केन्द्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण
विभाग, जल शक्ति मंत्रालय

भारत सरकार

Central Ground Water Board

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

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

Khelri,Lapung,Silli, Rahe, Tamar and Sonahatu Blocks of Ranchi District JHARKHAND

मध्य पूर्वी क्षेत्र, पटना
Mid Eastern Region, Patna

भारत सरकार

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AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN OF KHELRI, LAPUNG, SILLI, RAHE, TAMAR AND SONAHATU BLOCKS OF RANCHI DISTRICT, JHARKHAND STATE

जलभृत नक्शें तथा भूजल प्रबंधन योजना

खलारी, लापुंग, सिल्ली, राहे, तमार और

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अक्टूबर ,2022

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REPORT ON AQUIFER MAPPING AND GROUND WATER MANAGEMENT PLAN OF KHALRI LAPUNG SILLI RAHE TAMAR AND SONAHATU BLOCKS OF RANCHI DISTRICT, JHARKHAND STATE, JHARKHAND, 2019-20

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AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN OF KHELARI, LAPUNG, SILLI, RAHE, TAMAR AND SONAHATU BLOCKS OF RANCHI DISTRICT, JHARKHAND STATE

1.0 INTRODUCTION

The vagaries of rainfall, inherent heterogeneity & unsustainable nature of hard rock aquifers, over exploitation of once copious aquifers, lack of regulation mechanism etc has a detrimental effect on ground water scenario of the Country in last decade or so. Thus, prompting the paradigm shift from "**Traditional Groundwater Development concept**" to "**Modern Groundwater Management concept**". Varied and diverse hydrogeological settings demand precise and comprehensive mapping of aquifers down to the optimum possible depth at appropriate scale to arrive at the robust and implementable ground water management plans. This leads to concept of Aquifer Mapping and Ground Water Management Plan. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers. The proposed management plans will provide the **"Road Map"** for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation.

During XII five year plan (2012-17) National Aquifer Mapping (NAQUIM) study was initiated by CGWB to carry out detailed hydrogeological investigation. The Aquifer Mapping programme has been continued till 2023 to cover whole country. The present study of Aquifer Maps And Ground Water Management Plan of Khelari, Lapung, Silli, Rahe, Tamar and Sonahatu Blocks of Ranchi District, Jharkhand State has been taken up during 2019-20 as a part of NAQUIM Programme. The aquifer maps and management plans will be shared with the administration of Ranchi district and other user agencies for its effective implementation.

1.1 Objective and Scope of the study:

The major objectives of aquifer mapping are

- Delineation of lateral and vertical disposition of aquifers and their characterization
- Quantification of ground water availability and assessment of its quality to formulate aquifer management plans to facilitate sustainable management of ground water resources at appropriate scales through participatory management approach with active involvement of stakeholders.

The 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:

a). Identifying the aquifer geometry

b). Aquifer characteristics and their yield potential

c). Quality of water occurring at various depths

d). Aquifer wise assessment of ground water resources

e). Preparation of aquifer maps and

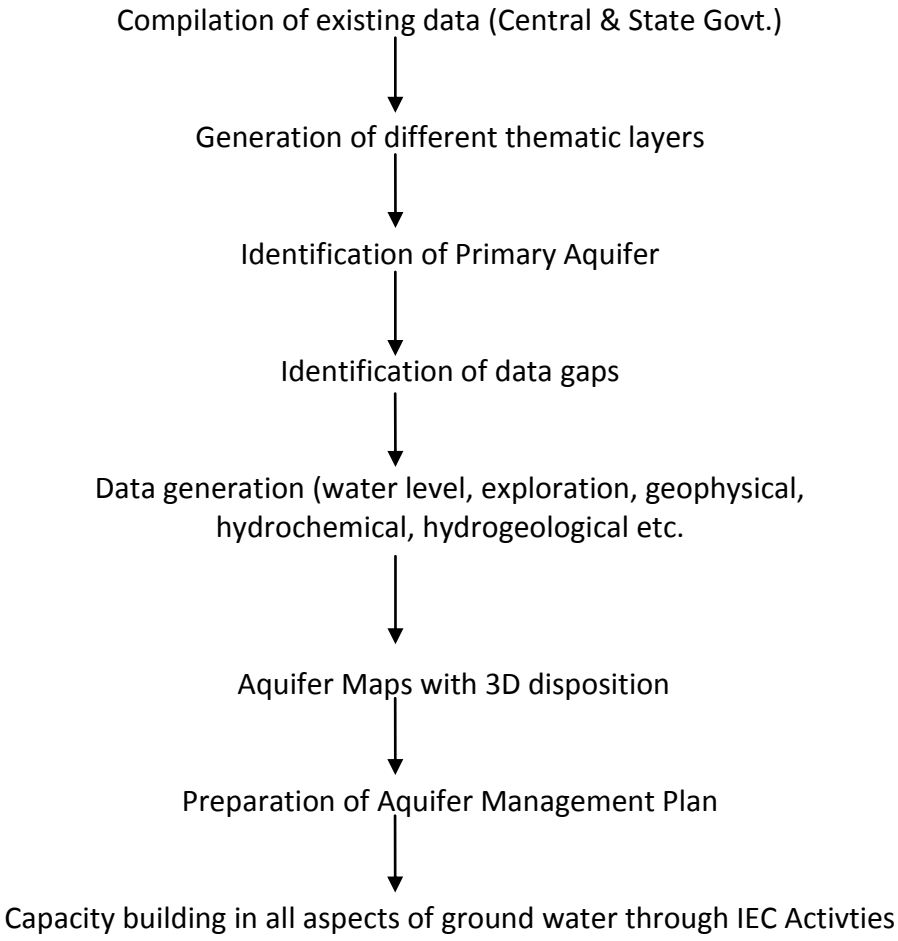
f). Formulate ground water management plan.

The demarcation of aquifers and their potential will help the agencies involved in water supply in ascertaining, how much volume of water is under their control. The robust and implementable ground water management plan will provide a **"Road Map"** to systematically manage the ground water resources for equitable distribution across the spectrum.

1.2. Approach and methodology:

The ongoing activities of NAQUIM include hydrogeological data acquisition supported by geophysical and hydro-chemical investigations supplemented with ground water exploration down to the depths of 200 meters

Considering the objectives of the NAQUIM, the data on various components was segregated, collected and brought on GIS platform by geo-referencing the available information for its utilization for preparation of various thematic maps. The approach and methodology followed for Aquifer mapping is as given below:



1.3 AREA DETAILS (Location, Extent and Accessibility) :

Ranchi is Capital City of Jharkhand. Ranchi district lies in the southern part of chotanagpur plateau of Jharkhand state. The district is bounded on the north by Ramgarh & Hazaribagh districts, on the south by Khunti & Saraikela Kharsawan, on the west by Gumla, Latehar & Lohardagga district and on the east by Saraikela Kharsawan and Purulia district of West Bengal. The district has total area of 4962 sq.km and is located between 22^0 52'- 23^0 45' North latitude to 84^0 45'- 85^0 50' East longitude. The area is included in Toposheet no. 73A, 73B, 73E and 73F. There is the presence of numerous large and small water falls in Ranchi district. The base map of Ranchi district is shown in figure 1 and asdministrative set is given in table 1.

Table – 1 Administrative set up of Ranchi District

S.No.	District Name	Geographical area (Sq. Km)	Gram Panchayats	Village	No. of Tehsil	Name of Tehsil
1.	Ranchi	4962	305	1420	18	Ranchi, Bundu, Bero, Burmu, Ormanjhi, Silli, Khalari, Lapung, Itki, Nagri, Kanke, Chanho, Mandar, Rahe, Sonahatu Angara, Ratu, and Tamar

1.4 DEMOGRAPHY:

The census report 2011 states that total population of Ranchi district has 2914253 whereas Male population is 1494937 and female population is 1419316. Based on the census - 2011 District wise population details are given in Table 2.

Table-2 Ranchi population details

Sl. No.	**District**	**Male**	**Female**	**Population Growth**	**Population Density/km2**	**Total**
1.	Ranchi	1494937	1419316	24%	572	2914253

