.037175	8.7	5.3	3.40	2018-19	HP
126	Dundera	Dongargarh	Rajnandgaon	80.83354	21.120339	16.6	11	5.60	2018-19	HP
127	Khursipar	Dongargarh	Rajnandgaon	80.970321	21.218861	20.9	15.2	5.70	2018-19	HP
128	Madiyan	Dongargarh	Rajnandgaon	80.648464	21.149417	14.8	9.83	4.97	2018-19	HP
129	Dongargarh	Dongargarh	Rajnandgaon	80.7597	21.1847	9.62	9.12	0.50	2018-19	PZ
130	Gothiya	Khairagarh	Rajnandgaon	80.964616	21.32399	24.2	13	11.20	2018-19	HP
131	Pendrikala	Khairagarh	Rajnandgaon	80.982152	21.376069	24.25	14.97	9.28	2018-19	HP
132	Aweli	Khairagarh	Rajnandgaon	81.080002	21.369791	20.9	19.19	1.71	2018-19	HP
133	Rahud	Khairagarh	Rajnandgaon	81.089775	21.415633	14.8	17.03	-2.23	2018-19	HP
134	Keshla	Khairagarh	Rajnandgaon	81.074108	21.465369	10.1	6.41	3.69	2018-19	HP
135	Acholi	Khairagarh	Rajnandgaon	81.099009	21.448074	15.32	10.84	4.48	2018-19	HP
136	Singhour	Khairagarh	Rajnandgaon	81.164661	21.449578	15.47	12.7	2.77	2018-19	HP

137	Padmabatipur	Chuikhadan	Rajnandgaon	81.051578	21.49935	12.2	4.86	7.34	2018-19	HP
138	Kheri	Chuikhadan	Rajnandgaon	81.070327	21.54313	20	8.77	11.23	2018-19	HP
139	Bhardagaon	Chuikhadan	Rajnandgaon	81.076231	21.577591	15.8	11.38	4.42	2018-19	HP
140	Gandai	Chuikhadan	Rajnandgaon	81.1089	21.6639	7.63	5.56	2.07	2018-19	PZ

Annexure 2 Details of Chemical Analysis

S.N o.	Block	Village	Latitude	Longitude	Sample Source	PH	EC	CO3	HCO3	Cl	SO4	NO3	F	TH	Ca	Mg	Na	K	Si	Po4	u	TDS
1	Chhuriya	Ambagarh chowki	20.775	80.74167		8.28	273	0	201	11	3.5	0	0.45	120	42	3.6	5.5	0.55	10	0	0	0
2	Ambagarh Chowki	Bandhabazar	20.8333	80.7417		7.59	492	0	114	74.55	33	0	0.23	180	46	15.6	24.9	1.5	10	0	0	0
3	Chhuriya	Chirchari	20.965776	80.77963		7.58	548	0	138	81.65	34	0	0.34	210	48	21.6	35	16	14	0	0	0
4	Chhuriya	SadakBanjari	21.0607	80.4517		8.1	930	0	486	31.95	34.6	0	0.66	165	42	14.4	115	35.2	11	0	0	0
5	Chhuria	Khobha	21.037986	80.56172	HP	7.65	503	0	176.9	38.5	47.38	18.64	0.09	175	28	25.2	28.4	6.26	5.98	0	11.2	337.01
6	Chhuria	Dammabanjari	20.901634	80.56397	HP	7.9	557	0	146.4	38.5	50.74	76.32	0.2	190	52	14.4	33.3	2.09	8.56	0	0	373.2
7	Chhuria	Kallubanjari	20.915301	80.57655	HP	8.07	701	0	201.3	63	37.87	61.19	0.01	180	42	18	52.3	50.2	9.96	0	0	469.67
8	Chhuria	Churia Dongri	20.873892	80.57826	HP	7.46	320	0	85.4	31.5	43.06	34.47	0.08	145	34	14.4	21.9	0.47	9.2	0	0	214.4
9	Chhuria	Hatbanjari	20.894516	80.58163	HP	7.89	364	0	158.6	14	37.28	24.39	0.01	150	38	13.2	19.2	1.95	10.1	0	0.6	243.88
10	Chhuria	Gopalpur	21.033353	80.58287	DW	8.23	215	0	67.1	14	28.74	1.49	0.1	75	24	3.6	11.8	1.46	10.1	0	0	144.05
11	Chhuria	Bamni	20.966549	80.58482	HP	8.12	1307	0	292.8	168	84.95	75.89	0.45	415	44	73.2	123.7	16.1	10.6	0	0	875.69
12	Ambagarh Chawki	Aatebandha	20.775788	80.59301	HP	7.23	1489	0	305	227.5	95.38	61.19	0.18	600	136	62.4	71.4	11.1	5.89	0	0	997.63
13	Chhuria	Metepar	20.894892	80.60465	HP	7.87	569	0	213.5	42	40.41	5.4	0.32	180	24	28.8	58.9	0.46	5.6	0	0	381.23
14	Ambagarh Chawki	Pandutola	20.793131	80.60983	HP	7.45	180	0	85.4	17.5	27.65	0.37	0.13	85	18	9.6	10.7	1.15	16.8	0	0	120.6
15	Ambagarh Chawki	Marartola	20.769896	80.61274	HP	7.65	798	0	176.9	108.5	67.6	26.87	0.06	345	64	44.4	28.2	1.69	10.5	0	0	534.66
16	Chhuria	Aliwara	20.873294	80.63315	HP	7.56	739	0	97.6	112	43.06	61.01	0.02	325	82	28.8	21.1	7.27	10.6	0	0	495.13
17	Dongargarh	Ranitalab	21.0828	80.6383		7.66	1020	0	90	159.75	34.6	0	0.38	300	88	19.2	58	3.1	10	0	0	0
18	Ambagarh Chawki	Jhitia	20.786567	80.64241	HP	7.21	505	0	256.2	28	37.872	0.16	0.27	230	50	25.2	45.7	0.5	17.6	0	0	338.35
19	Chhuria	Sitakasa 2	20.917956	80.64895	HP	7.64	756	0	146.4	101.5	49.54	61.20	0.07	270	56	31.2	49.7	1.35	9.61	0	0	506.52
20	Chhuria	Sitakasa 1	20.918306	80.64899	HP	7.26	1500	0	189.1	266	181.87	69.25	0.16	610	122	73.2	69.4	1.98	11.6	0	0	1005
21	Dongargarh	Muglani	21.1092	80.6511		8.12	620	0	140.3	67.45	49.2	29.1	1.1	260	42	37.82	21.3	0.7	20.9	0.01	0	0
22	Chhuria	Jangalpur	20.928517	80.65701	HP	7.46	559	0	164.7	35	59.23	77.25	0.07	210	52	19.2	39.7	1.94	7.21	0	1.2	374.53
23	Chhuria	Nallutola	21.058776	80.66567	HP	7.75	711	0	85.4	119	44.83	54.95	0.06	300	78	25.2	15.9	2.23	5.67	0	0	476.37
24	Chhuria	Khalakosa	21.024986	80.66684	HP	7.74	689	0	128.1	98	60.82	11.10	0.03	265	58	28.8	45.7	2.24	9.67	0	6.1	461.63
25	Ambagarh Chawki	Amatola	20.832329	80.67635	HP	7.84	566	0	225.7	52.5	37.97	6.39	0.38	185	32	25.2	56.6	0.41	15.1	0	0	379.22
26	Dongargarh	Lal bhadurnagar	21.0917	80.6883		7.73	807	0	120	81.65	18.7	0	0.02	265	70	21.6	25.8	25.9	7	0	0	0
27	Dongargarh	Govindpur	21.0997	80.7014		7.74	320	0	108	28.4	11	0	0.01	120	40	4.8	17.4	0.3	7	0	0	0
28	Ambagarh Chawki	Jadutola	20.85376	80.70804	HP	7.56	524	0	158.6	63	47.51	28.458	0.03	230	50	25.2	16.1	1.64	9.85	0	3.6	351.08
29	Dongargarh	Ramatola	21.1256	80.7114		7.91	842	0	300	85.2	18.6	0	1.1	45	10	4.8	165	2	6	0	0	0

S.N o.	Block	Village	Latitude	Longitude	Sample Source	PH	EC	CO3	HCO3	Cl	SO4	NO3	F	TH	Ca	Mg	Na	K	Si	Po4	u	TDS
30	Dongargarh	Kalyanpur	21.1456	80.7119		7.82	345	0	192	10.65	9	0	0.1	125	22	16.8	25.1	0.92	12	0	0	0
31	Chhuria	Telgaon	20.964613	80.71417	HP	8.13	301	0	146.4	21	28.41	3.472	0.15	125	30	12	29.8	1.31	18.7	0	0	201.67
32	Ambagarh Chawki	Hathikonhar	20.780487	80.71795	HP	7.82	786	0	146.4	108.5	75.216	35.85	0.02	275	46	38.4	32.1	1.95	10.9	0	0	526.62
33	Chuikhadan	Kheri	20.5111	80.725		8.09	695	0	189.1	78.1	46.6	20.3	1.29	200	28	31.7	72.8	1.25	9.9	0.01	0	0
34	Dongargarh	Bharritola	21.2042	80.7358		7.7	335	0	168	17.75	8.4	0	0.23	100	24	9.6	40	0.1	14	0	0	0
35	Chhuria	Arsitola	20.984506	80.7376	HP	7.23	317	0	73.2	31.5	27.25	30.92	0.09	110	28	9.6	21.3	0.45	22.8	0	0	212.39
36	Dongargarh	Uraidabritola	21.0822	80.7381		7.7	1087	0	138	60.35	270	0	0.1	375	72	46.8	68.9	2.5	10	0	0	0
37	Chhuria	Harratola	20.897118	80.74452	HP	7.56	1108	0	170.8	150.5	27.216	62.76	0.07	325	72	34.8	58.9	8.63	10.6	0	0	742.36
38	Chhuria	Mungalkala	20.90345	80.74452	HP	7.42	978	0	176.9	161	90.23	42.59	0.01	440	92	50.4	38.7	1.9	12.4	0	0	655.26
39	Dongargaon	Kokpur I	20.9917	80.7458		7.74	831	0	186	88.75	46.9	0	0.47	260	62	25.2	55.9	1.08	22	0	0	0
40	Ambagarh Chawki	Warchakutum	20.706142	80.74802	HP	7.63	288	0	91.5	14	30.84	0.87	0.17	120	26	13.2	11.5	1.39	16.9	0	3.8	192.96
41	Chhuria	Jantar	20.984433	80.75942	HP	7.49	414	0	134.2	17.5	32.54	22.96	0.11	165	42	14.4	15.4	3.77	9.63	0	0	277.38
42	Chhuria	Bijepar	20.912647	80.76238	HP	7.89	915	0	286.7	63	31.39	42.04	0.3	280	30	49.2	82.9	1.2	10.3	0	20.1	613.05
43	Ambagarh Chawki	Pangri	20.765708	80.76657	HP	7.01	990	0	280.6	168	83.62	38.29	0.04	345	62	45.6	56.6	1.14	12.9	0	0	663.3
44	Dongargaon	Kumarda.1	20.8906	80.7686		7.7	190	0	66	14.2	10.3	0	0.14	65	18	4.8	11.8	0.33	20	0	0	0
45	Ambagarh Chawki	Ledijob	20.702221	80.77497	HP	7.45	908	0	122	143.5	72.53	23.44	0.17	295	40	46.8	77.2	1.1	9.12	0	0	608.36
46	Khairagarh	Acholi	21.1917	80.7811		8	335	0	140.3	24.85	12.6	11.5	0.63	140	30	15.9	20.9	0.84	8.4	0.01	0	0
47	Dongargarh	Medha	21.1167	80.7917		8.46	282	0	134.2	10.65	7.5	16.8	1.37	105	32	6.1	8.7	7.2	25.2	0.01	0	0
48	Dongargarh	Dongargarh	21.215	80.7925		7.54	541	0	192	53.25	17	0	0.42	195	44	20.4	37	0.8	3	0	0	0
49	Dongargarh	kalkosa	21.215	80.7925		7.77	403	0	180	31.95	8.3	0	0.5	150	34	15.6	23.1	1.37	14	0	0	0
50	Chhuria	Bhandari Bharda	20.909325	80.8045	HP	7.65	671	0	298.9	14	30.98	3.98	0.09	165	24	25.2	68.4	1.84	9.55	0	0	449.57
51	Chhuria	Dhangaon	20.872214	80.81292	HP	7.5	433	0	146.4	31.5	43.06	35.15	0.02	200	40	24	17.3	1.68	12.9	0	0	290.11
52	Dongargaon	Mohar/Mohad	20.9583	80.8161		7.74	608	0	150	88.75	9.6	0	0.25	265	46	36	8.8	1.07	4	0	0	0
53	Khairagarh	Rangkathera	20.5819	80.8181		7.6	805	0	180	92.3	56.6	0	0.86	130	28	14.4	101	0.59	15	0	0	0
54	Khairagarh	Talagaon	21.3017	80.8197		7.84	633	0	186	60.35	33	0	0.21	210	34	30	35	2.3	9	0	0	0
55	Ambagarh Chawki	Mahud Machandur	20.783793	80.82016	HP	7.05	752	0	195.2	77	79.1	42.59	0.01	250	26	44.4	52.9	2.35	7.26	0	4.5	503.84
56	Dongargarh	Tappa	21.0764	80.8211		7.86	1157	0	210	142	51	0	0.39	215	36	30	125	1.7	10	0	0	0
57	Dongargarh	Reevagaon	21.2194	80.8256		7.7	1300	0	84	177.5	69.9	0	1.53	450	114	39.6	43	0.9	10	0	0	0
58	Khairagarh	Baigatola	21.3875	80.8458		7.71	679	0	204	88.75	24	0	0.07	190	60	9.6	50	40.1	14	0	0	0
59	Dongargarh	Dhara	21.2528	80.8569		7.37	590	0	60	78.1	20	0	0.65	170	56	7.2	23	39	36	0	0	0

