DYNAMIC GROUND WATER RESOURCE OF JHARKHAND, 2024

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

CGWB SUO, Ranchi
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Prashant Kumar, IAS
Secretary
Department of Water Resources
Government of Jharkhand

FOREWORD

Ground Water is an important resource to meet water requirements of our country. The spatial distribution of availability of ground water resources in the country however is uneven. Realistic assessment is therefore a pre-requisite for sustainable management of this resource.

Ground Water Resource in our country are being assess periodically. The Dynamic Ground Water Resources (as on March 2024) following the Groundwater Estimation Methodology, 2015, are estimated by State Ground Water Directorate, Water Resource Department, Government of Jharkhand in association with Central Ground Water Board, under the overall supervision of State Level Committee (SLC) on ground water assessment. The combined effort of State Ground Water Directorate, Water Resource Department, Government of Jharkhand and Central Ground Water Board, ushered in refinements in ground water resources assessment.

I would like to place on record my appreciation of the work done by the scientists of Central Ground Water Board, State unit Office, Ranchi, Mid-Eastern Region Patna and officers from State Ground Water Directorate, Water Resource Department, Government of Jharkhand, in bringing out this report, which presents a holistic scenario of ground water regime of the state. I am very hopeful that this report would be of immense use to the administrators, planners and other stakeholders dealing with ground water ensuring optimal utilization and sustainability of ground water resources.

(Prashant Kumar)
Secretary, Water Resource Department
Government of Jharkhand

Message

Ground water resources play a vital role in sustaining the livelihood in the state of Jharkhand. Its ubiquitous occurrence, reliability and availability in all seasons have made it the primary buffer against drought, playing a vital role in ensuring the food security at all levels. Groundwater has an important role in meeting the water requirements of agriculture, industrial and domestic sectors in India. Ground water is annually replenishable resource buts its availability is non-uniform in space and time. Hence, the sustainable development of ground water resources warrants precise quantitative assessment based on reasonably valid scientific principles. National Water Policy, 2012 has also laid emphasis on periodic assessment of ground water resources on scientific basis. The policy also reiterates that the exploitable quantity of ground water should be limited to the amount, which is being recharged annually, known as "Dynamic Ground Water Resource."

The present assessment has been jointly carried out by Central Ground Water Board and Ground Water Directorate, Water Resources Department, Government of Jharkhand following the Groundwater Estimation Methodology, 2015, considering the community development blocks as assessment unit and assessment year 2024.

I genuinely appreciate efforts made by a dedicated team of scientists of Central Ground Water Board, State unit Office, Ranchi, Mid-Eastern Region Patna and officers from Groundwater Directorate, Water Resource Department, Government of Jharkhand under overall supervision of State Level Committee (SLC) in bringing out this report. I am very hopeful that this report will be of great use to the administrators, planners and other stakeholders dealing with ground water ensuring optimal utilization and sustainability of ground water resources.

N Varadaraj
Member (East)
Central Ground Water Board, CHQ, Faridabad

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल बोर्ड , मध्य पूर्वी क्षेत्र

PREFACE

The State of Jharkhand is in the process of an accelerated development in the fields of irrigation and industrial activities. Ground water occupies a key position in development activities of the state. Although, ground water is a replenishable resource , over extraction of ground water, droughts, varied monsoon pattern etc. are leading to situation on which several blocks of the state have been categorized as over exploited to Semi critical.

Assessment of Ground Water Resources is being done jointly by Central Ground Water Board and Ground Water Directorate, Water Resources Department, Government of Jharkhand as per the methodology recommended by the Ground Water Resource Estimation Committee constituted by the Government of India. All the computations have been done by the web based application "INDIA-GROUNDWATER RESOURCE ESTIMATION SYSTEM (INGRES) developed by CGWB in collaboration with IIT-Hyderabad.

The report titled "DYNAMIC GROUND WATER RESOURCE ESTIMATION OF JHARKHAND-2024" summarizes the result of the assessment, primarily in terms of resource availability, utilization and categorization of the assessment units duly approved by State Level Committee (SLC) constituted for the purpose. The report briefly describes salient features of previous assessments, estimation methodology, rainfall distribution, hydrogeology of Jharkhand, ground water scenario in different chapters before describing various components of the Ground Water Resources Assessment 2024 in detail. As per Ground Water Resources assessment, total replenishable Ground Water Resources as on 2024 is 6.28 BCM. Annual Extractable Ground Water Resource of Jharkhand state has been found to be 5.76 BCM. The annual ground water draft in the state is 1.81 BCM with irrigation draft of 0.94 BCM, and 0.65 BCM drinking water demand and remaining 0.22 BCM ground water used for industrial purpose. The average Stage of Ground Water Development of the state as on 2024 is 31.42 %.

I am indebted to Shri Prashant Kumar, Secretary, Water Resource Department, Government of Jharkhand as well as Chairman of SLC for his valuable guidance in accomplishing task of Resource estimation within stipulated time frame. I express my sincere thanks to all the members of SLC for approval of the Estimation. I am obliged to Director, Ground Water Directorate, Water Resources Department, Government of Jharkhand for coordinating the work at state level.

A deep sense of gratitude is express to all the state officers of Water Resources Department, who were associated with this work in all stages. The special mention of the names are Sh. Mahesh kujur, Dy. Director, Ground Water Directorate and Sh. Rohit Singh, Hydrologist, Ground Water Directorate, Govt. of Jharkhand.