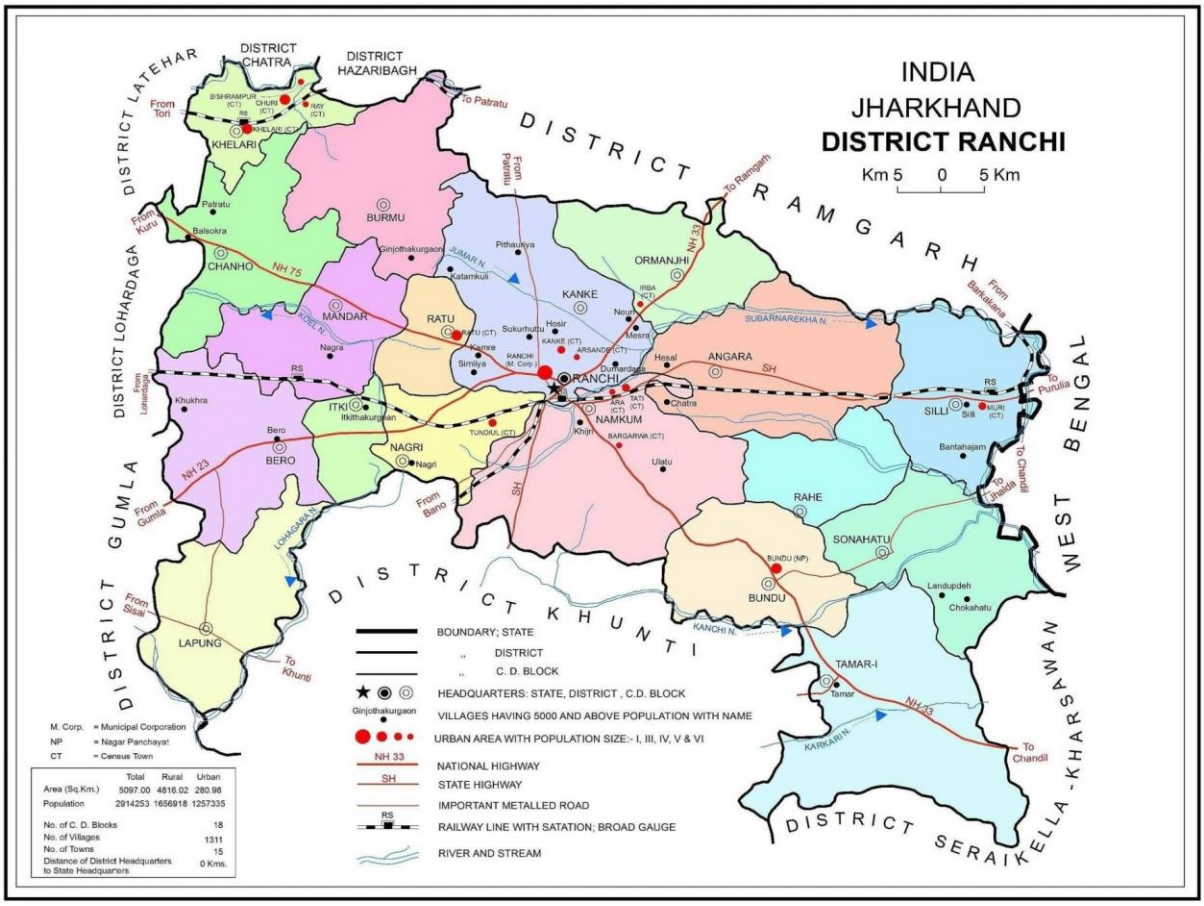


Fig.1 Base map of Ranchi district , Jharkhand

1.5 CLIMATE AND RAINFALL

The climate of the district is subtropical climate. The year can be divided in to three main seasons:

- Winter season from November to March
- Summer season is from March to May and
- Monsoon season from June to September

Ranchi district experiences subtropical climate, which is characterized by hot summer from March to May and well distributed rainfall during southwest monsoon from June to October. Winter season in the area is marked by dry and cold weather during the month of November to February. January is the coldest month with the mean daily maximum temperature at 22^0C and the mean daily minimum temperature at 7^0C. From February both day and night temperatures

increase rapidly till May which is the hottest month of the year with mean maximum temperature at 36^0 C.

The normal annual rainfall data indicate that average rainfall is 1394 mm. Maximum rainfall has been observed from June to October months. About 90% of the total annual rainfall is received in the monsoon period. During winter season it hardly records 10 cm rainfall. From the onset of the Monsoon by the middle of June, rainfall rapidly increases reaching the peak level in August and continued to till the September. The annual variation of rainfall is not much. The maximum precipitation occurs during July month.

1.6 GEOMORHOLOGY

Ranchi district is highly rugged topography with thick green forest all over the area. Major landforms which are situated in the district are as follows:-

Buried pediments- These are broad gently sloping erosional surface having detritus. Thickness of overburden is considerably high. Mandar, Itki and Ratu area comes in this segment.

Pediplain- These are developed over granite gneiss. Undulating erosional surface with interrupting dykes, ridges and inselbergs are prominent features. Bero locality is marked by these features.

Valley fills- These are developed over granite gneiss. It consists of boulders, cobbles, pebbles, gravels, sand, silt and clays. These features are developed in Parts of Nagri block.

Denudational hills-These features are developed in northernmost portion of the district covering parts of Burmu block. Moderate to low relief and steep slopes characterizes area.

Structural ridges— These features are developed over quartzite and having moderate relief and steep slope.

Laterite capping— These are developed over metamorphic rocks. Hard laterite cappings are formed on the highland. Its thickness is upto 50-60 metres. They are developed in Ratu and Nagri locality.

The northernmost and southernmost parts of the district are covered with hillocks and forests. Altitude of the area varies from 500m to 700m above mean sea level in general. There are many hillocks through the district having altitude 700m above mean sea level. The District is the part of Chotanagpur plateau. Geomorphological map of Ranchi district is shown in figure 2.

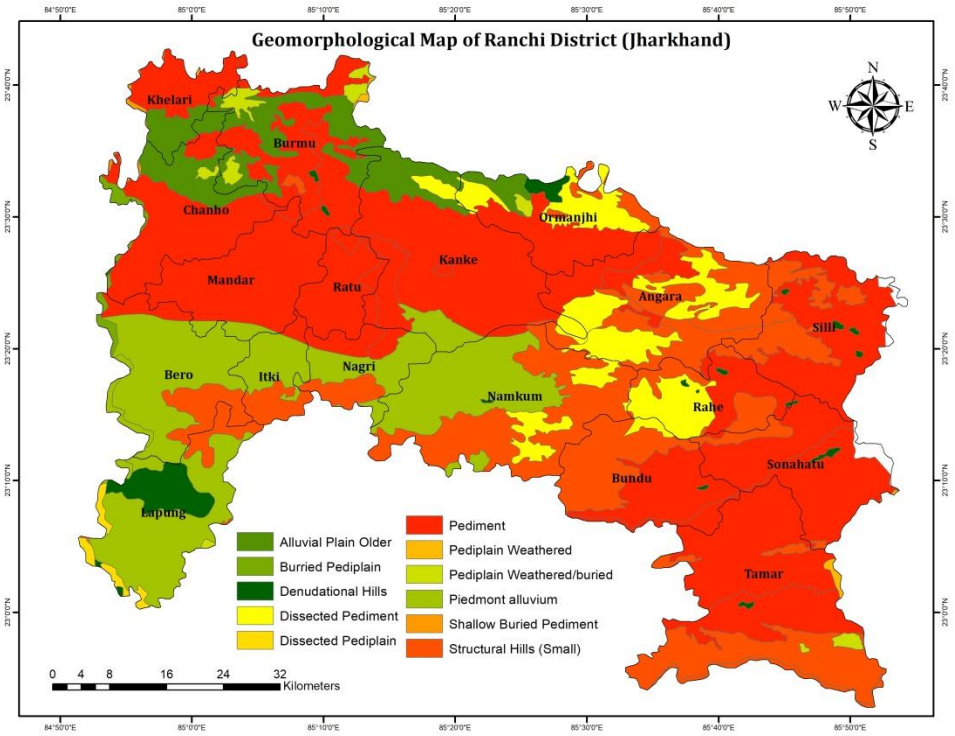


Fig.2 Geomorphological map of Ranchi district , Jharkhand

1.7 LAND USE

Ranchi district has a reported geographical area of 4962 square km, out of which only 48% is net sown area. The area under forest is 34% of total geographical area which includes reserved forests, demarcated protected forest, un-demarcated protected forest and unclassified forest.

The block wise Land Utilization potential for agriculture is tabulated below in table 3 and shown in figure 3:

Table 3 The block wise Land Utilization potential for agriculture(in Ha)

SI. No.	Name of Block	Total Geographical Area	Area under Agriculture				Area under Wasteland
			Gross Cropped Area (1)	Net Sown Area (2)	Area Sown more than once (1-2)	Cropping Intensity (%)	
1	Burmu	31698	19638	17718	1920	110.84	498.19
2	Khelari	13600	7024	5620	1404	124.98	396.72
3	Kanke	37706.8	19712	17817	1895	110.64	3069.01

4	Ormanjhi	22812	14775	12776	1999	115.65	895.73
5	Angara	44491	20718	19772	946	104.78	3183.96
6	Rahe	18042	11038	7279.36	3758.64	151.63	1114.57
7	Silli	32093	15721	14678	1043	107.11	1048.68
8	Sonahatu	27312	14776	12321	2455	119.93	3347.3
9	Namkum	49705	22710	19417	3293	116.96	3115.51
10	Ratu	10439	17876	13778	4098	129.74	1889.89
11	Nagri	12661	7714.33	5260.43	2453.9	146.65	6651.46
12	Mandar	23822	16607	14708	1899	112.91	970.85
13	Chanho	27285	11768	7745	4023	151.94	1604.26
14	Bero	29070	23333	22722	611	102.69	3500.51
15	Itki	9740.11	5929.53	4556.84	1372.69	130.12	472.19
16	Lapung	30083	13776	4044	9732	340.65	2387.33
17	Bundu	26418	14377	9466	4911	151.88	902.1
18	Tamar I	51353	16732	14632	2100	114.35	3107.33
Total		498330.9	274224.9	224310.6	49914.23	122.25	38155.59

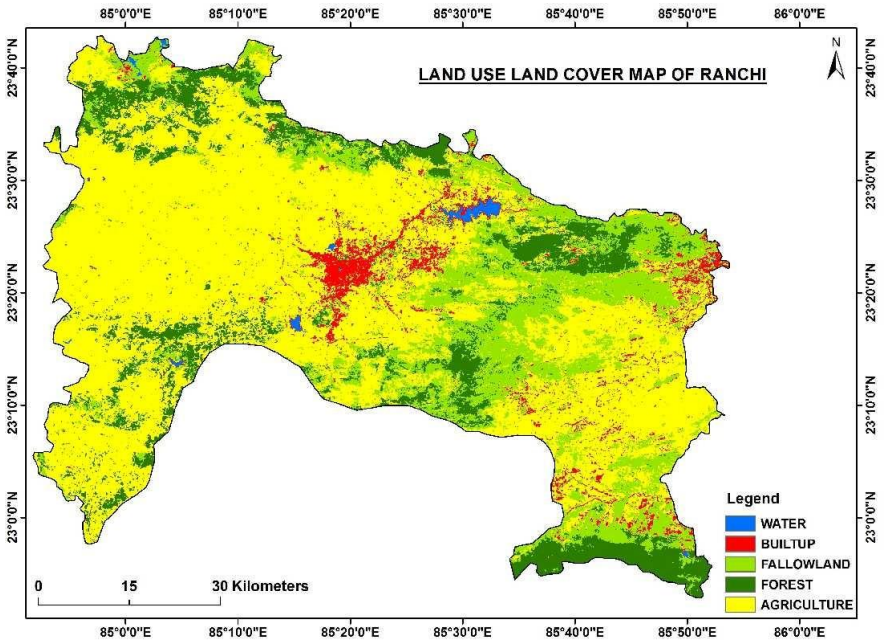


Fig.3 Land Use map of Ranchi, Jharkhand

1.8 SOIL

As per report of Department of Agriculture & Cane Development, Govt. of Jharkhand on assessment and mapping of some important soil parameters, three soil orders namely Entisols, Inceptisols and Alfisols were observed in Ranchi district. The soil of the region is shallow or medium in depth and the topography is undulating with a slope varying from 7% to 10%. The moisture content of the soil is low. The district has vast tracts of barren and fallow land constituting 12.16% of total geographical area which needs to be brought under cultivation. The hilly terrain also necessitates leveling of land for cultivation along with measures to check soil erosion. The soil map of Ranchi district is shown in figure 4. The soils of the district can broadly be grouped into three classes:-

Heavy Clays: This soil is locally known as Kewal Soil. This soil becomes hard when dry and sticky when wet. This soil can hold moisture for a longer period and as a result considered to be favorable for Rabi crops.