S.N o.	Block	Village	Latitude	Longitude	Sample Source	PH	EC	CO3	HCO3	Cl	SO4	NO3	F	TH	Ca	Mg	Na	K	Si	Po4	u	TDS
60	Dongargaon	Dongargaon.1	20.9708	80.8569		7.58	734	0	126	99.4	62	0	0.42	215	54	19.2	54.6	10	23	0	0	0
61	Khairagarh	Parsahi	21.3172	80.8731		8.39	774	0	256.2	46.15	63.5	15.4	1.19	245	24	45.1	89.9	1.8	11	0.02	0	0
62	Ambagarh Chawki	Jodhra	20.917791	80.88627	HP	7.45	897	0	250.1	91	55.36	35.15	0.08	270	54	32.4	91.2	2.01	6.89	0	0	600.99
63	Khairagarh	Salhebara	21.3983	80.8875		7.77	419	0	120	42.6	3.4	0	0.14	155	48	8.4	8.9	0.8	9	0	0	0
64	Ambagarh Chawki	Umarwahi	20.833473	80.89353	HP	7.82	2019	0	372.1	220.5	238.94	62.54	0.18	475	112	46.8	110.1	78.2	12.7	0	0	1352.73
65	Khairagarh	Sonpuri	21.0181	80.8942		8	291	0	79.3	28.4	3.8	33.1	0.59	125	38	7.32	16.3	0.78	10	0	0	0
66	Ambagarh Chawki	Chandia	20.884294	80.90273	HP	7.45	930	0	207.4	112	76.38	22.73	0.02	280	62	30	72.5	0.93	13.3	0	0	623.1
67	Khairagarh	Salgapat	21.3167	80.9125		8.08	1201	0	672	10.65	12.5	0	0.82	125	12	22.8	198	1	19	0	0	0
68	Ambagarh Chawki	Kaldabri	20.926744	80.93705	HP	leaked	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	Ambagarh Chawki	Maharum	20.932457	80.94612	DW	7.11	461	0	158.6	45.5	26.49	0.55	0.07	180	14	34.8	20.3	1.75	9.2	0	0	295.04
70	Rajnandgaon	Anjora	21.1436	80.9533		7.51	824	0	114	131.4	42	0	0.01	275	78	19.2	43.4	6.99	10	0	0	0
71	Chhuikadhan	Mohgaon	21.7069	80.9592		7.89	844	0	282	67.45	45.1	0	0.68	95	28	6	99.2	2.9	10	0	0	0
72	Khairagarh	Gothiya	21.32399	80.96462		7.45	1270	0	67.1	202.4	68.9	69.2	0.44	485	138	34.2	35.9	1.46	9.9	0.01	0	0
73	Khairagarh	Khairagarh	21.4333	80.9708		7.66	1203	0	102	173.9	77.3	0	0.12	410	94	42	57.3	2.7	19	0	0	0
74	Khairagarh	Badaitola	21.3475	80.9789		7.85	450	0	132	56.8	17.4	0	0.48	100	34	3.6	58.5	1.13	11	0	0	0
75	Rajnandgaon	Reevadih	21.0861	80.9936		7.85	1366	0	168	195.3	76.4	0	0.46	305	48	44.4	120	0.69	19	0	0	0
76	Chuikhadan	Chuikhadan	21.525	80.9958		7.63	647	0	162	67.45	62	0	0.7	220	48	24	46.5	0.36	12	0	0	0
77	Khairagarh	Dhaneli	21.4086	81.0064		7.76	1101	0	336	142	46	0	0.7	350	86	32.4	58	42	23	0	0	0
78	Chhuikadhan	Bhorampur	21.5569	81.0133		7.53	1241	0	156	205.9	68	0	0.01	175	34	21.6	129	40	12	0	0	0
79	Khairagarh	Singarpur	21.2747	81.0172		9.1	514	0	67.1	53.25	35.5	55.9	0.45	130	20	19.5	25.9	45.2	8	0.02	0	0
80	Rajnandgaon	Singhola	21.2747	81.0172		8.2	552	0	268	11	6.3	0	0.32	115	50	14	25.6	0.78	8	0	0	0
81	Rajnandgaon	Dumardih kala	21.2233	81.0206		7.81	767	0	73.2	106.5	40.1	76.4	0.56	285	92	13.4	29.6	0.7	9.2	0.02	0	0
82	Rajnandgaon	Revagahan	21.1036	81.0214		7.93	240	0	114	14.2	8.1	0	0.9	65	20	3.6	23	0.3	27	0	0	0
83	Chuikhadan	Bidauri	21.5397	81.0256		8.2	367	0	54.9	24.85	16.2	6.7	1.31	110	20	14.6	38.4	0.72	11.9	0.01	0	0
84	Rajnandgaon	Bhaistara (Bhatapara)	21.3183	81.0289		7.64	390	0	138	46.15	16	0	1	160	46	10.8	11.9	4.8	40	0	0	0
85	Rajnandgaon	Maladabri	21.345	81.0294		7.97	300	0	132	14.2	1.9	0	0.32	105	26	9.6	19	0.35	24	0	0	0
86	Khairagarh	Dograbhata	21.4725	81.0331		7.95	462	0	115.9	42.6	6.4	55.4	1.03	220	42	28.1	6.3	0.61	9.4	0.01	0	0
87	Rajnandgaon	Talai	21.1667	81.0361		8.15	456	0	186	39.05	8.8	0	0.57	205	34	28.8	6.5	0.52	10	0	0	0
88	Rajnandgaon	Padumtara	21.194722	81.04278		8.44	1292	0	152.5	106.5	37.1	0	0.25	110	60	12	195	25.5	7	0	0	0

S.N o.	Block	Village	Latitude	Longitude	Sample Source	PH	EC	CO3	HCO3	Cl	SO4	NO3	F	TH	Ca	Mg	Na	K	Si	Po4	u	TDS
89	Rajnandgaon	Gathula	21.1325	81.0542		8.1	1269	0	79.3	166.8 5	83.8	35.4	0.41	320	76	31.72	5.6	1.9	6.1	0.03	0	0
90	Rajnandgaon	Ranitarai	20.9978	81.0542		7.97	1610	0	288	230.7 5	89	0	0.52	265	28	46.8	200	4.5	11	0	0	0
91	Rajnandgaon	Bori	21.1417	81.0583		7.61	901	0	168	145.6	39	0	0.18	335	78	33.6	40.5	12	28	0	0	0
92	Rajnandgaon	Saloni	21.3833	81.0667		7.55	1270	0	156	205.9	75.3	0	0.39	400	102	34.8	78	2.8	10	0	0	0
93	Khairagarh	Panduka	21.4017	81.0669		8.18	232	0	128.1	10.65	3.6	14.1	0.7	95	22	9.76	14.1	0.64	8.9	0.01	0	0
94	Rajnandgaon	Bhatgaon	21.2908	81.0703		8.08	1345	0	176.9	220	84.3	0	0.65	415	112	30	72	17.5	12	0	0	0
95	Khairagarh	Madrakuhi	21.3869	81.0722		8.01	535	0	312	7.1	6.9	0	0.4	90	12	14.4	91	2.17	8	0	0	0
96	Chhuikadhan	Narmada	21.6214	81.0722		7.73	1126	0	90	191.7	47.1	0	0.4	305	48	44.4	82	2.4	10	0	0	0
97	Khairagarh	Rahud	21.4097	81.0844		8	189	0	134.2	24.85	4	15.2	0.45	125	24	15.86	19.1	0.64	7.7	0.01	0	0
98	Rajnandgaon	Malpuri	21.0256	81.0847		7.79	906	0	85.4	166.8 5	49.9	63.4	0.81	360	84	36.6	31.3	1	11.6	0.02	0	0
99	Rajnandgaon	Sundara	21.1039	81.0894		7.7	980	0	144	216.5 5	6.3	0	0.4	255	58	26.4	74.8	1.1	9	0	0	0
100	Chhuikadhan	Gandaipandaria	21.6644	81.0953		7.52	490	0	126	46.15	25.8	0	0.01	180	44	16.8	26	0.57	20	0	0	0
101	Dongargarh	Ghortalab	21.2914	81.0953		7.54	425	0	126	39.05	15.1	0	0.03	180	58	8.4	7.6	0.64	9	0	0	0
102	Rajnandgaon	Patewa	21.34	81.1039		8.05	604	0	384	14.2	10.5	0	0.6	155	32	18	81.2	0.6	18	0	0	0
103	Rajnandgaon	Thakurtolla	21.1258	81.1189		7.53	1417	0	79.3	209.4 5	20.3	69.4	0.66	425	120	30.5	98	23.4	8.3	0.01	0	0
104	Rajnandgaon	Gidhwah	21.2717	81.1194		7.73	1152	0	132	202.4	59	0	0.68	350	78	37.2	87.1	0.5	21	0	0	0
105	Rajnandgaon	Baghera	21.1861	81.1242		7.7	877	0	72	195.2 5	53	0	0.14	275	92	10.8	56.4	2.8	14	0	0	0
106	Chuikhadan	Bhardagaon	21.0783	81.1256		8.12	523	0	164.7	49.7	23.5	8.3	1.15	165	24	25.62	46.7	1.2	9.4	0.01	0	0
107	Rajnandgaon	Uperwah	21.2447	81.14		7.88	432	0	210	17.75	18.5	0	1.3	110	28	9.6	47	0.34	16	0	0	0
108	Rajnandgaon	Nawagaon	21.1686	81.15		7.89	488	0	222	21.3	16.4	0	0.07	160	34	18	30	2.03	10	0	0	0
109	Khairagarh	Jalbanda	21.365	81.1547		7.58	1252	0	120	234.3	59	0	0.2	370	86	37.2	97.9	1.93	10	0	0	0
110	Rajnandgaon	Murhipar	21.1944	81.1564		7.85	324	0	126	31.95	3.7	0	0.16	120	24	14.4	18.1	0.7	10	0	0	0
111	Rajnandgaon	Joratarai	21.1908	81.1853		7.66	355	0	96	35.5	17.4	0	0.15	110	44	0	17.1	0.4	23	0	0	0
112	Rajnandgaon	Dewada	21.1519	81.1908		7.64	621	0	246	53.25	43	0	0.55	160	44	12	48.5	36.3	12	0	0	0