Sandy Soil: This soil is locally known as Balsundar and consists of course sand to a large extent and facilitates production of Paddy, Fruits and vegetables.

Loamy Soil: This soil is locally name as Dorasa and consists of sand and clay. This soil is suitable for growing sugarcane.

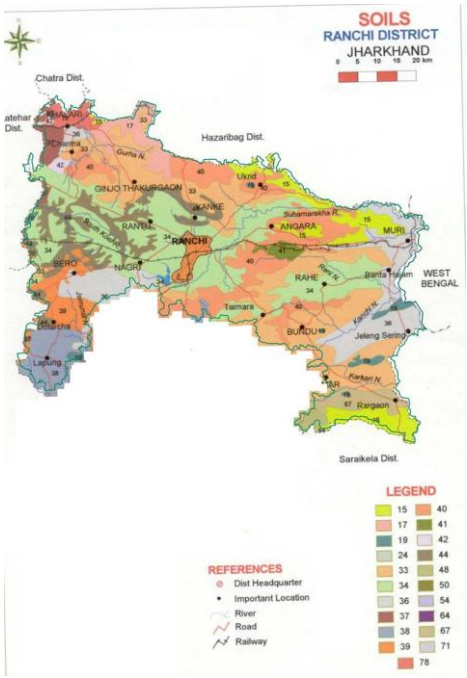


Fig. 4 Soil map of Ranchi district

1.9 HYDROLOGY & DRAINAGE

The study area is highly dissected by rivers of varying magnitude. The major water divides in the area runs upon north to south direction through Ratu and Lodhma. The area in the eastern part of the water divide is drained by Subarnrekha and the western part of the divide is drained by South Koel and Karo. The important river basins are the Subarnrekha, the South Koel, the Damodar and the Karkari. The Kanchi and Raru are the tributaries of river Subarnrekha. The South Koel originates from Piska near Ranchi. In the southern part of the area the drainage is mainly controlled by the Major rivers like Tajna, Banai, Chata and Karo. The hydrological condition of the area is governed by two major river basin/sub-basins of study area.

S. no.	Name of River Basin/Sub Basin
1.	Subernarekha River Basin
2.	South Koel River Basin

Subernarekha River Basin:

Subarnarekha River is also referred as the Swarnarekha River. After it originates from the Nagri/Piska near Ranchi, it traverses long distances via Ranchi district as well as East Singhbhum district. Further, it flows for short distance through Paschim Medinipur, West Bengal for 80 kms through Odisha Balasore district. From there, it flows for the next 75 kms and joins the Bay of Bengal near Talsari. The Subarnarekha Basin is extremely small amongst the multi-state basins. It covers a drainage area of 1.92 million hectares. The prime tributaries of this river include- Roro, Kharkai, Karakari, Singaduba, Damra, Dulunga, Kanchi, Gurma, Chinguru, Karru, Kodia, Khaijori and Garra.

South Koel River Basin:

It originates on the Ranchi plateau a few miles east of Ranchi. The Koel is fed by three streams in Jharkhand, namely the North Karo, South Karo and Koina.

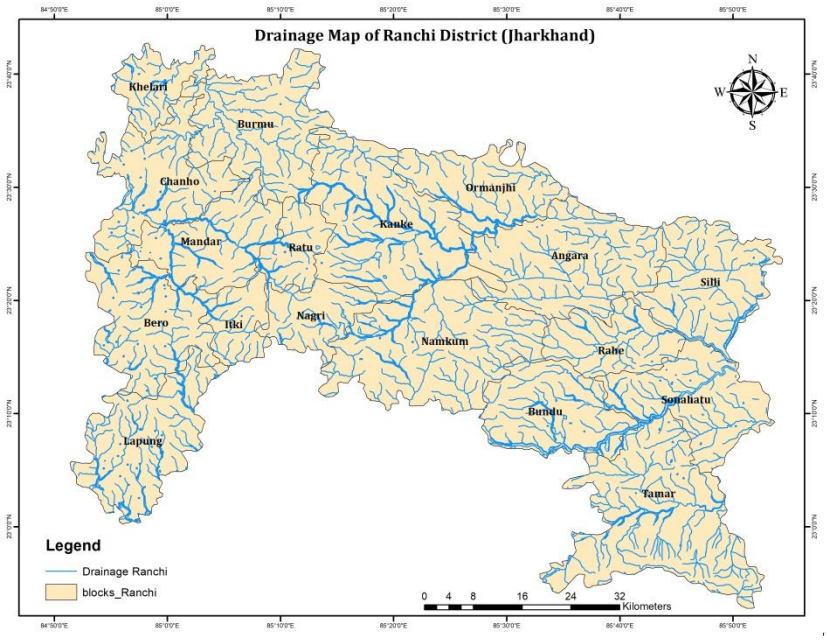


fig.5 Drainage map of the Ranchi district

1.10 IRRIGATION

The area has poorly developed irrigation facilities. According to the fifth minor irrigation census data total 338.59 ha is irrigated by minor irrigation schemes whereas 196.02ha is irrigated by ground water schemes and 142.57 ha is irrigated through surface water schemes. The details of total numbers of sources and area irrigated by different schemes are given in (Table 4)

Table 4 Details of irrigation sources

		Total Number of Sources						
		Ground Water			Surface Water			
Dug well	Shallow Tube well	Medium tube well	Deep Tube well	Total	S. Flow Scheme	S. Lift Scheme	Total	Grand Total
18985	462	155	51	19653	1587	454	2041	21694

1.11 CROPPING PATTERN

Agriculture is the main occupation of the people. Different growing season, varied soils and different climate conditions influence the cropping pattern. Principal Crops of the area are paddy, maize, pea, green gram, groundnut, urd, wheat, chickpea and arhar. The horticulture crops are cauliflower, cabbage, tomato, brinjal, lady finger, cucumber etc.

1.12 GEOLOGICAL SETUP

The area under study comprises mostly the rocks of Unclassified Metamorphics, Chhotanagpur Gneissic Complex, Dolerite dykes and Gondwana Super Group. The Unclassified Metamorphics Group belongs to Archaean to Palaeo Proterozoic in age. This group consists of hornblende schist, crystalline limestone and basic associates. These are enclaves of older meta-sedimentaries and meta-igneous rocks. The Chhotanagpur Gneissic Complex, which covers major part of the area, belongs to Archaean (?) Proterozoic age. It is represented by granite gneiss, migmatite, biotite gneiss, hornblende granite gneiss with enclaves of basic rocks. The Gondwana Group contains sandstone, shale, fire clay and coal of Karharbari Formation and sandstone, shale and coal of Barakar Formation.

The tentative geological succession of the area is given below:

Age	Group/Supergroup	Formation	Lithology
Quaternary/Recent		Alluvium	Sand, Silt and Clay
Early Permian Palaeocene	Gondwana Supergroup	Barakar Formation	Sandstone, shale with coal
		Karharbari Formation	Sandstone, shale, fire clays & coal
Late Carboniferous to Early Permian		Talchir Formation	Sandstone
Proterozoic	Intrusives		Dolerite dyke

Archean (?) to Proterozoic	Chotanagpur Granite Gneiss Complex		Granite gneiss, augen gneiss
Archean to Lower Proterozoic	Unclassified Metamorphics		Crystalline Limestone, Hornblende schist , Amphibolite

Tentative geological succession (Source: GSI)

The district is covered by major geological formations viz, the Precambrian crystallines, and the Gondwanas. Besides, the tertiary laterite and alluvium also cover part of the district. The Alluvium cover of considerable thickness occurs in the northern part and south western part of the district. Geological map of Ranchi district has been presented in Fig-7

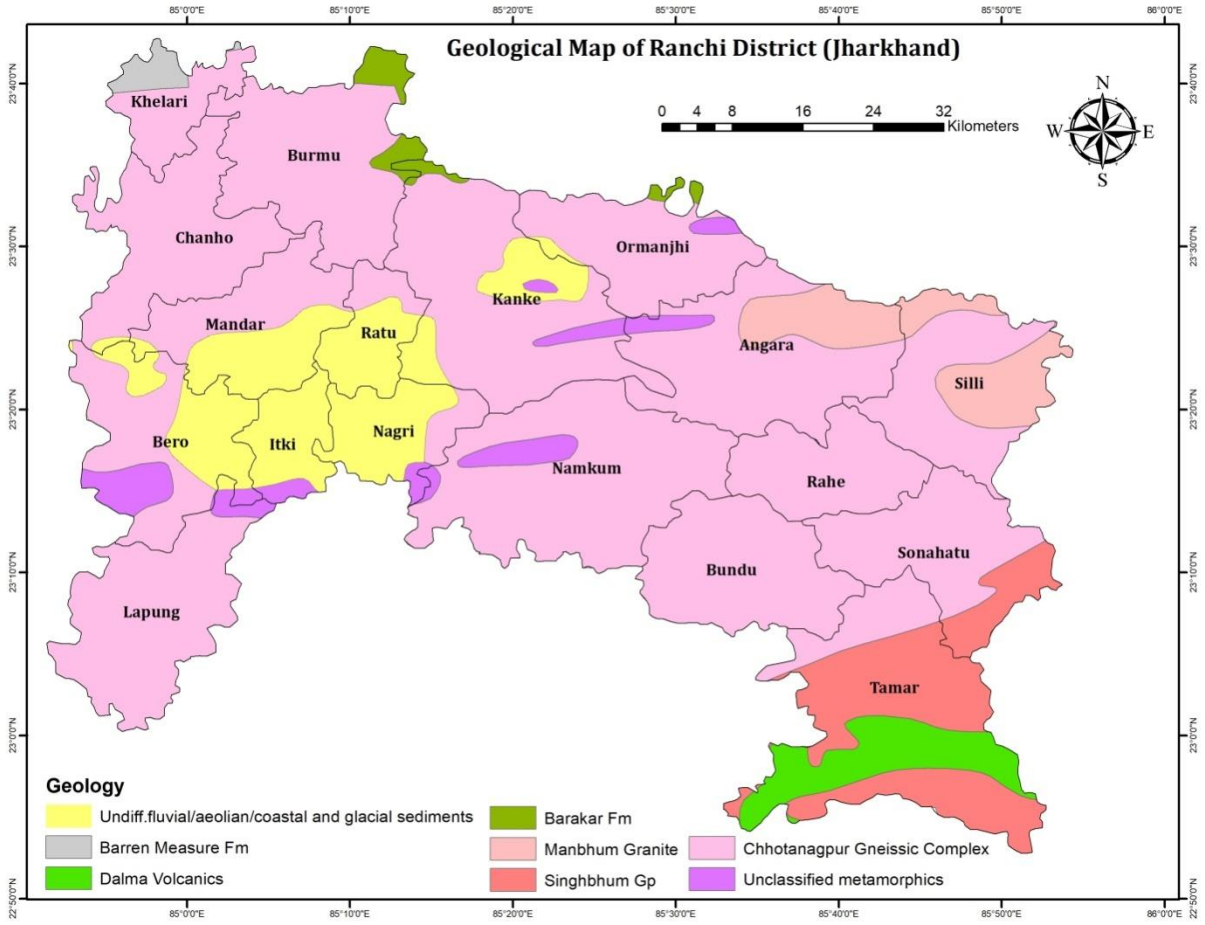


Fig: 6 Geological Map of Ranchi District (Jharkhand)

1.13 **Hydrogeology**;-

The occurrence and movement of ground water in the area is variable, which is broadly governed by geological frameworks i.e., nature of rock formations including their porosity (primary and secondary) and permeability. The principal aquifer in the area is Chhotanagpur Gnesiss Complex, where the occurrence and movement of ground water primarily depends on the degree of interconnection of secondary pores/voids developed by fracturing and weathering. Based on morpho-genetic, geological diversities and relative ground water potentialities of the aquifers, the district can be broadly divided into three Hydrogeological units: Consolidated or Fissured formations, semi-consolidated and unconsolidated or porous formations.

1. Consolidated or Fissured formations - Precambrians formation
2. Semi-Consolidated Formation-Gondwana Formation
2. Unconsolidated or Porous formations - Laterites and Alluvium

In major part of this district, hard rock form the principal aquifers, which includes mainly Chotanagpur gneissic complex, However, Gondwana formation of sand stone with coal at Khelari, laterites at isolated patches(In Ratu and Bero Blocks) as well as alluvium materials (like big patch of older alluvium in Mandar block extending from Brambay and murma areas and vicinity of rivers) also form potential aquifers.

Ground Water In Aquifer-I

Ground water occurs under phreatic/ unconfined to semi-confined conditions in Aquifer-I which is represented by weathered granite and Weathered Shale/Sandstone. Ground water occurs in unconfined state in shallow Aquifer-I tapped by alluvium, laterites, weathered granite and weathered Shale and Sandstone(Upto 30 m depth) , however in some cases depth varies from more than 30m. Yield of the wells in Aquifer-I ranges from 0.8 to 3 lps in this formation. Weathered zones of granites and gneisses are the most productive zone for ground water development in shallow aquifer. The depth of weathering varies from place to place, which influences the aquifer characteristics.

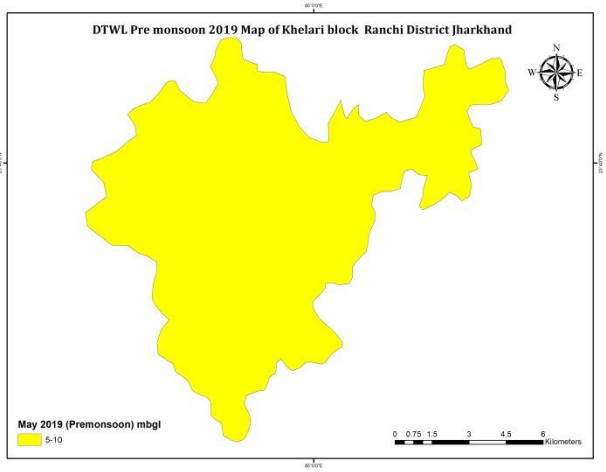
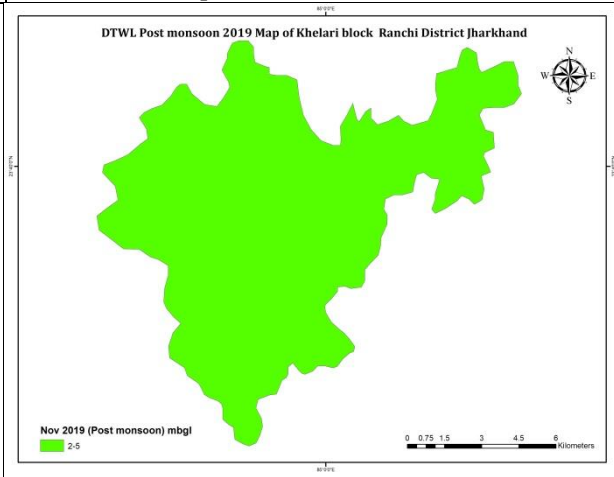
Ground Water In Aquifer-II

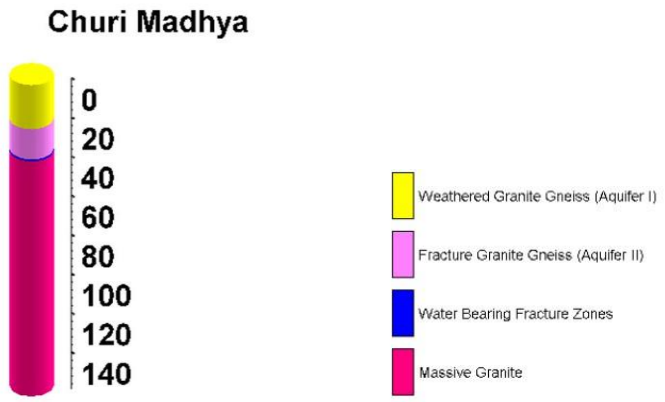
Ground water occurs under Semi-confined to confined condition in Aquifer-II represented by Fractured/Jointed granite-gneiss, Fractured Shale and Sandstones upto the depth of 200

mtr depth. Generally extent of Aquifer-II in Precambrian formation ranges from 30-120m. Granites and Gneisses are the most predominant rock types among all other rocks falling under the consolidated unit. Tectonic disturbances in granitic rocks are pronounced and fissures and joints etc are also well developed. These rocks are traversed by numerous veins of quartz and pegmatite. Fracture porosity plays an important role but with varying degree, in different parts of the area depending upon the pattern and intensity of joints and fractures. The potentiality and yielding property of these aquifers vary considerably. Bore wells can be constructed tapping the deep-seated fractures and joints. The semi-consolidated (Gondwana) formation occurs in Khalari block in the northern western part of the district. The rocks are mainly sandstones and shales belonging to the Barakar and Talchir formation. Barakar sandstones are coarse to medium grained, weathered in nature and may be a productive zone for ground water development.

2.0 BLOCK WISE AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS,

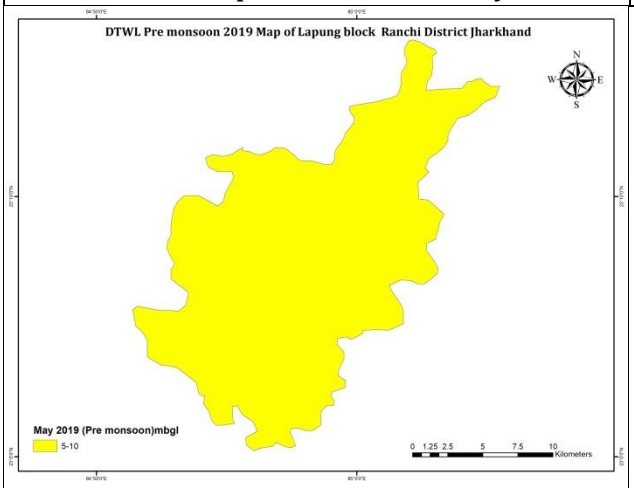
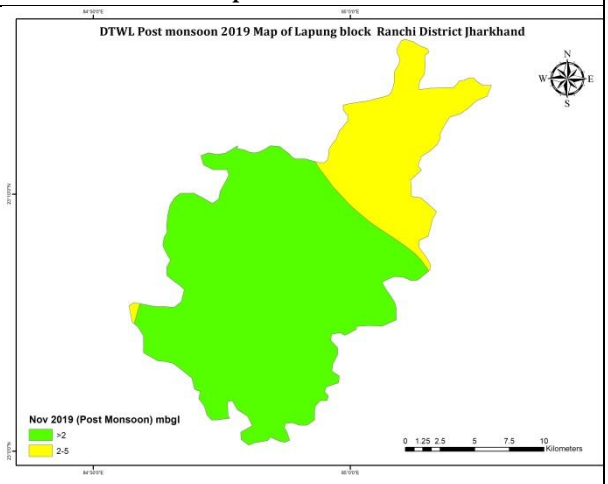
2.1 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, KHELARI BLOCK, RANCHI DISTRICT, JHARKHAND

1.SALIENT FEATURES	
• Block Name	khelari
• Geographical Area (Sq. km.)	130.34 sqkm
• Population (2011)	**78219**
• Rainfall Monsoon (mm) • Rainfall Annual (mm)	1568.70 1499.40
• Water level behavior Pre monsoon 2019	Water level behavior Post monsoon 2019
DTWL Map Pre-monsoon May 2019	DTWL Map Post-monsoon Nov 2019
	