Annexure 3 Details of Exploration in Rajnandgaon District

Sl. No.	Location	Block	District	Latitude	Longitude	Reduced Level	Depth	casing	Formation	Zone_encountered	SWL	Discharge	T (m2/day)	S
1	Thelkadih	Dongargarh	Rajnandgaon	21.1827	80.9181	323.6	240	15	0-26 Sandstone 26-240 Limestone	27-30,55	4.74	18	37.14	1.8X10 ⁻⁵
2	Thelkadih OW	Dongargarh	Rajnandgaon	21.183	80.9179	324.1	75	15	sandstone & limestone	27-31,75				
3	Salteakri	Dongargarh	Rajnandgaon	21.2018	80.9046	330.5	300.52	5.8	0-148.52 Gunderdihi Fm148.52-300.52 Charmuria L.st	14-16 ,35		very low yield		
4	Pandadah	Khairagarh	Rajnandgaon	21.4014	80.9078	328.7	18	9	ABANDONED	14-17				
5	Pailimeta	Chhuikhadan	Rajnandgaon	21.6696	80.9865	409.4	160.22	16.15	0-160.12 Chilpi Fm	22.1-23,27-27.5,33.5-33.8&46-46.5	2.1	11.8	266.34	
6	Udaipur	Chhuikhadan	Rajnandgaon	21.5204	81.0897	320.3	107.02	9.32	0-89.5Chandi Fm89.5-107.02 Charmuria Fm	25-25.2,89.5 - 90,103 - 105	4.1	7.7	8.5	
7	Badaitola	Khairagarh	Rajnandgaon	21.35	80.9833	337	198.18	15.18	0.0-67.0 Chandi Fm 67.0-198.18 Gunderdihi Fm	13.2-13.5,15.78-19.38,38.58-42.1887.78-91.78114.58-118.18122.18-125.78156.18-160.18	9	7	95.48	
8	Tadesara	Rajnandgaon	Rajnandgaon	21.1389	81.1814	301	300.55	12.2	0-4.00 Soil4.00-256.00 Gunderdihi Fm 256-300.55 Charmuria L.st	13.25-16,46.15-49.75	12	1	0.92	
9	Saloni	Khairagarh	Rajnandgaon	21.3833	81.0667	310.1	228.62	26	0-8.00 Soil 8-76.4 Chandi Fm76.4-200 Gunderdihi Fm200-228.02 Charmuria Fm	13-13.4, 25.5-33	7.67	7	61.53	
10	Bundeli	Chhuikhadan	Rajnandgaon	21.5833	81.1083	316	61.42	50.75	0.0-61.42 Chandi Fm	24.5-25,45.8-48,49-61.42	4.65	18	396	2.5X10 ⁻⁵
11	Bundeli OW	Chhuikhadan	Rajnandgaon	21.5833	81.1083	316	60	25.15	Chandi Fm	24-25,31-35	4.35	2.68		
12	Bundeli OW	Chhuikhadan	Rajnandgaon	21.5833	81.1083	316	56.75	50.75	Chandi Fm	24.5-25,45.8-56.75				
13	Chhuikhadan	Chhuikhadan	Rajnandgaon	21.525	80.9917	342.8	167.77	19.6	0-114.5 Chilpi Fm 114.5-167.77 Bijli Rhyolite	19.5,63-67,99.4-100,109-112,114-114.5	2.98	7	63.28	
14	Gandai	Chhuikhadan	Rajnandgaon	21.6639	81.0917	328.6	32.1	0-18 - 7"BP 18-24.5 - 6"SP	0-12 Soil & Weathered zone,12-32 Boulder pieces of S.st, chert, phyllite 32-32.1 Lime	12--24,32.1	8.31	7	922.9	

									stone					
15	Piparia	Khairagarh	Rajnandgaon	21.45	80.9667	327	190.58	26	0-67 Chanderpur Fm67-190.58 Chilipi Fm	23-24.50, 50.5,115.68-116, 140-140.5	7.78	2.5	15.1	
16	Tumdibod	Dongargaon	Rajnandgaon	21.0833	80.9042	308.9	228.52	6	Charmuria L.st,Chanderpur Fm &Granite	14.5,27,34	4.2	9.2	132.35	9X10 ⁻⁷
17	Tumdibod OW	Dongargaon	Rajnandgaon	21.0833	80.9042	308.9	106.9	8	Charmuria L.st,Chanderpur Fm &Granite	10.7,14.2-15.2,27.5-29.9	4.6			
18	Bijabhata	Dongargaon	Rajnandgaon	21.0333	80.8667	317.8	190.5	30.9	0-86 Chanrapur Fm86-190.5 Archaean	32-34,91-92.5,99-100	9.65	9.2	41.07	2.9X10 ⁻⁵
19	Bijabhata OW	Dongargaon	Rajnandgaon	21.0333	80.8667	317.8	129.72	25.5		14-16,40-41				
20	Rampur	Dongargaon	Rajnandgaon	21.0583	80.9708	308.9	304.52	8.25	0-4 Soil,4-24 Gunderdih Fm 24.0-241.0 Charmuria L.st 241.0-304.52 Chanderpur Fm	12,24,35	0.55	0.5	0.4	
21	Dundera	Dongargarh	Rajnandgaon	21.1167	80.8417	322	151	13.45	Bijali Rhyolite	33-34,80-83	3.32	3.5		
22	Badgaon Charbhata	Dongargaon	Rajnandgaon	20.9667	80.9333	306	46.12	31.2	Charmuria Limestone	25-26,33-36.5				
23	Rajnandgaon	Rajnandgaon	Rajnandgaon	21.0975	81.0543	305	158.12	10.4	Gunderdehi Shale	31-34,44-45	9.2	0.5	0.793	
24	Lalbahadur Nagar	Dongargarh	Rajnandgaon	21.0942	80.6844	355.9	149	24.04	Weathered granite	28-32,70-75	1.95	5.5		
25	Gendatola	Chhuriya	Rajnandgaon	20.9049	80.6493	343	150.81	16.45	Rhyolite	14-16,68.76, 99-102	1	4.55	6.80	
26	Ashra	Rajnandgaon	Rajnandgaon	21.1333	80.99	321.1	114.52	14.1	Andesite	14-19,34-38	35.86	1.5		
27	Badgaon Charbhata OW	Dongargaon	Rajnandgaon	20.9667	80.9333	306	46.2	23.14 blank pipe & 6.07 m slotted	Charmuria Limestone	28-30,34.5-37				
28	Bholapur	Rajnandgaon	Rajnandgaon	21.1333	80.99	321.1	137.32	16.15	Andesite &Granite	16-19 ,118-122	2.63	3.5	3.08	
29	Aliwara	Dongargarh	Rajnandgaon	21.1431	80.895	319.8	141.67	9.35	Limestone	14-16,129-133	8.07	4.55	46.13	
30	Mendha	Manpur	Rajnandgaon	20.3779	80.6683	372.1	150	24.02	Weathered Granite	24.5-26,113-115	3.32	1		

31	Bagtarai	Rajnandgaon	Rajnandgaon	21.1333	80.99	321.1	152.52	11.7	Gunderdehi Shale	13.5-13.7,33	14.38			
32	Atargaon	Ambagarh chowki	Rajnandgaon	20.7639	80.8125	333.6	151.2	14.78	Bijali Rhyolite	14-18,,70-72		0.47		
33	Ataria	Chhuikhadan	Rajnandgaon	21.6035	81.058	335.2	44.95	38.95	Charmuria Lst & Chandrapur SSt	20-44.95	-	10		
34	Keshritoal	Ambagarh chowki	Rajnandgaon	20.8083	80.8125	331	150.81	6.1	Bijali Rhyolite	16-18,		0.47		
35	Singarghat	Khairagarh	Rajnandgaon	21.4389	80.9333	329.3	151.2	13.6	Bijali Rhyolite	14-16,	-	0.47		
36	Chirchhari	Chhuriya	Rajnandgaon	21.0861	80.5847	392.1	141.1	10.54	Weathered Granite	22-30,75-75.5	3	1		
37	Mohala	Mohla	Rajnandgaon	20.5847	80.7486	402.3	132.8	13.72	Bijali Rhyolite	16-18,32	-	Negligible		
38	Majhipar	Mohla	Rajnandgaon	20.6222	80.725	414.1	114.25	14	Rhyolite	27-28.5, 31.5- 33, 40.5- 44	3.05	3.48		
39	Gotatola	Mohla	Rajnandgaon	20.5875	80.8778	395.8	137.1	35.99	Rhyolite	27-31, 121-125,127-130, 131-135	9.92	12.39		
40	Dhara	Dongargarh	Rajnandgaon	21.2528	80.8556	350.2	103.94	14.89	Granite	14.6-26.5,35	0.88	1.71		
41	Panbaras	Manpur	Rajnandgaon	20.4649	80.7451	365.2	128.2	26.98	Granite	14-16,30	128.2	0.47		
42	Ratanbhat	Chhuriya	Rajnandgaon	20.9181	80.9561	317.5	91.4	8.85	Granite	87-88	5.21	11.39		
43	Chhuria	Rajnandgaon	Rajnandgaon	21.1333	80.99	321.1	106.92	9.6	Granite	11-11.5,14-15,27-28,87-87.5	5.06	3.17		
44	Kumhli	Manpur	Rajnandgaon	20.5179	80.9517	425.8	101.2	23.17	Bijali Rhyolite	18-24,35-37, 72-79,92-93	0.86	12.39		
45	Boria Tibbu	Manpur	Rajnandgaon	20.4722	80.8875	383	114.4	14.58	Bijali Rhyolite	36-39.6-53 &83.6	-	0.63		
46	Boharanbheri	Ambagarh chowki	Rajnandgaon	20.8083	80.8125	331	126	9.8	Rhyolite	28.5-29.5,38		0.34		
47	Hiddar	Mohla	Rajnandgaon	20.6528	80.7264	406.5	89.6	13.16	Andesite	14-27,35	2.58	2.25		
48	Bortalao	Dongargarh	Rajnandgaon	21.2188	80.6346	406.8	109.68	15.76	Rhyolite	14-16,71-73	2.97	4.43		
49	Irragaon	Manpur	Rajnandgaon	20.3931	80.7952	336.2	100.54	18.28	Meta Rhyolite	25-36,60-69	9.1	12.39		
50	Bucha-Tola	Chhuriya	Rajnandgaon	20.9333	80.5875	364	140.92	10.5	Rhyolite	8.5-31,40	3.72	2.45	2.76	
51	Kaudikasa	Ambagarh chowki	Rajnandgaon	20.7167	80.7333	345	151	69.5	Fractured Rhyolite	21-23.5,35-36,99 &115	6.3	1.5		
52	Kaudikasa-II	Ambagarh chowki	Rajnandgaon	20.7167	80.7333	345	34.7	Abondond	Fractured Rhyolite	15-34,40	6	2		
53	Arajkund	Ambagarh chowki	Rajnandgaon	20.6811	80.7139	378.5	124.8	21.4	Bijali Rhyolite	22.4-25,32-32.5,61-62,74-75,	5.4	2.25		
54	Arajkund	Chhuriya	Rajnandgaon	20.9236	80.9389	330.4	118.82	20.32	Sandstone & Granite	14-16,95		0.5		