2.0 AQUIFER DISPOSITION	
Major formation	Granite gneiss,
2.1 Numbers of aquifers	Aquifer – I- Weathered Granite gneiss, Aquifer – II- Fractured Granite-Gneiss
2.2 Number of EW constructed	01
2.3 Litholog:	



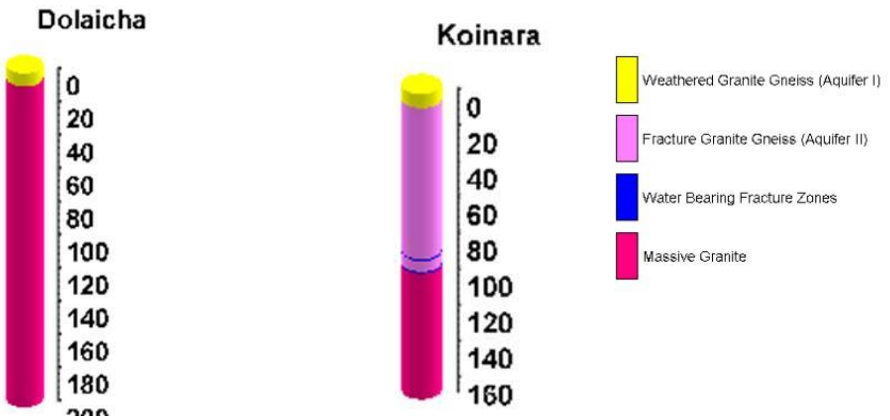
3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31st March 2020)	
Annual extractable ground water for recharge (ham)	966.66
Current annual ground water extraction for irrigation (ham)	74.625
Current annual ground water extraction for domestic (ham)	168.20
Current annual ground water extraction for industrial (ham)	500
Current annual ground water extraction for all uses (ham)	742.83
Net ground water availability for future use (ham)	222.66
Stage of ground water extraction (%)	76.84
Category	Semi-critical
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
Overall ground water quality of shallow aquifer (Aquifer – I) is potable and suitable for domestic purpose and irrigation purposes.	
3.3 Other issues	
3.3.1 Low ground water Potential/Sustainability:- Based on exploration and field studies there is issue of Low ground water Potential/Ground Water Sustainability in the area. Semi-critical block due to Industrial draft is more ie 500 ham	
4. SUPPLY SIDE MANAGEMENT	
4.1 Artificial recharge to ground Water: The identification of feasible areas for artificial recharge to ground water in Khalari block, Ranchi district has been carried out based on depth to water level (post-monsoon) and ground water level trend. The computation of unsaturated zone available, surface water requirement and source water availability for Artificial recharge and proposed numbers of different types of artificial recharge structures feasible in Khelari block, Ranchi district has been worked out. Based on the study 59 No of Nala Bund/Check Dam/Gully Plus and 09 No of Percolation tanks can be constructed. In addition, Roof Top rainwater harvesting system may also be installed in buildings. The implementation of water conservation through artificial recharge measures will have a positive impact on drinking water sources of the area.	
5. DEMAND SIDE MANAGEMENT	
The main demand side interventions may be: - i) Promote improved irrigation technologies (drip or sprinkler irrigation, etc.) ii) Crop choice management and diversification (promote less intensive crops)	

2.2 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, LAPUNG BLOCK, RANCHI DISTRICT, JHARKHAND

1.SALIENT FEATURES	
• Block Name	Lapung
• Geographical Area (Sq. km.)	300.86 sqkm
• Population (2011)	63053
• Rainfall Monsoon (mm) • Rainfall Annual (mm)	916.4 825.80
• Water level behavior Pre monsoon 2019	Water level behavior Post monsoon 2019
• DTWL Map Pre-monsoon May 2019	DTWL Map Post-monsoon Nov 2019
	

2.0 AQUIFER DISPOSITION	
Major formation	Granite gneiss,
2.1 Numbers of aquifers	Aquifer – I- Weathered Granite gneiss, Aquifer – II- Fractured Granite-Gneiss
2.2 Number of EW constructed	03
2.3 Aquifer Characterstics	T : 95.05 m2/day , S: 3.30x10-6, Q : 0.25-6 lps

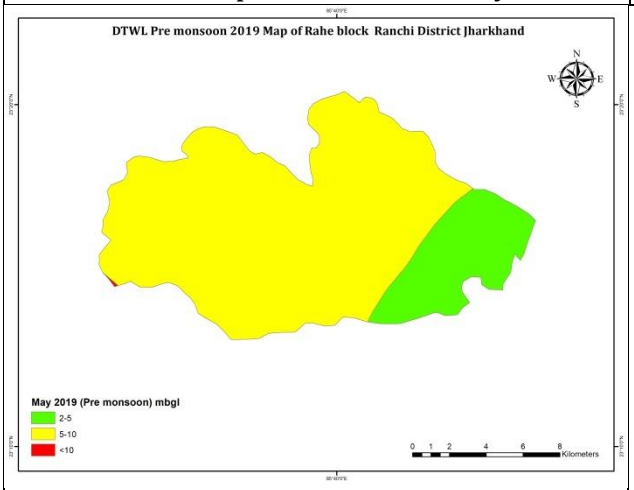
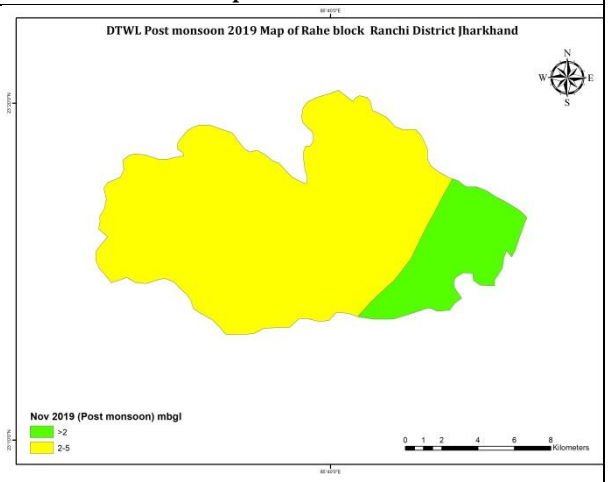
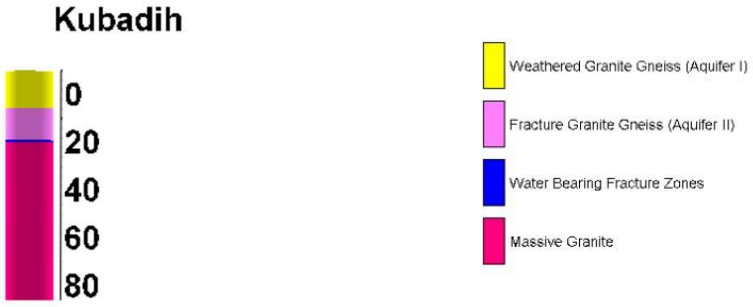
2.3Litholog:



3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31st March 2020)	
Annual extractable ground water for recharge (ham)	1995.92
Current annual ground water extraction for irrigation (ham)	630
Current annual ground water extraction for domestic (ham)	83.20
Current annual ground water extraction for industrial (ham)	0.00
Current annual ground water extraction for all uses (ham)	713.2
Net ground water availability for future use (ham)	1282.14
Stage of ground water extraction (%)	35.73
Category	safe
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
Overall ground water quality of shallow aquifer (Aquifer – I) is potable and suitable for domestic purpose and irrigation purposes.	
3.3 Other issues	
3.3.1 Low ground water development: Low ground water development is the one major issue of the block. Based on Ground water resource assessment as on 2020 stage of ground water development is only 35.73%. **3.3.2** Low ground water Potential/Sustainability:- Based on exploration and field studies there is issue of Low ground water Potential/Ground Water Sustainability in the area.	
4. SUPPLY SIDE MANAGEMENT	
4.1 Ground Water Development Strategies-Construction of Tube well/Bore well based on available safe resources: As per Dynamic Ground Water Resource estimation 2020, the stage of ground water development is only 35.73%. There is large scope of further Ground water Development. To enhance the ground water development, construction of 512 dug wells (10 -20 m depth; 2 to 4 m diameter) and 99 bore wells (up to 60-70 m) are proposed	
4.2 Artificial recharge to ground Water: The identification of feasible areas for artificial recharge to ground water in Lapung block, Ranchi district has been carried out based on depth to water level (post-monsoon) and ground water level trend. The computation of unsaturated zone available, surface water requirement and source water availability for Artificial recharge and proposed numbers of different types of artificial recharge structures feasible in Lapung block, Ranchi district has been worked out. Based on the study 83 No of Nala Bund/Check Dam/Gully Plus and 13 No of Percolation tanks can be constructed. In addition, Roof Top rainwater harvesting system may also be installed in buildings. The implementation of water conservation through artificial recharge measures will have a positive impact on drinking water sources of the area.	

5. DEMAND SIDE MANAGEMENT
The main demand side interventions may be: - i) Promote improved irrigation technologies (drip or sprinkler irrigation, etc.) ii) Crop choice management and diversification (promote less intensive crops)

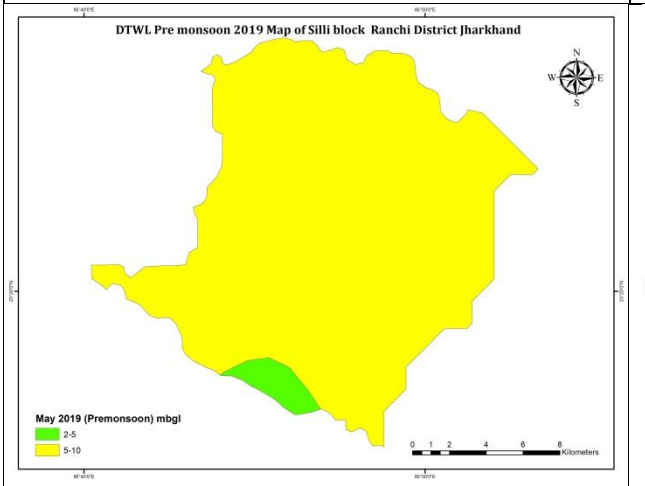
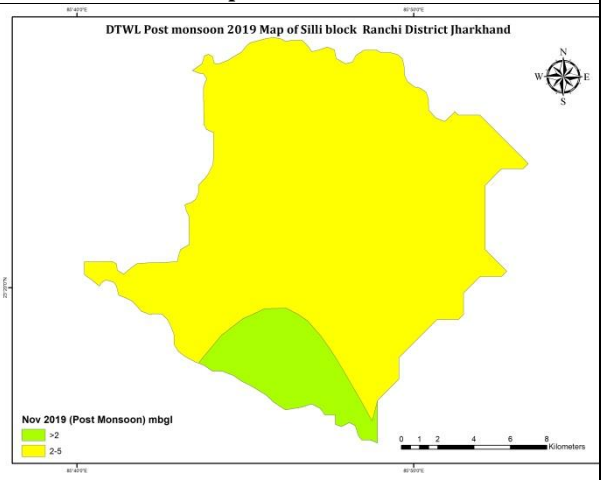
2.3 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, RAHE BLOCK, RANCHI DISTRICT, JHARKHAND

1.SALIENT FEATURES	
• Block Name	Rahe
• Geographical Area (Sq. km.)	179.05 sqkm
• Population (2011)	53916
• Rainfall Monsoon (mm) • Rainfall Annual (mm)	1307 1221
• Water level behavior Pre monsoon 2019	Water level behavior Post monsoon 2019
• DTWL Map Pre-monsoon May 2019	DTWL Map Post-monsoon Nov 2019
	
2.0 AQUIFER DISPOSITION	
Major formation	Granite gneiss,
2.1 Numbers of aquifers	Aquifer – I- Weathered Granite gneiss, Aquifer – II- Fractured Granite-Gneiss
2.2 Number of EW constructed	01
2.3 Aquifer Characterstics	Q : low yield
2.3Litholog: 	

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31st March 2020)	
Annual extractable ground water for recharge (ham)	944.74
Current annual ground water extraction for irrigation (ham)	94.875
Current annual ground water extraction for domestic (ham)	71.14653
Current annual ground water extraction for industrial (ham)	0.00
Current annual ground water extraction for all uses (ham)	166.0
Net ground water availability for future use (ham)	778.22
Stage of ground water extraction (%)	17.57
Category	safe
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
Overall ground water quality of shallow aquifer (Aquifer – I) is potable and suitable for domestic purpose and irrigation purposes.	
3.3 Other issues	
3.3.1 Low ground water development: Low ground water development is the one major issue of the block. Based on Ground water resource assessment as on 2020 stage of ground water development is only 17.57%. **3.3.2** Low ground water Potential/Sustainability:- Based on exploration and field studies there is issue of Low ground water Potential/Ground Water Sustainability in the area.	
4. SUPPLY SIDE MANAGEMENT	
4.1 Ground Water Development Strategies-Construction of Tube well/Bore well based on available safe resources: As per Dynamic Ground Water Resource estimation 2020, the stage of ground water development is only 17.57%. There is ample scope of further Ground water Development. To enhance the ground water development, construction of 311 dug wells (10 -20 m depth; 2 to 4 m diameter) and 60 bore wells (up to 60-70 m) are proposed	
4.2 Artificial recharge to ground Water: The identification of feasible areas for artificial recharge to ground water in Rahe block, Ranchi district has been carried out based on depth to water level (post-monsoon) and ground water level trend. The computation of unsaturated zone available, surface water requirement and source water availability for Artificial recharge and proposed numbers of different types of artificial recharge structures feasible in Lapung block, Ranchi district has been worked out. Based on the study 33 No of Nala Bund/Check Dam/Gully Plus and 05 No of Percolation tanks can be constructed. In addition, Roof Top rainwater harvesting system may also be installed in buildings. The implementation of water conservation through artificial recharge measures will have a positive impact on drinking water sources of the area.	
5. DEMAND SIDE MANAGEMENT	

The main demand side interventions may be: -
i) Promote improved irrigation technologies (drip or sprinkler irrigation, etc.)
ii) Crop choice management and diversification (promote less intensive crops)

2.4 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, SILLI BLOCK, RANCHI DISTRICT, JHARKHAND

1.SALIENT FEATURES	
• Block Name	SILLI
• Geographical Area (Sq. km.)	289.59 sqkm
• Population (2011)	113798
• Rainfall Monsoon (mm) • Rainfall Annual (mm)	1047 905
• Water level behavior Pre monsoon 2019	Water level behavior Post monsoon 2019
• DTWL Map Pre-monsoon May 2019	DTWL Map Post-monsoon Nov 2019
	
2.0 AQUIFER DISPOSITION	
Major formation	Granite gneiss,
2.1 Numbers of aquifers	Aquifer – I- Weathered Granite gneiss, Aquifer – II- Fractured Granite-Gneiss
2.2 Number of EW constructed	02
2.3 Aquifer Characterstics	Q : low yield

2.3Litholog:

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31st March 2020)	
Annual extractable ground water for recharge (ham)	2771.47
Current annual ground water extraction for irrigation (ham)	2465
Current annual ground water extraction for domestic (ham)	71.14
Current annual ground water extraction for industrial (ham)	10.8
Current annual ground water extraction for all uses (ham)	2640.72
Net ground water availability for future use (ham)	129.61
Stage of ground water extraction (%)	95.28
Category	Critical

3.2 Chemical quality of ground water and contamination

3.2.1 Variation in Major and Minor elements

Phreatic Aquifer (Aquifer - I)

The EC value of the phreatic aquifer found from 303 µS/cm. TDS has been observed 197 mg/l. Total hardness value found 135 mg/l. Similarly, the Chloride value observed 22 mg/l while the Sulphate value found 24mg/l. Nitrate value observed 4.39 mg/l. Fluoride value found 0.5 mg/l. Overall ground water quality of shallow aquifer (Aquifer – I) is potable and suitable for domestic purpose and irrigation purposes.

3.3 Other issues

3.3.1 Low ground water Potential/Sustainability:- Based on exploration and field studies there is issue of Low ground water Potential/Ground Water Sustainability in the area.

3.3.2 Critical block due to Irrigation draft is higher side

4. SUPPLY SIDE MANAGEMENT

4.1 Artificial recharge to ground Water: The identification of feasible areas for artificial recharge to ground water in Silli block, Ranchi district has been carried out based on depth to water level (post-monsoon) and ground water level trend. The computation of unsaturated zone available, surface water requirement and source water availability for Artificial recharge and proposed numbers of different types of artificial recharge structures feasible Silli block, Ranchi district has been worked out. Based on the study 91 No of Nala Bund/Check Dam/Gully Plus and 15 No of Percolation tanks can be constructed. In addition, Roof Top rainwater harvesting system may also be installed in buildings. The implementation of water conservation through artificial recharge measures will have a positive impact on drinking water sources of the area.

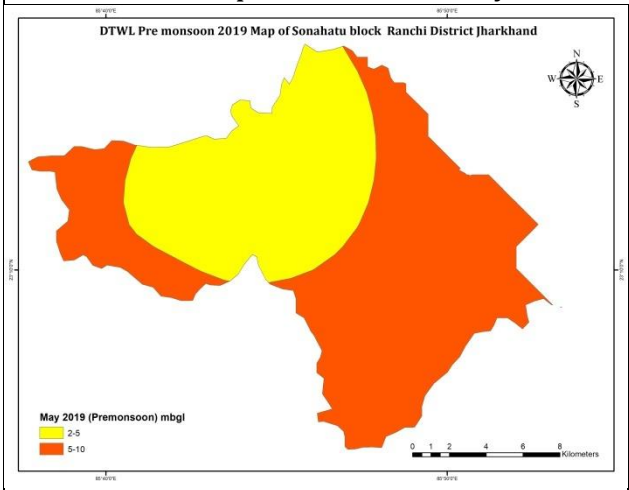
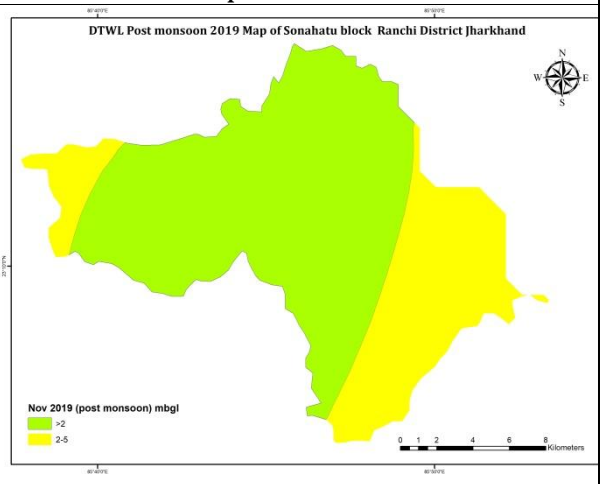
5. DEMAND SIDE MANAGEMENT

The main demand side interventions may be: -

i) Promote improved irrigation technologies (drip or sprinkler irrigation, etc.)

ii) Crop choice management and diversification (promote less intensive crops)

2.5 AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS SONAHATU BLOCK, RANCHI DISTRICT, JHARKHAND

1.SALIENT FEATURES	
• Block Name	Sonahatu
• Geographical Area (Sq. km.)	269.12 sqkm
• Population (2011)	77252
• Rainfall Monsoon (mm) • Rainfall Annual (mm)	1108 1004
• Water level behavior Pre monsoon 2019	Water level behavior Post monsoon 2019
• DTWL Map Pre-monsoon May 2019	DTWL Map Post-monsoon Nov 2019
	
2.0 AQUIFER DISPOSITION	
Major formation	Granite gneiss,
2.1 Numbers of aquifers	Aquifer – I- Weathered Granite gneiss, Aquifer – II- Fractured Granite-Gneiss
2.2 Number of EW constructed	01
2.3 Aquifer Characterstics	Q : low yield
2.3Litholog: 	