55	Bagnadi	Dongargarh	Rajnandgaon	21.0778	80.4561	349	99.55	10.73	Andesite	24-28,50.5-55	11	0.3		
56	Telitola	Ambagarh chowki	Rajnandgaon	20.8306	80.7611	334.1	137.1	36.6	Rhyolite	14-16, 60-65. 82-84	6.52	7.9		
57	Pinkapar	Chhuriya	Rajnandgaon	20.95	80.9583	309	151.4	19.4	Charmuria Formation	23-27,46-50	4	1		
58	Somatola	Mohla	Rajnandgaon	20.6583	80.8403	404.2	123.6	10.64	Basalt	14-16,	-	0.23		
59	Somni	Rajnandgaon	Rajnandgaon	21.123	81.1457	309.8	152.52	10.1	Gunderdehi Shale	14-17,98-99	7.2	2.1		
60	Kaneri	Mohla	Rajnandgaon	20.5111	80.725	384.4	141.67	26.6	Granite	23-32,85.5-90	2.86	1.29		
61	Surgi	Rajnandgaon	Rajnandgaon	21.0304	81.1074	304	152.52	16.5	Gunderdehi Shale	14-19,85.12	17.4	1		
62	Accholi	Dongargarh	Rajnandgaon	21.1951	80.7885	343.4	131.51	24.4	Weathered and fractured granite	24-28	1.04	1.9		
63	Rangkathera	Mohla	Rajnandgaon	20.5822	80.8181	378.7	141.67	24.23	Granite	27-32,64-68	6.34	1.57		
64	Manpur	Manpur	Rajnandgaon	20.375	80.7333	369	132.53	10.36	Granite	14-16,30	-	0.27		
65	Gaulitola	Ambagarh chowki	Rajnandgaon	20.7458	80.7333	336.2	153	16.3	Fractured Rhyolite	20-21,35	4	1.5		
66	Khujjy	Dongargaon	Rajnandgaon	20.95	80.9	310	150	16.5	Fractured Sandstone	25-26,42.5	4.58	3.5		
67	Gidarri	Chhuriya	Rajnandgaon	20.9	80.9	329	145	10.55	Fractured Rhyolite	18-18.5,33.7-34.2, 40-41, 84-85	5	5		
68	Kolhiapuri	Dongargarh	Rajnandgaon	21.0781	80.8072	343.3	153	11.8	Fractured Rhyolite	12--19,25	7	1		
69	Vicharpur	Dongargaon	Rajnandgaon	21.057	80.765	339.6	153	12.85	Fractured andesite	12.5-17.1	10.8	1.5		
70	Vicharpur	Dongargaon	Rajnandgaon	21.0605	80.7659	338.2	76.7	10.3	Fractured andesite	14.5-15.4, 20-21.5, 22.5-23.5	11.81	1.5		
71	Sansoitola	Ambagarh chowki	Rajnandgaon	20.7915	80.7021	356.1	153	15	Granite	16-17,30	12	1.5		
72	Bhansula	Ambagarh chowki	Rajnandgaon	20.775	80.7833	332	150	12.2	Massive Rhyolite	10-11,27-27.5,30	35	0.4		
73	Salik Jhitia	Dongargaon	Rajnandgaon	21.0278	80.9111	307.6	42.5	16.5	Cavernous	12.5-16,35	5	4.5		
74	Karipath	Dongargarh	Rajnandgaon	21.1639	80.7358	350.3	145	12.9	W/ Fractured Granite	12.9-15.5, 26.5-27.7,28-28.2,49-49.2	2.64	1.75		
75	Mahod	Chhuriya	Rajnandgaon	20.95	80.8244	317.3	84.3	63.5	Weathered Rhyolite	14-16,30-57	6	4.3		
76	Jadutola	Ambagarh chowki	Rajnandgaon	20.85	80.7167	351	150	19.75	Fractured Rhyolite	19-20,30	3	1		
77	Kaudikasa-III	Ambagarh chowki	Rajnandgaon	20.7167	80.7333	345	150	69.75	Fractured Rhyolite	16-18, 90	6	1.5		
78	Pinkapar	Chhuriya	Rajnandgaon	21.0456	80.6352	346.6	153	26.72	Weathered Granite	15-24.5,40	3.54	3.1		

79	Sonesarar	Dongargaon	Rajnandgaon	21.0083	80.9556	304.3	153	12.35	Cavernous Limestone	15-16,40	6	0.5		
80	Bandhabazar	Ambagarh chowki	Rajnandgaon	20.8083	80.8125	331	153	11.2	Fractured Rhyolite	18-20, 34-36,	10	1.5		
81	Bihari Khurd - I	Ambagarh chowki	Rajnandgaon	20.7533	80.7402	334.7	48.5	38.5	Andesite	14-18.42.5-45	12	4.55		
82	Bihari Khurd - II	Ambagarh chowki	Rajnandgaon	20.7534	80.7402	334.8	51.5	48	Andesite	14-18.44.5-45	12.5	1.6		
83	Bihari Khurd - III	Ambagarh chowki	Rajnandgaon	20.7534	80.7402	334.8	150.9	38.58	Andesite	14-20,32	15	Dry		
84	Bihari Kala - III	Ambagarh chowki	Rajnandgaon	20.7492	80.7496	335.5	137	69.5	Rhyolite	14-16,135-135.5	8	6.3		
85	Bihari Kala - II	Ambagarh chowki	Rajnandgaon	20.7493	80.7497	335.4	70	40	Rhyolite	14-16,58	7.5	0.15		
86	Bihari Kala - I	Ambagarh chowki	Rajnandgaon	20.7492	80.7498	335.2	40	23.62	Rhyolite	14-16,32-34	7	0.82		
87	Murethitola	Ambagarh chowki	Rajnandgaon	20.7042	80.7436	354.7	40	21.2	Andesite	23.7-24.5, 40	3	1.57		
88	Mandirpara Bhagwantola - I	Ambagarh chowki	Rajnandgaon	20.6996	80.7263	360	61.7	23.1	pyroxene	20-25, 35	15	0.35		
89	Mandirpara Bhagwantola - II	Ambagarh chowki	Rajnandgaon	20.6996	80.7263	360	69.3	47	pyroxene	14-16,51.5	15	0.78		
90	Mandirpara Bhagwantola - III	Ambagarh chowki	Rajnandgaon	20.6996	80.7262	360.5	152.9	62.1	pyroxene	18-20, 62.1-152.9	15	Seepage		
91	Ghotiya (EW)	Khairagarh	Rajnandgaon	21.3236	80.9647	345.6	201	13	Laterite	20-22,30	9	1		
92	Tolagaon east (EW)	Khairagarh	Rajnandgaon	21.3164	80.9406	345.1	200	14	Limestone	12-15,43-79	12.2	0.2		
93	Tolagaon west	Khairagarh	Rajnandgaon	21.3164	80.9406	345.1	201	15	Limestone	13-18,35	12	2.6		
94	Bhatgaon	Rajnandgaon	Rajnandgaon	21.2883	81.0689	311.6	202	12	Limestone	17-19,86-89,116-119,150-153	5.11	6.2		
95	Padumtara	Rajnandgaon	Rajnandgaon	21.1947	81.0428	317.2	204.1	6	Limestone	30.20-33.30,137-140	11.91	1		
96	Bhatgaon	Rajnandgaon	Rajnandgaon	21.2883	81.0689	311.6	202	12	Limestone	17-19,86-89,116-119,150-152	6.2	3		
97	Singhola	Rajnandgaon	Rajnandgaon	21.0347	81.0333	301.1	204.1	12	Shale	14-18,79-82,	4.01	0.1		
98	Padumtara	Rajnandgaon	Rajnandgaon	21.1947	81.0428	317.2	204.1	12.5	Limestone	11-13,36.30-39.40,69.90-79	8.99	2.3		
99	Baghera	Rajnandgaon	Rajnandgaon	21.1981	81.1305	325.2	204.1	18.5	Limestone	12-15,63-66,118-121,127-133,	17.59	3.96		