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31st March 2020)	
Annual extractable ground water for recharge (ham)	1266.23
Current annual ground water extraction for irrigation (ham)	414
Current annual ground water extraction for domestic (ham)	101.94
Current annual ground water extraction for industrial (ham)	0
Current annual ground water extraction for all uses (ham)	515.94
Net ground water availability for future use (ham)	749.58
Stage of ground water extraction (%)	40.75
Category	Safe
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
The EC value of the phreatic aquifer found from 360 µS/cm. TDS has been observed 234 mg/l. Total hardness value found 120 mg/l. Similarly, the Chloride value observed 37 mg/l while the Sulphate value found 7mg/l. Fluoride value found 0.3 mg/l. Overall ground water quality of shallow aquifer (Aquifer – I) is potable and suitable for domestic purpose and irrigation purposes.	
3.3 Other issues	
3.3.1 Low ground water Potential/Sustainability:- Based on exploration and field studies there is issue of Low ground water Potential/Ground Water Sustainability in the area. **3.3.2** Low ground water development: Low ground water development is the one major issue of the block. Based on Ground water resource assessment as on 2020 stage of ground water development is only 40.75%.	
4. SUPPLY SIDE MANAGEMENT	
4.1 Ground Water Development Strategies-Construction of Tube well/Bore well based on available safe resources: As per Dynamic Ground Water Resource estimation 2020, the stage of ground water development is only 40.75%. There is ample scope of further Ground water Development. To enhance the ground water development, construction of 299 dug wells (10 -20 m depth; 2 to 4 m diameter) and 58 bore wells (up to 60-70 m) are proposed	
4.2 Artificial recharge to ground Water: The identification of feasible areas for artificial recharge to ground water in Sonahatu block, Ranchi district has been carried out based on depth to water level (post-monsoon) and ground water level trend. The computation of unsaturated zone available, surface water requirement and source water availability for Artificial recharge and proposed numbers of different types of artificial recharge structures feasible in Sonahatu block, Ranchi district has been worked out. Based on the study 45 No of Nala Bund/Check Dam/Gully Plus and 07 No of Percolation tanks can be constructed. In addition, Roof Top rainwater harvesting system may also be installed in	

buildings. The implementation of water conservation through artificial recharge measures will have a positive impact on drinking water sources of the area.

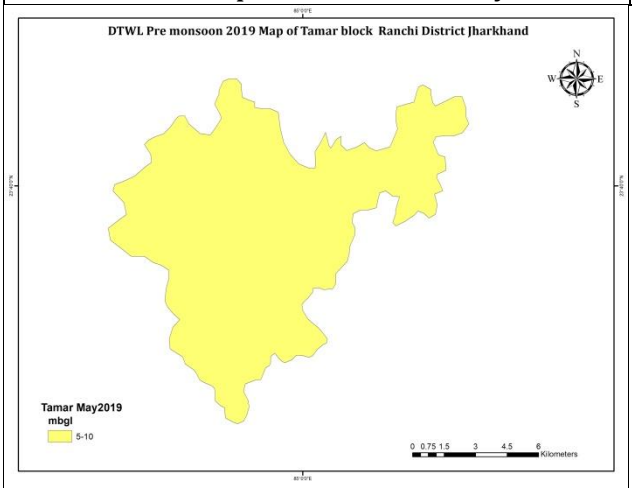
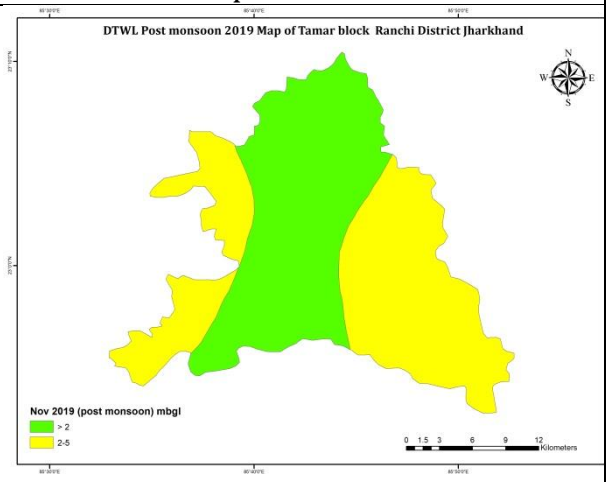
5. DEMAND SIDE MANAGEMENT

The main demand side interventions may be: -

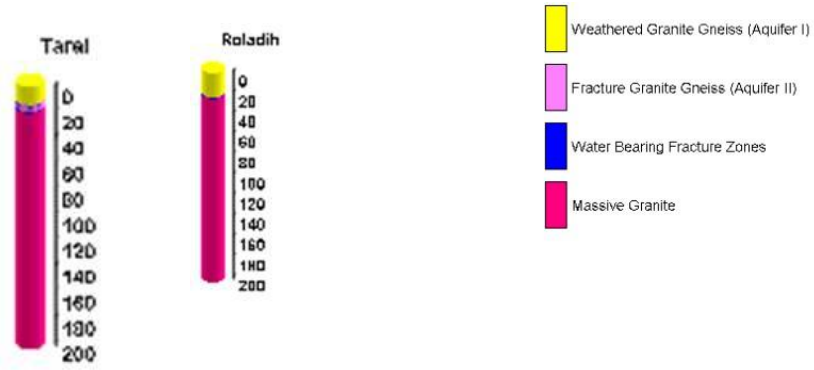
i) Promote improved irrigation technologies (drip or sprinkler irrigation, etc.)

ii) Crop choice management and diversification (promote less intensive crops)

2.6 MAPS AND GROUND WATER MANAGEMENT PLANS TAMAR BLOCK, RANCHI DISTRICT, JHARKHAND

1.SALIENT FEATURES	
• Block Name	Tamar
• Geographical Area (Sq. km.)	513.49 sqkm
• Population (2011)	132672
• Rainfall Monsoon (mm) • Rainfall Annual (mm)	1124 1116
• Water level behavior Pre monsoon 2019	Water level behavior Post monsoon 2019
• DTWL Map Pre-monsoon May 2019	DTWL Map Post-monsoon Nov 2019
	
2.0 AQUIFER DISPOSITION	
Major formation	Granite gneiss,
2.1 Numbers of aquifers	Aquifer – I- Weathered Granite gneiss, Aquifer – II- Fractured Granite-Gneiss
2.2 Number of EW constructed	02

2.3Litholog:



3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES	
3.1 Aquifer wise resource availability and extraction	
Phreatic Aquifer (Aquifer - I)	
Ground water resource estimation (As on 31st March 2020)	
Annual extractable ground water for recharge (ham)	1963.9
Current annual ground water extraction for irrigation (ham)	175.5
Current annual ground water extraction for domestic (ham)	175.07
Current annual ground water extraction for industrial (ham)	0.34
Current annual ground water extraction for all uses (ham)	350.91
Net ground water availability for future use (ham)	1611.77
Stage of ground water extraction (%)	17.8
Category	Safe
3.2 Chemical quality of ground water and contamination	
3.2.1 Variation in Major and Minor elements	
Phreatic Aquifer (Aquifer - I)	
The EC value of the phreatic aquifer found from 742 µS/cm. TDS has been observed 482 mg/l. Total hardness value found 456 mg/l. Similarly, the Chloride value observed 20 mg/l while the Sulphate value found 87mg/l. Fluoride value found 0.3 mg/l. Overall ground water quality of shallow aquifer (Aquifer – I) is potable and suitable for domestic purpose and irrigation purposes.	
3.3 Other issues	
3.3.1 Low ground water Potential/Sustainability:- Based on exploration and field studies there is issue of Low ground water Potential/Ground Water Sustainability in the area. **3.3.2 Low ground water development:** Low ground water development is the one major issue of the block. Based on Ground water resource assessment as on 2020 stage of ground water development is only 17.8%.	
4. SUPPLY SIDE MANAGEMENT	
4.1 Ground Water Development Strategies-Construction of Tube well/Bore well based on available safe resources: As per Dynamic Ground Water Resource estimation 2020, the stage of ground water development is only 17.8 %. There is ample scope of further Ground water Development. To enhance the ground water development, construction of 644 dug wells (10 -20 m depth; 2 to 4 m diameter) and 125 bore wells (up to 60-70 m) are proposed	
4.2 Artificial recharge to ground Water: The identification of feasible areas for artificial recharge to ground water Tamar block, Ranchi district has been carried out based on depth to water level (post-monsoon) and ground water level trend. The computation of unsaturated zone available, surface water requirement and source water availability for Artificial recharge and proposed numbers of different types of artificial recharge structures feasible in Tamar block, Ranchi district has been worked out. Based on the study 87 No of Nala Bund/Check Dam/Gully Plus and 14 No of Percolation tanks can be constructed. In addition, Roof Top rainwater harvesting system may also be installed in buildings. The implementation of water conservation through artificial recharge measures	

will have a positive impact on drinking water sources of the area.

5. DEMAND SIDE MANAGEMENT

The main demand side interventions may be: -

i) Promote improved irrigation technologies (drip or sprinkler irrigation, etc.)

ii) Crop choice management and diversification (promote less intensive crops)

Annexure - I

DETAILS OF WELLS CONSTRUCTED IN HARD FORMATION IN PARTS OF RANCHI DISTRICT

Sl No	Location	Block	Co-ordinate	Depth Drilled	Length of Casing pipe	Granular Zone / fracture Tapped	Static Water level	Discharge	Drawdown	Specific Capacity	Transmissivity	Storativity	Dia. of assembly	Formation	Year
				mbgl.	m	m	m bgl.	m^3/hr	m	m^3/hr/m	m^2/day		mm		
EXPLORATORY WELLS DRILLED BY DEPARTMENTAL RIGS															
1	**Patra Toli** EW	Rahe	$23^0$15'40" $85^0$39'20"	51.8	19.5		10.2	2	18.2					Chotanagpur Granite gneiss	Mar-76
2	**Silli** EW	Silli	$23^0$20'30" $85^0$51'00"	65	5		5.7	4.09	29.6					Chotanagpur Granite gneiss	Aug'76
3	**Majatoli** EW	Lapung	$23^0$06'00" $85^0$01'00"	79.58	22.85		8.5	3.05	21.3					Chotanagpur Granite gneiss	May'76
4	**Kocho** EW	Lapung	$23^0$06'30" $84^0$56'35"	92.18	28.7		3.97	7.2	12.9					Chotanagpur Granite gneiss	Sep'76
5	**Singhpur** EW	Lapung	$23^0$04'30" $84^0$56'35"	90	7.83		2.77	4.06	36.5					Chotanagpur Granite gneiss	Nov.'76
6	**Amahatoli** EW	Lapung	$23^0$03'30" $84^0$56'45"	90.15	11.03		5.43	2.4	24.55					Chotanagpur Granite gneiss	Dec'76
7	**Shorro** EW	Lapung	$23^0$13'30" $85^0$02'35"	81.75	16.42		2.44	6	15.2					Chotanagpur Granite gneiss	April'77
8	**Kerkela** EW	Lapung	$23^0$08'00" $85^0$01'00"	45.86	23.8		21.49	0.12	3.17					Chotanagpur Granite gneiss	June'77
9	**Forest Nursery** Tamar EW	Tamar	23°02'45" 85°39'00"	185	21.56	-							175	Chotanagpur Granite gneiss	2010-11
10	**Forest Ranger** Campus, Tamar, EW	Tamar	23°02'45" 85°39'30"	129.6	5.5	18.00-19.80	7.35	1.8					175	Chotanagpur Granite gneiss	2010-11

11	**Lapung Hospital Campus** EW 1	Lapung	$23^0$05'06" $84^0$57'15"	184.1	11.7	Dry								Chotanagpur Granite gneiss	2011-12
12	**Lapung Hospital Campus** EW 2	Lapung	$23^0$05'06" $84^0$57'20"	178	17.75	139-140		4.32						Chotanagpur Granite gneiss	2011-12
13	**Kampidih**	Rahe	$23^0$13'53.8" $85^0$38'30.6												2021-22

Through Outsource Drilling (WAPCOS)

Sl.No.	**Location**	**Block**	**Co-ordinate**	**Depth Drilled**	**Casing Depth/ Dia.**	**Fractures encountered**	**Static Water level**	**Discharge (Comp)**	**Discharge (Pumping Test)**	**Drawdown**	**Specific Capacity**	**T**	**S**	**Formation**	**Year**
				m	**m/mm**	**m**	**m bgl.**	**m^3/hr**	**m^3/hr**	**m**	**m^3/hr./m.**	**m^2/day**			
1	Banuwadih	Silli	$85^0$49'22.7" $23^0$26'24.4"	135	41.7	101.59 – 103 108 - 109.63 110.33 - 112.87	4.63	6.48	3.6	**1.08**		33.72		Granite Gneiss	**2020-21**
2	Sonahatu	Sonahatu	$85^0$42'28.7" $23^0$11'01.6"	204	36.08	58.0-59.0	7.4	1.584				0.789		Granite Gneiss	**2020-21**
3	Tarai	Tamar	$85^0$49'50.2" $22^0$58'25.6"	204	15	15.79-18.39 19.67-20.93	5.83	0.756				0.135		Granite Gneiss	**2020-21**
4	Roladih	Tamar	$85^0$44'41.9" $23^0$01'07.2"	204	23.64	24.2-24.7	0.3	9	3.24	-		23.85		Granite Gneiss	**2020-21**
5	Dolaicha	Lapung	$84^0$58'11.9" $23^0$11'08.2"	201	7.8	nil	**4.4**	Nil				0.55		Granite Gneiss	**2020-21**
6	Koinara	Lapung	$84^0$55'28.2" $23^0$09'16.8"	170	8	92.5,100	**12.10**	27	21.6	**12.86**		**47.52**	**$3.3x10^{-4}$**	Granite Gneiss	**2020-21**
	OW		$84^0$55'28.2" $23^0$09'16.8"	98	7.05	95	**12.04**	36		**1**				Granite Gneiss	**2020-21**
7	Churi Madhya	Khelari	$85^0$01'32.6" $23^0$39'43.0"	159	22.5	38.1-38.6	**15.88**	42.84	3.24	**1.75**		**32.44**		**Gondwana**	**2020-21**
8	Patrahatu	Silli	$85^0$45'43" $23^0$17'28.7"	121	30.2	108.9-109.47	**11.0**	42.84	3.6	**2.16**		**15.82**		Granite Gneiss	**2020-21**

Hydrogeological Details of Piezometers

Sl No	Location	Block	Co-ordinate	Depth Drilled	Length of Casing pipe	Granular Zone / fracture Tapped	Static Water level	Discharge	Drawdown	Specific Capacity	Transmissivity	Storativity	Dia. of assembly	Formation	Year
				mbgl.	**m**	**m**	**m bgl.**	**m^3/hr**	**m**	**m^3/hr/m**	**m^2/day**		**mm**		
EXPLORATORY WELLS DRILLED BY DEPARTMENTAL RIGS															
1	**Forest Ranger** Tamar Pz	Tamar	23°02'30" 85°39'30"	74.7	2.5	15.50-17.50	7.75	1.8					175	Chotanagpur Granite gneiss	2010-11

Annexure – II

WATER QUALITY DATA OF AQUIFER - I (DUG WELL SAMPLES) OF AQUIFER MAPPING STUDY OF SILLI TAMAR BLOCKS OF RANCHI DISTRICT (2021-22)

NHS chemical data of 2019-2020																		
District	**Block**	**Location**	**Latitude**	**Longitude**	**pH**	**EC**	**TH**	**Ca**	**Mg**	**Na**	**K**	**CO3**	**HCO3**	**Cl**	**NO3**	**SO4**	**F**	**TDS**
Ranchi	Silli	Kita	23°21'56'' N	85°45'23'' E	7.84	303	135	30	14.58	11.47	2.7	0	129.15	21.7	4.39	24.02	0.52	196.95
Ranchi	Silli	Patrahatu	23°19'31'' N	85°46'52'' E	8.11	451	190	40	21.87	24.9	0.65	0	129.2	56.8	9.6	27.54	0.47	293.15
Ranchi	Tamar	Rangamati	23°22'12'' N	85°49'48'' E	7.65	742	456	54	74	31	1.4	0	338.25	19.882	BDL	87.2	0.31	482.3
Ranchi	Silli	Silli	23°22'00'' N	85°50'00'' E	7.51	512	210	48	21.87	31.5	3.7	0	178.4	42.3	BDL	53.7	1.4	332.8

Annexure-III

Details of weathered and semi weathered zones and possible presence of thin fractured zones in Rahe Silli Tamar Sonahatu, Lapung and Khalari Blocks of Ranchi district(by WAPCOS)

VES	Village /Location	Weathered zone (WZ)			Semi-weathered zone(SWZ)/ Less compact zone or different lithounit			Fractured zone(FZ)	Recommendations for borehole drilling	Remarks
		Resistivity (ohm.m)	Depth to bottom (m)	Bottom depth of probable WZ aquifer (m)	Resistivity (ohm.m)	Depth to bottom (m)	Bottom depth of probable SWZ aquifer/ (Depth to compact formation) (m)	Probable occurrence of thin FZ aquifer in the depth range (m)		
Tamar block										
233	**Lupungdih**	33	10	10	NA	NA	NA (10)	30-35, 45-50,120-140	NA	WZ aquifer, FZs are feeble
234	**Tamar**	71	18	18	NA	NA	NA (18)	NA	NA	WZ aquifer up to 18 m may form aquifer
Sonahatu block										
235	**Sonahatu**	NA	NA	NA	119	5	NA (5)	NA	NA	Very high resistivities
Rahe block										
236	**Rahe**	45	15	15	NA	NA	NA (15)	NA	NA	WZ up to 15 m depth may form aquifer
Silli block										
237	**Dowaru**	NA	NA	NA	98	16	16 (16)	NA	NA	SWZ up to 16 m depth may form aquifer
238	**Silli**	70	18	18	NA	NA	NA (18)	NA	NA	WZ up to 18 m depth may form aquifer
Lapung block										
239	**Sarsa**	52	8	NA	130	37	37 (37)	30-35, 45-55, 75-80, 90-95	100 m	SWZ and FZs may form aquifers
240	**Kakriya**	NA	NA	NA	117	28	28 (28)	35-40, 60-70	100 m	SWZ and FZs may form aquifers

Khelari block										
241	**Khelari**	26	2	NA	138	93	93 (93)	80-90	100 m	SWZ and FZ within it may form aquifer
The upper limit of resistivity of the weathered zone is 85 ohm.m, however for weathered zone aquifer it is taken as 60 ohm.m. The weathered zone of thickness less than 10 m has not been considered as aquifer. The resistivity of semi weathered zone is 85 to 300 ohm.m, however the upper limit of resistivity about 150 ohm.m has been considered for semi-weathered zone aquifer. The fractured zones have been inferred through empirical approaches only. WZ: Weatherd zone; SWZ: Semi-weathered zone, FZ: Fractured zone										

Annexure-IV

Details of Dynamic Ground Water Resources of Rahe Silli Tamar Sonahatu, Lapung and Khalari Blocks of Ranchi district

Sl. No.	District	Administrative Units	Annual Extractable Ground Water Recharge	Current Annual Ground Water Extraction for irrigation	Current Annual Ground Water Extraction for domestic	Current Annual Ground Water Extraction for industrial	Current Annual Ground Water Extraction for All uses	Annual GW Allocation for for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction
			(ham)	(ham)	(ham)	(ham)	(ham)	(ham)	(ham)	(%)
1	Ranchi	Khelari	966.66	74.63	168.20	500.00	742.83	169.37	222.66	76.85
2	Ranchi	Lapung	1995.92	630.00	83.20	0.00	713.20	83.78	1282.14	35.73
3	Ranchi	Rahe	944.74	94.88	71.15	0.00	166.03	71.64	778.22	17.57
4	Ranchi	Silli	2771.47	2465.00	164.88	10.84	2640.72	166.02	129.61	95.28
5	Ranchi	Sonahatu	1266.23	414.00	101.94	0.00	515.94	102.65	749.58	40.75
6	Ranchi	Tamar	1963.90	175.50	175.07	0.34	350.91	176.29	1611.77	17.87