100	Baghera	Rajnandgaon	Rajnandgaon	21.1984	81.1303	325.3	204.1	18.5	Limestone	12-15,66-69,127-130,	20.58	1.98		
101	Matwari	Rajnandgaon	Rajnandgaon	21.3058	81.0408	310.9	202	6	Limestone	22-25,35	19.55	negligeable		
102	Ataria	Chhuikhadan	Rajnandgaon	21.6036	81.058	335	144	21.7	Limestone	33.3-39.4, 137-140	13.4	0.731		
103	Ataria	Chhuikhadan	Rajnandgaon	21.6036	81.058	335	39.4	21.7	Limestone	20-23,30	abandoned			
104	Aweli	Khairagarh	Rajnandgaon	21.367	81.084	306.4	200	20.7	Limestone	20-24,36		Dry		
105	Bicharpur nawagaon	Dongargaon	Rajnandgaon	21.0605	80.7657	338.6	200	17	Andesite	14-19,40		Dry		
106	Udaypur	Chhuikhadan	Rajnandgaon	21.5204	81.0899	320.5	200	14.5	Limestone	88.20-91.3	24.5	0.078		
107	Sankra OW	Khairagarh	Rajnandgaon	21.4207	80.8844	340	69.9	17.7	Pegmatites, Quartz Vein	24.20-27.20, 66.9-69.9	3.8	2.49		
108	Sankra	Khairagarh	Rajnandgaon	21.4207	80.8844	340	11	18.3	Basic Volcanics	14-16,25	abandoned			
109	Sankra EW	Khairagarh	Rajnandgaon	21.4207	80.8844	340	200	17.7	Pegmatites, Quartz Vein	24.20-27.20, 66.9-69.9	3.8	2.49		
110	Dhandongri EW	Dongargarh	Rajnandgaon	21.129448	80.64117	366.1	200	27.5	Granite	22-25,42.7-50.32, 57.94-62.56, 93.04-96.04	12.55	5.9		
111	Dhandongri OW	Dongargarh	Rajnandgaon	21.129448	80.64117	366.1	78	18	Granite	22-25,45.7-50.32, 60-62.56, 94.04-96.04	10.28	4		
112	Dhara	Dongargarh	Rajnandgaon	21.2523	80.8557	350.9	200	20	Granite	12.22-16.84, 32.08-35.08, 164.62-169.24, 179.86-184.84	3.3	1.3	13.903	
113	Arjuni	Dongargaon	Rajnandgaon	21.0308	80.9147	309.8	200	10.5	Limestone	14-16,158.4-161.4	34.9	0.078		
114	Pawantara	Khairagarh	Rajnandgaon	21.3634	81.1451	307.2	200	35	Limestone	39.40-42.50, 121.80-124.8	10.35	0.731		
115	Dongargarh	Dongargarh	Rajnandgaon	21.194	80.7749	347.7	200	6.05	Granite	47.32-50.32	12.15	0.078		
116	Musra EW	Dongargarh	Rajnandgaon	21.1641	80.8673	327.2	123.52	11.5	Granite	32.08-35.08, 57.94-65.56, 70.18-73.18	12.38	4.5		
117	Musra OW	Dongargarh	Rajnandgaon	21.1641	80.8673	327.2	54.94	11.5	Granite	32.08-35.08, 57.94-65.56,70.18-73.18	12.38	4.5		
118	Indamara EW	Rajnandgaon	Rajnandgaon	21.1038	80.9533	322.1	200	7.85	Shale	19-22,57.94-62.56, 187.48-192.1	34.04	2.15		
119	Indamara OW	Rajnandgaon	Rajnandgaon	21.1038	80.9533	322.1	192	7.85	Shale	17-21,57.94-62.56, 187.48-192.1	34.04	2.15		
120	Bohrampur khurd	Khairagarh	Rajnandgaon	21.4321	80.9161	342.5	200	6.08	Rhyolite and Tuff	22-25	25	Dry		
121	Pendrikala	Khairagarh	Rajnandgaon	21.3734	80.9823	327.1	190	14.2	Limestone and Shale	79.1-82.2	12.47	0.078		
122	Dundera	Dongargarh	Rajnandgaon	21.1198	80.8341	331.5	103.96	10	Andesite	9.22-12.22,30	9	1.48	13.002	

123	Banhardi	Dongargaon	Rajnandgaon	21.0659	80.9468	315.1	118.7	9	Limestone	57.7-60.8, 115.7-118.7	10.32	1.2		
124	Phuljhar	Rajnandgaon	Rajnandgaon	21.1646	81.1596	306.9	200	11	Shale	14-16,32		Dry		
125	Somni	Rajnandgaon	Rajnandgaon	21.1234	81.1454	309.6	200	7.85	Shale	24.36-27.36, 54.84-57.84	17.83	0.731		
126	Khairagarh	Khairagarh	Rajnandgaon	21.4193	80.9791	318	27.2	9.7	Limestone	22.46,50	30.8			
127	Khairagarh EW	Khairagarh	Rajnandgaon	21.4193	80.9791	318	124	9.7	Limestone	45.5-48.6, 57.7-60.8, 85.2-88.2	6.26	6.18		
128	Khairagarh OW	Khairagarh	Rajnandgaon	21.4193	80.9791	318	100.4	8.5	Limestone	45.5-48.6, 57.7-60.8, 85.2-88.2	6.26	6.18		
129	Surgi	Rajnandgaon	Rajnandgaon	21.03	81.1076	307.1	200	12	Shale and Limestone	24.36-27.36,45		Dry		
130	Manikpur	Dongargarh	Rajnandgaon	21.1212	80.7259	343.4	200	9.22	Granite	42.7-50.32, 57.94-62.56, 93.04-96.04				
131	Manki	Rajnandgaon	Rajnandgaon	21.1066	81.0936	299.7	200	6.05	Shale	6.6-9.22, 88.42-93.04,176.86-179.86	10.23	0.441		
132	Medha	Dongargarh	Rajnandgaon	21.1162	80.7775	338	169.54	9	Granite	27.46-30.8, 50.32-54.94, 62.56-65.56	10.7	4.92		
133	Bicharpur nawagaon	Dongargarh	Rajnandgaon	21.050735	80.764174	343.7	200	17	Granite	14-19,41		Dry		

Annexure 4 Special Study 2005-15

Location	Source	As Conc. in mg/l (2005-06)	As Conc. in mg/l (215-16)
Joratarai-3	HP	0.108	0.095
Kaudikasa-7	HP	0.169	0.09
Kaudikasa	DW	0.058	0.071
Kaudikasa	HP	0.009	0.053
Sonsai Tola-6	HP	0.105	0.053
Sonsai Tola-4	BW	NS	0.05
Sonsai Tola-5	BW	0.018	0.04
Kodu Tola-2	BW	NS	0.022
Meregaon-2	HP	0.026	0.021
Jadu Tola-2	HP	0.033	0.017
Bharri Tola-2	HP	0.007	0.01

Annexure 5 Special Study 2015-16

S. No.	Location	Block	District	Lat	Log	Date of collection	Source	As in ppm
	Hathikanhar	Ambagarh Chowki	Rajnandgaon	20.776	80.721	13/10/2015	Hand Pump	bdl
A2	Hathikanhar	Ambagarh Chowki	Rajnandgaon	20.782	80.717	13/10/2015	Hand Pump	bdl
A3	Hathikanhar	Ambagarh Chowki	Rajnandgaon	20.781	80.717	13/10/2015	Power Pump	bdl
A4	Kekti Tola	Ambagarh Chowki	Rajnandgaon	20.790	80.717	13/10/2015	Hand Pump	bdl
A5	Kekti Tola	Ambagarh Chowki	Rajnandgaon	20.790	80.717	13/10/2015	Power Pump	bdl
A6	Sonsai Tola-1	Ambagarh Chowki	Rajnandgaon	20.789	80.703	13/10/2015	Power Pump	0.003
A7	Sonsai Tola-2	Ambagarh Chowki	Rajnandgaon	20.793	80.702	13/10/2015	Hand Pump	0.009
A8	Sonsai Tola-3	Ambagarh Chowki	Rajnandgaon	20.794	80.700	13/10/2015	Arsenic Filter	bdl
A9	Sonsai Tola-4	Ambagarh Chowki	Rajnandgaon	20.794	80.700	13/10/2015	Power Pump	0.05
A10	Sonsai Tola-5	Ambagarh Chowki	Rajnandgaon	20.797	80.699	13/10/2015	Power Pump	0.04
A11	Kodu Tola-1	Ambagarh Chowki	Rajnandgaon	20.800	80.689	13/10/2015	Hand Pump	0.002
A12	Kodu Tola-2	Ambagarh Chowki	Rajnandgaon	20.806	80.692	13/10/2015	Power Pump	0.022
A13	Chikli	Ambagarh Chowki	Rajnandgaon	20.816	80.704	13/10/2015	Hand Pump	bdl
A14	Hodi Tola	Ambagarh Chowki	Rajnandgaon	20.825	80.695	13/10/2015	Hand Pump	bdl
A15	Manga Tola	Ambagarh Chowki	Rajnandgaon	20.813	80.679	13/10/2015	Hand Pump	bdl
A16	Manga Tola	Ambagarh Chowki	Rajnandgaon	20.814	80.677	13/10/2015	Power Pump	bdl
A17	Ama Tola	Ambagarh Chowki	Rajnandgaon	20.828	80.669	13/10/2015	Power Pump	bdl
A18	Handi Tola	Ambagarh Chowki	Rajnandgaon	20.821	80.659	13/10/2015	Power Pump	bdl
A19	Kahadkasa	Ambagarh Chowki	Rajnandgaon	20.827	80.656	13/10/2015	Hand Pump	bdl
A20	Singha Bhedi	Ambagarh Chowki	Rajnandgaon	20.842	80.657	13/10/2015	Hand Pump	bdl
A21	Raja Tola	Ambagarh Chowki	Rajnandgaon	20.841	80.671	13/10/2015	Hand Pump	bdl
A22	Renu Tola	Ambagarh Chowki	Rajnandgaon	20.856	80.671	13/10/2015	Hand Pump	bdl
A23	Khora Tola	Ambagarh Chowki	Rajnandgaon	20.865	80.668	13/10/2015	Hand Pump	bdl
A24	Manjhi Tola	Ambagarh Chowki	Rajnandgaon	20.856	80.694	13/10/2015	Hand Pump	0.006
A25	Bitai	Ambagarh Chowki	Rajnandgaon	20.840	80.693	13/10/2015	Hand Pump	bdl
A26	Jadu Tola-1	Ambagarh Chowki	Rajnandgaon	20.852	80.711	13/10/2015	Hand Pump	bdl
A27	Jadu Tola-2	Ambagarh Chowki	Rajnandgaon	20.852	80.713	13/10/2015	Hand Pump	0.017
A28	Thaili Tola	Ambagarh Chowki	Rajnandgaon	20.849	80.720	13/10/2015	Hand Pump	bdl
A29	Joratarai-1	Ambagarh Chowki	Rajnandgaon	20.848	80.735	13/10/2015	Hand Pump	bdl
A30	Joratarai-2	Ambagarh Chowki	Rajnandgaon	20.845	80.736	13/10/2015	Hand Pump	0.008
A31	Joratarai-3	Ambagarh Chowki	Rajnandgaon	20.845	80.734	13/10/2015	Hand Pump	0.095
A32	Shikari Tola	Ambagarh Chowki	Rajnandgaon	20.845	80.713	13/10/2015	Hand Pump	bdl
A33	Ragho Tola	Ambagarh Chowki	Rajnandgaon	20.840	80.712	13/10/2015	Hand Pump	bdl

A34	Toyagondi	Ambagarh Chowki	Rajnandgaon	20.832	80.711	13/10/2015	Hand Pump	bdl
A35	Dhadhu Tola	Ambagarh Chowki	Rajnandgaon	20.834	80.728	13/10/2015	Hand Pump	bdl
A36	Gunderdehi	Ambagarh Chowki	Rajnandgaon	20.841	80.755	13/10/2015	Hand Pump	bdl
A37	Kilargondi	Ambagarh Chowki	Rajnandgaon	20.838	80.769	13/10/2015	Power Pump	bdl
A38	Brahman Bhedi	Ambagarh Chowki	Rajnandgaon	20.829	80.774	13/10/2015	Hand Pump	bdl
A39	Teli Tola	Ambagarh Chowki	Rajnandgaon	20.828	80.762	13/10/2015	Hand Pump	bdl
A40	Teli Tola	Ambagarh Chowki	Rajnandgaon	20.828	80.762	13/10/2015	Hand Pump	bdl
A41	Kotra	Ambagarh Chowki	Rajnandgaon	20.830	80.744	13/10/2015	Hand Pump	bdl
A42	Maldongri	Ambagarh Chowki	Rajnandgaon	20.805	80.735	14/10/2015	Hand Pump	bdl
A43	Bharri Tola-1	Ambagarh Chowki	Rajnandgaon	20.812	80.718	14/10/2015	Hand Pump	bdl
A44	Khursipar	Ambagarh Chowki	Rajnandgaon	20.813	80.719	14/10/2015	Hand Pump	bdl
A45	Jantargundra	Ambagarh Chowki	Rajnandgaon	20.857	80.654	14/10/2015	Hand Pump	bdl
A46	Singha Bhedi	Ambagarh Chowki	Rajnandgaon	20.850	80.642	14/10/2015	Hand Pump	bdl
A47	Singha Bhedi	Ambagarh Chowki	Rajnandgaon	20.853	80.635	14/10/2015	Nala	bdl
A48	Jarha Tola	Ambagarh Chowki	Rajnandgaon	20.851	80.624	14/10/2015	Hand Pump	bdl
A49	Renga Kathera	Ambagarh Chowki	Rajnandgaon	20.841	80.621	14/10/2015	Hand Pump	bdl
A50	Renga Kathera	Ambagarh Chowki	Rajnandgaon	20.833	80.621	14/10/2015	Hand Pump	bdl
A51	Hajju Tola	Ambagarh Chowki	Rajnandgaon	20.826	80.621	14/10/2015	Hand Pump	bdl
A52	Tirpemeta	Ambagarh Chowki	Rajnandgaon	20.827	80.592	14/10/2015	Hand Pump	bdl
A53	Latakodo	Ambagarh Chowki	Rajnandgaon	20.837	80.589	14/10/2015	Power Pump	bdl
A54	Makke	Ambagarh Chowki	Rajnandgaon	20.832	80.579	14/10/2015	Hand Pump	bdl
A55	Tirpemeta	Ambagarh Chowki	Rajnandgaon	20.817	80.593	14/10/2015	Hand Pump	bdl
A56	Duwalgundra	Ambagarh Chowki	Rajnandgaon	20.812	80.600	14/10/2015	Hand Pump	bdl
A57	Halamkodo	Ambagarh Chowki	Rajnandgaon	20.813	80.622	14/10/2015	Hand Pump	bdl
A58	Halamkodo	Ambagarh Chowki	Rajnandgaon	20.808	80.628	14/10/2015	Hand Pump	bdl
A59	Edmagundi	Ambagarh Chowki	Rajnandgaon	20.807	80.647	14/10/2015	Hand Pump	bdl
A60	Dongargaon	Ambagarh Chowki	Rajnandgaon	20.824	80.643	14/10/2015	Hand Pump	bdl
A61	Sonsai Tola-6	Ambagarh Chowki	Rajnandgaon	20.793	80.700	14/10/2015	Hand Pump	0.053
A62	Sangli	Ambagarh Chowki	Rajnandgaon	20.812	80.762	14/10/2015	Power Pump	0.001
A63	Sangli	Ambagarh Chowki	Rajnandgaon	20.810	80.769	14/10/2015	Hand Pump	0.004
A64	Hitagunda	Ambagarh Chowki	Rajnandgaon	20.809	80.785	14/10/2015	Hand Pump	bdl
A65	Thuadabri	Ambagarh Chowki	Rajnandgaon	20.821	80.791	14/10/2015	Hand Pump	bdl
A66	Bharri Tola	Ambagarh Chowki	Rajnandgaon	20.825	80.804	14/10/2015	Hand Pump	bdl
A67	Chhachan Pahari	Ambagarh Chowki	Rajnandgaon	20.803	80.804	14/10/2015	Hand Pump	bdl
A68	Bahoran Bhedi	Ambagarh Chowki	Rajnandgaon	20.808	80.809	14/10/2015	Hand Pump	bdl
A69	Atara	Ambagarh Chowki	Rajnandgaon	20.827	80.819	14/10/2015	Hand Pump	bdl
A70	Bararmundi (Para)	Ambagarh Chowki	Rajnandgaon	20.839	80.802	14/10/2015	Hand Pump	bdl

A71	Bararmundi	Ambagarh Chowki	Rajnandgaon	20.837	80.811	14/10/2015	Hand Pump	bdl
A72	Dautola	Ambagarh Chowki	Rajnandgaon	20.849	80.815	14/10/2015	Hand Pump	bdl
A73	Dumarguncha	Ambagarh Chowki	Rajnandgaon	20.854	80.825	14/10/2015	Hand Pump	bdl
A74	Jheetu Tola	Ambagarh Chowki	Rajnandgaon	20.837	80.821	14/10/2015	Hand Pump	bdl
A75	Kanhe	Ambagarh Chowki	Rajnandgaon	20.771	80.734	15/10/2015	Hand Pump	bdl
A76	Dhanapayali	Ambagarh Chowki	Rajnandgaon	20.763	80.726	15/10/2015	Power Pump	bdl
A77	Hathikanhar	Ambagarh Chowki	Rajnandgaon	20.777	80.710	15/10/2015	Hand Pump	bdl
A78	Semharbandha	Ambagarh Chowki	Rajnandgaon	20.769	80.707	15/10/2015	Hand Pump	bdl
A79	Mogra Barrage	Ambagarh Chowki	Rajnandgaon	20.759	80.667	15/10/2015	Hand Pump	bdl
A80	Mogra	Ambagarh Chowki	Rajnandgaon	20.764	80.675	15/10/2015	Power Pump	bdl
A81	Munjal	Ambagarh Chowki	Rajnandgaon	20.787	80.661	15/10/2015	Hand Pump	bdl
A82	Jhitia	Ambagarh Chowki	Rajnandgaon	20.782	80.642	15/10/2015	Hand Pump	bdl
A83	Khadkhadi	Ambagarh Chowki	Rajnandgaon	20.771	80.631	15/10/2015	Hand Pump	bdl
A84	Chilhati	Ambagarh Chowki	Rajnandgaon	20.786	80.617	15/10/2015	Hand Pump	bdl
A85	Mohgaon	Ambagarh Chowki	Rajnandgaon	20.791	80.620	15/10/2015	Hand Pump	bdl
A86	Pandu Tola	Ambagarh Chowki	Rajnandgaon	20.793	80.609	15/10/2015	Hand Pump	bdl
A87	Singrai Tola	Ambagarh Chowki	Rajnandgaon	20.792	80.593	15/10/2015	Hand Pump	bdl
A88	Otabandha	Ambagarh Chowki	Rajnandgaon	20.783	80.584	15/10/2015	Hand Pump	bdl
A89	Pendalkuhi	Ambagarh Chowki	Rajnandgaon	20.793	80.569	15/10/2015	Hand Pump	bdl
A90	Kusumkasa	Ambagarh Chowki	Rajnandgaon	20.812	80.575	15/10/2015	Hand Pump	bdl
A91	Salhe Kusumkasa	Ambagarh Chowki	Rajnandgaon	20.816	80.567	15/10/2015	Hand Pump	bdl
A92	Nigenchuwa	Ambagarh Chowki	Rajnandgaon	20.781	80.568	15/10/2015	Hand Pump	bdl
A93	Karcha Tola	Ambagarh Chowki	Rajnandgaon	20.771	80.573	15/10/2015	Hand Pump	bdl
A94	Khursitikul	Ambagarh Chowki	Rajnandgaon	20.770	80.584	15/10/2015	Hand Pump	bdl
A95	Boga Tola	Ambagarh Chowki	Rajnandgaon	20.751	80.564	15/10/2015	Hand Pump	bdl
A96	Hemalkodo	Ambagarh Chowki	Rajnandgaon	20.746	80.572	15/10/2015	Hand Pump	bdl
A97	Dumarghucha	Ambagarh Chowki	Rajnandgaon	20.729	80.579	15/10/2015	Hand Pump	bdl
A98	Mudpar	Ambagarh Chowki	Rajnandgaon	20.732	80.592	15/10/2015	Hand Pump	bdl
A99	Tatekasa	Ambagarh Chowki	Rajnandgaon	20.690	80.600	15/10/2015	Hand Pump	0.002
A100	Keshal Dabri	Ambagarh Chowki	Rajnandgaon	20.683	80.603	15/10/2015	Hand Pump	bdl
A101	Pangri	Ambagarh Chowki	Rajnandgaon	20.684	80.623	15/10/2015	Hand Pump	bdl
A102	Khairi	Ambagarh Chowki	Rajnandgaon	20.697	80.613	15/10/2015	Hand Pump	bdl
A103	Thakur Bandha	Ambagarh Chowki	Rajnandgaon	20.724	80.601	15/10/2015	Hand Pump	bdl
A104	Bicharpur	Ambagarh Chowki	Rajnandgaon	20.734	80.605	15/10/2015	Hand Pump	bdl
A105	Salhe	Ambagarh Chowki	Rajnandgaon	20.743	80.606	15/10/2015	Hand Pump	0.001
A106	Mirche	Ambagarh Chowki	Rajnandgaon	20.760	80.613	15/10/2015	Hand Pump	0.002
A107	Marar Tola	Ambagarh Chowki	Rajnandgaon	20.772	80.612	15/10/2015	Hand Pump	bdl

A108	Dakko Tola	Ambagarh Chowki	Rajnandgaon	20.772	80.609	15/10/2015	Hand Pump	bdl
A109	Bhadsena	Ambagarh Chowki	Rajnandgaon	20.780	80.680	15/10/2015	Hand Pump	bdl
A110	Bhadsena	Ambagarh Chowki	Rajnandgaon	20.779	80.690	15/10/2015	Hand Pump	bdl
A111	Bihari Khurd	Ambagarh Chowki	Rajnandgaon	20.754	80.739	16/10/2015	Hand Pump	bdl
A112	Gauli Tola	Ambagarh Chowki	Rajnandgaon	20.747	80.729	16/10/2015	Hand Pump	bdl
A113	Pipar Khar	Ambagarh Chowki	Rajnandgaon	20.750	80.713	16/10/2015	Hand Pump	bdl
A114	Katulwahi	Ambagarh Chowki	Rajnandgaon	20.749	80.692	16/10/2015	Hand Pump	bdl
A115	Sansargarh	Ambagarh Chowki	Rajnandgaon	20.736	80.682	16/10/2015	Hand Pump	bdl
A116	Durre Tola	Ambagarh Chowki	Rajnandgaon	20.748	80.679	16/10/2015	Hand Pump	bdl
A117	Aamagarh	Ambagarh Chowki	Rajnandgaon	20.738	80.659	16/10/2015	Hand Pump	bdl
A118	Bhurbhsi	Ambagarh Chowki	Rajnandgaon	20.751	80.654	16/10/2015	Hand Pump	bdl
A119	Chamrutola	Ambagarh Chowki	Rajnandgaon	20.727	80.646	16/10/2015	Hand Pump	bdl
A120	Dodke	Ambagarh Chowki	Rajnandgaon	20.732	80.629	16/10/2015	Hand Pump	bdl
A121	Sonali	Ambagarh Chowki	Rajnandgaon	20.726	80.627	16/10/2015	Dugwell	bdl
A122	Sonali	Ambagarh Chowki	Rajnandgaon	20.725	80.628	16/10/2015	Hand Pump	bdl
A123	Belarpur	Ambagarh Chowki	Rajnandgaon	20.715	80.628	16/10/2015	Hand Pump	bdl
A124	Chorpani	Ambagarh Chowki	Rajnandgaon	20.717	80.653	16/10/2015	Hand Pump	bdl
A125	Kuturghoda	Ambagarh Chowki	Rajnandgaon	20.705	80.652	16/10/2015	Hand Pump	bdl
A126	Jade Tola	Ambagarh Chowki	Rajnandgaon	20.701	80.627	16/10/2015	Hand Pump	bdl
A127	Pandki	Ambagarh Chowki	Rajnandgaon	20.686	80.647	16/10/2015	Hand Pump	bdl
A128	Dev Wadvi	Ambagarh Chowki	Rajnandgaon	20.666	80.657	16/10/2015	Hand Pump	bdl
A129	Parremeta	Ambagarh Chowki	Rajnandgaon	20.661	80.646	16/10/2015	Hand Pump	bdl
A130	Pateli	Ambagarh Chowki	Rajnandgaon	20.666	80.673	16/10/2015	Hand Pump	bdl
A131	Pateli	Ambagarh Chowki	Rajnandgaon	20.679	80.678	16/10/2015	Hand Pump	bdl
A132	Tumadikasa	Ambagarh Chowki	Rajnandgaon	20.699	80.689	16/10/2015	Hand Pump	bdl
A133	Tumadikasa	Ambagarh Chowki	Rajnandgaon	20.699	80.688	16/10/2015	Hand Pump	bdl
A134	Bharri Tola-2	Ambagarh Chowki	Rajnandgaon	20.708	80.697	16/10/2015	Hand Pump	0.01
A135	Bharri Tola-3	Ambagarh Chowki	Rajnandgaon	20.710	80.701	16/10/2015	Hand Pump	0.004
A136	Bhandari Tola	Ambagarh Chowki	Rajnandgaon	20.706	80.688	16/10/2015	Hand Pump	bdl
A137	Kundera Tola-1	Ambagarh Chowki	Rajnandgaon	20.724	80.697	16/10/2015	Hand Pump	0.003
A138	Kundera Tola-2	Ambagarh Chowki	Rajnandgaon	20.723	80.695	16/10/2015	Hand Pump	0.001
A139	Harekhapayali	Ambagarh Chowki	Rajnandgaon	20.720	80.684	16/10/2015	Hand Pump	bdl
A140	Harekhapayali	Ambagarh Chowki	Rajnandgaon	20.718	80.682	16/10/2015	Hand Pump	bdl
A141	Kesla	Ambagarh Chowki	Rajnandgaon	20.801	80.767	16/10/2015	Hand Pump	bdl
A142	Sirrabhatha	Ambagarh Chowki	Rajnandgaon	20.791	80.764	16/10/2015	Hand Pump	0.001
A143	Boirdih	Ambagarh Chowki	Rajnandgaon	20.787	80.763	16/10/2015	Hand Pump	bdl
A144	Sirmunda	Ambagarh Chowki	Rajnandgaon	20.784	80.762	16/10/2015	Hand Pump	0.007

A145	Metepar	Ambagarh Chowki	Rajnandgaon	20.742	80.738	17/10/2015	Hand Pump	bdl
A146	Metepar	Ambagarh Chowki	Rajnandgaon	20.744	80.737	17/10/2015	Hand Pump	bdl
A147	Gauli Tola	Ambagarh Chowki	Rajnandgaon	20.748	80.731	17/10/2015	Hand Pump	0.001
A148	Pipar Khar	Ambagarh Chowki	Rajnandgaon	20.747	80.709	17/10/2015	Hand Pump	bdl
A149	Parsa Tola	Ambagarh Chowki	Rajnandgaon	20.739	80.706	17/10/2015	Hand Pump	bdl
A150	Parsa Tola	Ambagarh Chowki	Rajnandgaon	20.734	80.704	17/10/2015	Hand Pump	bdl
A151	Khursitikur-1	Ambagarh Chowki	Rajnandgaon	20.736	80.708	17/10/2015	Hand Pump	0.001
A152	Khursitikur-2	Ambagarh Chowki	Rajnandgaon	20.735	80.708	17/10/2015	Hand Pump	bdl
A153	Khursitikur-3	Ambagarh Chowki	Rajnandgaon	20.737	80.709	17/10/2015	Hand Pump	bdl
A154	Ghorda	Ambagarh Chowki	Rajnandgaon	20.736	80.721	17/10/2015	Hand Pump	bdl
A155	Nichekohda	Ambagarh Chowki	Rajnandgaon	20.724	80.714	17/10/2015	Hand Pump	bdl
A156	Nichekohda	Ambagarh Chowki	Rajnandgaon	20.722	80.715	17/10/2015	Hand Pump	bdl
A157	Ghorda	Ambagarh Chowki	Rajnandgaon	20.732	80.727	17/10/2015	Hand Pump	bdl
A158	Kaudikasa-1	Ambagarh Chowki	Rajnandgaon	20.725	80.729	17/10/2015	Hand Pump	bdl
A159	Kaudikasa-2	Ambagarh Chowki	Rajnandgaon	20.724	80.733	17/10/2015	Hand Pump	0.002
A160	Kaudikasa-3	Ambagarh Chowki	Rajnandgaon	20.721	80.735	17/10/2015	Hand Pump	0.001
A161	Kaudikasa-4	Ambagarh Chowki	Rajnandgaon	20.717	80.737	17/10/2015	Arsenic Filter	bdl
A162	Kaudikasa-5	Ambagarh Chowki	Rajnandgaon	20.724	80.736	17/10/2015	Power Pump	0.007
A163	Kaudikasa-6	Ambagarh Chowki	Rajnandgaon	20.718	80.736	17/10/2015	Pond water	0.008
A164	Kaudikasa-7	Ambagarh Chowki	Rajnandgaon	20.718	80.738	17/10/2015	Hand Pump	0.09
A165	Bhagwan Tola-1	Ambagarh Chowki	Rajnandgaon	20.712	80.725	17/10/2015	Hand Pump	0.001
A166	Arajkund	Ambagarh Chowki	Rajnandgaon	20.687	80.712	17/10/2015	Hand Pump	bdl
A167	Arajkund	Ambagarh Chowki	Rajnandgaon	20.683	80.712	17/10/2015	Power Pump	bdl
A168	Arajkund	Ambagarh Chowki	Rajnandgaon	20.682	80.713	17/10/2015	Hand Pump	bdl
A169	Netam Tola	Ambagarh Chowki	Rajnandgaon	20.677	80.700	17/10/2015	Hand Pump	0.001
A170	Pathra Tola	Ambagarh Chowki	Rajnandgaon	20.666	80.697	17/10/2015	Hand Pump	bdl
A171	Pathra Tola	Ambagarh Chowki	Rajnandgaon	20.664	80.696	17/10/2015	Hand Pump	bdl
A172	Bhagwan Tola-2	Ambagarh Chowki	Rajnandgaon	20.700	80.723	17/10/2015	Hand Pump	0.002
A173	Bhagwan Tola-3	Ambagarh Chowki	Rajnandgaon	20.698	80.726	17/10/2015	Hand Pump	0.003
A174	Belargondi	Ambagarh Chowki	Rajnandgaon	20.693	80.729	17/10/2015	Hand Pump	bdl
A175	Halami Tola	Ambagarh Chowki	Rajnandgaon	20.672	80.724	17/10/2015	Hand Pump	bdl
A176	Barcha Kutumb	Ambagarh Chowki	Rajnandgaon	20.698	80.751	17/10/2015	Hand Pump	0.002
A177	Mungeshi Tola	Ambagarh Chowki	Rajnandgaon	20.691	80.758	17/10/2015	Hand Pump	bdl
A178	Dharni	Ambagarh Chowki	Rajnandgaon	20.678	80.757	17/10/2015	Hand Pump	bdl
A179	Hitkasa	Ambagarh Chowki	Rajnandgaon	20.675	80.775	17/10/2015	Hand Pump	bdl
A180	Hitkasa	Ambagarh Chowki	Rajnandgaon	20.674	80.772	17/10/2015	Hand Pump	bdl
A181	Bodal	Mohla	Rajnandgaon	20.661	80.764	17/10/2015	Hand Pump	bdl

A182	Bodal	Mohla	Rajnandgaon	20.659	80.762	17/10/2015	Hand Pump	0.002
A183	Taram Tola	Ambagarh Chowki	Rajnandgaon	20.666	80.757	17/10/2015	Hand Pump	bdl
A184	Taram Tola	Ambagarh Chowki	Rajnandgaon	20.668	80.759	17/10/2015	Hand Pump	bdl
A185	Gotulmunda	Ambagarh Chowki	Rajnandgaon	20.680	80.752	17/10/2015	Hand Pump	bdl
A186	Dewarsur	Ambagarh Chowki	Rajnandgaon	20.690	80.747	17/10/2015	Hand Pump	bdl
A187	Dewarsur	Ambagarh Chowki	Rajnandgaon	20.693	80.746	17/10/2015	Hand Pump	bdl
A188	Muleti Tola	Ambagarh Chowki	Rajnandgaon	20.706	80.741	17/10/2015	Hand Pump	0.002
A189	Muleti Tola	Ambagarh Chowki	Rajnandgaon	20.706	80.745	17/10/2015	Hand Pump	bdl
A190	Barcha Kutumb	Ambagarh Chowki	Rajnandgaon	20.705	80.747	17/10/2015	Hand Pump	bdl
A191	Muleti Tola	Ambagarh Chowki	Rajnandgaon	20.707	80.745	17/10/2015	Hand Pump	bdl
A192	Muleti Tola	Ambagarh Chowki	Rajnandgaon	20.706	80.745	17/10/2015	Hand Pump	bdl
A193	kalkasa	Ambagarh Chowki	Rajnandgaon	20.710	80.758	17/10/2015	Hand Pump	bdl
A194	Chhote Kalkasa	Ambagarh Chowki	Rajnandgaon	20.718	80.757	17/10/2015	Hand Pump	bdl
A195	Boirdih	Ambagarh Chowki	Rajnandgaon	20.710	80.770	17/10/2015	Hand Pump	bdl
A196	Ghawre Tola	Ambagarh Chowki	Rajnandgaon	20.717	80.778	17/10/2015	Hand Pump	bdl
A197	Biharikala-1	Ambagarh Chowki	Rajnandgaon	20.753	80.746	18/10/2015	Hand Pump	bdl
A198	Biharikala-2	Ambagarh Chowki	Rajnandgaon	20.753	80.746	18/10/2015	Hand Pump	0.001
A199	Biharikala-3	Ambagarh Chowki	Rajnandgaon	20.751	80.747	18/10/2015	Hand Pump	0.003
A200	Bagmara	Ambagarh Chowki	Rajnandgaon	20.750	80.756	18/10/2015	Hand Pump	0.001
A201	Bagmara	Ambagarh Chowki	Rajnandgaon	20.749	80.761	18/10/2015	Hand Pump	0.001
A202	Pandritarai	Ambagarh Chowki	Rajnandgaon	20.739	80.745	18/10/2015	Hand Pump	0.001
A203	Pandritarai	Ambagarh Chowki	Rajnandgaon	20.735	80.745	18/10/2015	Hand Pump	bdl
A204	Pandritarai	Ambagarh Chowki	Rajnandgaon	20.736	80.745	18/10/2015	Hand Pump	bdl
A205	Kumhali	Ambagarh Chowki	Rajnandgaon	20.731	80.751	18/10/2015	Hand Pump	bdl
A206	Kumhali	Ambagarh Chowki	Rajnandgaon	20.730	80.757	18/10/2015	Nala	bdl
A207	Goplin Chuwa	Ambagarh Chowki	Rajnandgaon	20.725	80.765	18/10/2015	Hand Pump	bdl
A208	Goplin Chuwa	Ambagarh Chowki	Rajnandgaon	20.728	80.767	18/10/2015	Hand Pump	bdl
A209	Goplin Chuwa	Ambagarh Chowki	Rajnandgaon	20.727	80.769	18/10/2015	Hand Pump	bdl
A210	Adejhar	Ambagarh Chowki	Rajnandgaon	20.711	80.786	18/10/2015	Hand Pump	bdl
A211	Adejhar	Ambagarh Chowki	Rajnandgaon	20.705	80.789	18/10/2015	Hand Pump	bdl
A212	Karamtara	Ambagarh Chowki	Rajnandgaon	20.690	80.789	18/10/2015	Hand Pump	bdl
A213	Karamtara	Ambagarh Chowki	Rajnandgaon	20.692	80.789	18/10/2015	Hand Pump	bdl
A214	Ledijod	Ambagarh Chowki	Rajnandgaon	20.701	80.777	18/10/2015	Hand Pump	bdl
A215	Ledijod	Ambagarh Chowki	Rajnandgaon	20.699	80.778	18/10/2015	Hand Pump	bdl
A216	Khursitikur	Ambagarh Chowki	Rajnandgaon	20.703	80.795	18/10/2015	Hand Pump	bdl
A217	Butakasa	Ambagarh Chowki	Rajnandgaon	20.726	80.796	18/10/2015	Hand Pump	bdl
A218	Bhurbhshi	Ambagarh Chowki	Rajnandgaon	20.728	80.792	18/10/2015	Hand Pump	bdl

A219	Butakasa	Ambagarh Chowki	Rajnandgaon	20.729	80.800	18/10/2015	Hand Pump	bdl
A220	Huche Tola	Dondi Lohara	Balod	20.731	80.818	18/10/2015	Hand Pump	bdl
A221	Siralgarh	Ambagarh Chowki	Rajnandgaon	20.735	80.801	18/10/2015	Hand Pump	bdl
A222	Mohad	Ambagarh Chowki	Rajnandgaon	20.752	80.809	18/10/2015	Hand Pump	bdl
A223	Atargaon	Ambagarh Chowki	Rajnandgaon	20.762	80.805	18/10/2015	Hand Pump	bdl
A224	Atargaon	Ambagarh Chowki	Rajnandgaon	20.767	80.810	18/10/2015	Hand Pump	bdl
A225	Mahud Machandur	Ambagarh Chowki	Rajnandgaon	20.773	80.813	18/10/2015	Hand Pump	bdl
A226	Mahud	Ambagarh Chowki	Rajnandgaon	20.784	80.817	18/10/2015	Hand Pump	bdl
A227	Gorra Tola	Ambagarh Chowki	Rajnandgaon	20.779	80.802	18/10/2015	Hand Pump	bdl
A228	Bhansula	Ambagarh Chowki	Rajnandgaon	20.780	80.784	18/10/2015	Hand Pump	bdl
A229	Brahman Lanjhiya	Ambagarh Chowki	Rajnandgaon	20.794	80.782	18/10/2016	Hand Pump	bdl
A230	Thethwar Lanjhiya	Ambagarh Chowki	Rajnandgaon	20.792	80.791	18/10/2017	Hand Pump	bdl
A231	Bhansula	Ambagarh Chowki	Rajnandgaon	20.777	80.782	19/10/2019	Hand Pump	bdl
A232	Keshri Tola	Ambagarh Chowki	Rajnandgaon	20.760	80.780	19/10/2020	Hand Pump	bdl
A233	Pangri	Ambagarh Chowki	Rajnandgaon	20.766	80.767	19/10/2019	Hand Pump	0.002
A234	Dongaghat	Ambagarh Chowki	Rajnandgaon	20.766	80.756	19/10/2020	Hand Pump	bdl
A235	Ambagarh Chowki-1	Ambagarh Chowki	Rajnandgaon	20.773	80.746	19/10/2021	Hand Pump	0.001
A236	Ambagarh Chowki-2	Ambagarh Chowki	Rajnandgaon	20.772	80.741	19/10/2022	Hand Pump	bdl
A237	Ambagarh Chowki-3	Ambagarh Chowki	Rajnandgaon	20.782	80.747	19/10/2023	Hand Pump	0.001
A238	Meregaon-1	Ambagarh Chowki	Rajnandgaon	20.794	80.750	19/10/2024	Hand Pump	0.001
A239	Meregaon-2	Ambagarh Chowki	Rajnandgaon	20.794	80.750	19/10/2025	Hand Pump	0.021
A240	Kariya Tola	Rajnandgaon	Rajnandgaon	20.959	80.838	19/10/2015	Hand Pump	bdl
A241	Mohad	Rajnandgaon	Rajnandgaon	20.957	80.829	19/10/2015	Hand Pump	bdl
A242	Khursitikul	Chhuriya	Rajnandgaon	20.936	80.807	19/10/2015	Hand Pump	bdl
A243	Ocholi	Chhuriya	Rajnandgaon	20.927	80.799	19/10/2015	Hand Pump	bdl
A244	Aamgaon ka	Chhuriya	Rajnandgaon	20.916	80.789	19/10/2015	Hand Pump	bdl
A245	Nareti Tola	Chhuriya	Rajnandgaon	20.889	80.768	19/10/2015	Hand Pump	bdl
A246	Ghupsal	Chhuriya	Rajnandgaon	20.873	80.761	19/10/2015	Hand Pump	bdl

Annexure 6 RGI Special Study 9/1/2017

Name	Longitude	Latitude	Elevation (m)	May 2017(DWL in mbgl)	9/1/2017(DWL in mbgl)	12/1/2017 (DWL in mbgl)	1/1/2018 (DWL in mbgl)	As(ppb) Sep 17	As (ppb) May 17
Kaudikasa H.P(Hand Pump)	80.7356	20.7175	349	3.9	2.8	3.56	3	30.45	77.94

Murerthitola H.P	80.7408	20.7061	352	14.3	8.3	9.63	9.25	2.54	5.815
Bhagwantola primary School H.P.,Near Pond	80.7355	20.7175	369	5.75	3.35	3.38	5.12	0	2.121
Bhagwantola Peepal Chowk D.W(Dug Well)	80.7228	20.6994	360	1.8	1	1.36	1.21	0	0
Arajkund H.P	80.7119	20.7203	379	7.75	8.3	3.98	3.8	0	0
Kaudikasa Boy's Hostel D.W	80.7378	20.7183	360	2.5	1.3	1.48	1.45	34.95	202
Kaudikasa Girls' Hostel D.W	80.7352	20.7189	359	2.85	0.6	0.96	0.72	0.834	7.583
Nichekohra H.P	80.7136	20.7244	353	6.2	5.9	6.54	10.4	10	0
Gaulitola H.P	80.7247	20.7475	349	10.7	4.45	9.05	3.49	0	0
Parsatola H.P	80.6997	20.7433	349	4.65	3.3	3.45	4.09	0	0
Bihari Kala H.P	80.7467	20.7522	342	4	0.3	1	1.7	0	0
Sanghli H.P	80.7608	20.8117	345	6.5	4.6	4.6	5.1	0	0
Telitola H.P	80.7603	20.8286	344	12.5	3.5	3.65	5.2	0	20.66
Joratarai H.P	80.7339	20.8453	367	14.35	10.2	12.46	11.25	53.4	37.63
Jadutola H.P	80.713	20.8519	363	17	5.42	14.95	23.15	0	0.158
Manjhitola H.P	80.6953	20.8553	364	9.88	2.6	3.2	4.1	0.059	0
Meregaoan PHED office Bore Well	80.75	20.7944	360					26.89	24.91
Pangri H.P	80.7644	20.7644	301	11.48	7.2	4.62	7.35	0	19.25
Kesritola H.P	80.7794	20.7636	347	7.68	3.78	5.51	6.47	1.455	0.865
Atargoan H.P	80.7972	20.7692	355	12.6	6.1	11.08	7.25	0	0.512
Mohar H.P	80.8061	20.7522	355	5.38	1.85	2.52	3.3	0	0
Tetwarilanjiya (Diprapara) D.W	80.7903	20.7908	342	2.5	1.3	1.14	1.05	6.882	2.987
Hitaguta H.P	80.7847	20.8083	342	10.8	6.15	9.25	6.95	0	0
Wararmundi H.P	80.8094	20.8306	342	25.9	7.6	4.72	7.35	0	0
Seonath River Sample(Thudabdri)	80.7914	20.8339	335					0	0.865
Sansaitola H.P	80.6992	20.7933	359	11.1	8	7.88	6.83	1.61	24.2
Kodutola	80.6886	20.8003	352	7.1	4.3	5.81	6.65	7.34	23.85
Bharsena H.P	80.6922	20.7783	351	5	3.15	3.76	4.88	7.34	1.926
Bhirritola H.P	80.7175	20.8117	364	9.92	5.9	7.8	9.82	0	0
Dautola	80.815	20.8456	341	21.9	10.3	9.38	14.15	0.99	1.956
Atra H.P	80.82	20.8292	338	23.1	4.9	13.8	18.75	0	0
Boharanbheri H.P	80.8103	20.8114	342	1.5	1.7	1.72	2.4	0	0

Mahudmachandur H.P	80.8181	20.7836	337	6.55	4.6	5.7	6.5	0	0.865
Bhansula D.W	80.7736	20.7767	341	8	0.5	2.76	4.46	0	0
Dewarsur H.P	80.7461	20.6928	336	6.8	2.5	4.4	5.65	0	0
Netamtola D.W	80.7006	20.6747	373	6.6	2.45	3.28	4.8	0	0
Dewarvi H.P	80.6728	20.6658	389	8.9	7.45	7.7	8.6	0	0
Tumrikasa H.P	80.6894	20.6989	354	11.8	5.1	8.76	7.15	0	0
Bharritola H.P	80.7003	20.7097	356	6.9	11.65	7.8	9.6	0.059	12.53
Kunderatola H.P	80.6967	20.7244	352	7.65	2.5	3.8	5.38	0	4.754
Ghorda D.W	80.72	20.7358	343	6.65	1.8	3.85	5.8	0	0
Pandritarai H.P	80.8464	20.7344	351	23.1	19.35	10.8	12.95	0	0
Bagnara H.P	80.7583	20.7494	344	14.5	7.5	5.21	8.04	0	0
Goplinchua D.W	80.7675	20.7286	357	9.1	3.5	5	6.24	0	0
Adhejhar H.P	80.7881	20.7108	361	8.4	1.2	1.52	2.33	0	0
Karamtara H.P	80.7894	20.7089	379	11	6.1	6.6	9.28	0	0
Hitkasa H.P	80.7722	20.6739	384	9.45	3.8	4.65	6.88	0	0
Taramtola H.P	80.7592	20.6678	395	9.35	3.82	5.3	6.58	59	0
Mungesitola H.P	80.7558	20.6894	384	15.8	10.9	12.18	12.55	0.99	0
Butakasa H.P	80.7994	20.7283	372	9.35	5.45	5	7.95	0	1.572
Dangarh Nala								0	2.633
Donghaghat H.P	80.7564	20.7658	343	7.2	3.75	4.3	4.45	0	0
Thalitola Irrigation Bore Well	80.7233	20.8486	365					0	
Sansaitola D.W Behind A.R Plant	80.7003	20.7953	365					7.192	
Sansaitola H. P inside pry. School	80.7	20.7611						15.72	
Mogra Ram chatta chowk H.P	80.7	20.7611						0	
Mogra Dam Water Sample	80.7	20.7611						0	
Ambagarh Chowki Arsenic Removal Plant (250ml)	80.7412	20.7792						0	
Ambagarh Chowki Arsenic Removal Plant (1 litre)	80.7412	20.7792						0	
Sansaitola A.R.P. Adjacent H.P	80.7	20.7611						28.13	

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