I wish to place on record my appreciation of the untiring efforts of Shri Atul Beck, Sc B, Miss Sapna Sakshi, Sc B under guidance of Smt Rose Anita Kujur, Officer in charge, for completing the challenging task of Recourse assessment and compiling this informative Report.

I hope that this report will be useful to all user agencies engaged in planning and development of Groundwater of the State.

(R. R. Shukla)
Regional Director

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURES

Contributors' Page

Principal Contributors (CGWB, SUO, Ranchi)	***Principal Contributors (GWD, WRD, Govt. of Jharkhand)***
Sh. Atul Beck, Scientist-B, CGWB, Ranchi	Sh. Manohar Prasad, Diretor
Miss. Sapna Sakhsi, Scientist-B, CGWB, Ranchi	Sh. Mahesh Kujur, Dy. Director
	Sh. Rohit Singh, Dy. Director

Other Contributors

Smt. Sulekha Bhaya , Scientist-C, CGWB, Ranchi

Dr Anukaran Kujur, Scientist-B, CGWB, Ranchi

Smt. Ritu Kumari Oraon , Scientist-C, CGWB, Ranchi

Md Shadman, Asstt. Hydrogeologist, CGWB, Ranchi

DYNAMIC GROUND WATER RESOURCES OF JHARKHAND, 2024

AT A GLANCE

Total Annual Ground Water Recharge : 6.28 BCM
Annual Extractable Ground Water Resources : 5.76 BCM
Annual Ground Water Extraction : 1.81 BCM
Stage of Ground Water Extraction : 31.42 %

CATEGORIZATION OF ASSESSMENT UNITS

(Blocks/ Mandals/ Taluks)

Sl.No	Category	Number of Assessment Units		Recharge worthy Area		Annual Extractable Ground Water Resource	
		Number	%	in lakh sq. km	%	(in bcm)	%
1	Safe	240	91.25	56718.24	93.52	5302.35	92.09
2	Semi-Critical	12	4.56	2396.09	3.95	259.77	4.51
3	Critical	6	2.28	1068.48	1.76	132.32	2.3
4	Over-Exploited	5	1.9	463.92	0.76	63.13	1.1
5	Saline						
	TOTAL	263	100	60646.73	100	5757.57	100

EXECUTIVE SUMMARY

The re-estimation of ground water resources of Jharkhand as on March-2024 has been jointly made by Central Ground Water Board, State Unit office, Ranchi/Mid-Eastern Region, Patna with State Ground Water Directorate, Water Resources Dept. Govt. of Jharkhand.In present estimation a total numbers of 263 assessment units (259 blocks and 4 urban centres- Ranchi urban, Dhanbad urban, Medininagar urban and Jamshedpur urban) have been assessed.The estimation is based on Ground Water Estimation methodologies as per GEC2015.The most of the blocks has been assessed using RIF (Rainfall Infiltration Factor) method in comparison to WLF (Water Level Fluctuation) method.Total Replenishable Ground Water Recharge as on March 2024 has been assessed as ***6.28 BCM***. Considering natural discharge of ***0.52 BCM***, Annual extractable Ground Water Resources for the state of Jharkhand has been assessed as **5.76** ***BCM***.Current Annual Ground Water Extraction in the state of the Jharkhand has been assessed as ***1.81 BCM*** with Irrigation draft of ***0.94 BCM***, industrial draft of **0.22 BCM** and ***0.65 BCM*** is drawn to meet up the drinking water demand. The average Stage of Ground Water Extraction as on March 2024 is **31.42 %**.The net ground water availability for future use is **3.96** ***BCM***. Annual GW Allocation for Domestic Use as on 2025 is **0.65 BCM**. Monsoon has got an overwhelming control over recharge of Jharkhand state.

Out of **263** assessment units (blocks-259, Urban area-04), 5 units (1.9 %) have been categorized as 'Over-exploited', 6 units (2.28 %) as 'Critical', 12 units (4.56 %) as 'Semi-critical' and rest 240 units (91.25 %) are under 'Safe' category and there is no saline assessment unit in the State.Similarly, out of 60646.73 sq km recharge worthy area of the State, 463.92 sq km (0.76 %) area are under 'Over-Exploited', 1068.48 sq km (1.76 %) under 'Critical', 2396.09 sq km (3.95 %) under 'Semi-critical' and 56718.24 sq km (93.52 %) under 'Safe' categories of assessment units. Out of total 5757.56 mcm annual extractable ground water resources of the State, 63.13mcm (1.1%) are under 'Over-exploited', 132.32mcm (2.3%) under 'Critical', 259.77mcm (4.51%) under 'Semi-critical' and 5302.35mcm (92.09%) are under 'Safe' categories of assessment units.As compared to 2023 assessment, Total Annual Ground Water Recharge and Annual Extractable Ground Water Resources have increased from 6.25 to 6.28 bcm and 5.73 to 5.76 bcm respectively. The Annual Ground Water Extraction for the State has increased from 1.79 to 1.81 bcm and the Stage of Ground Water Extraction has increased from 31.38% to 31.42%.The block-wise categorization reflecting temporal variation in ground water recharge/discharge/draft pattern. Results indicate that high stage of development is due to industrialisation and Mining activity in Bermo, Baliapur, Topchanchi, Khelari and due to urbanisation in Golmuri-cum Jugsalai, Jamshedpur urban, Ranchi Urban, Dhanbad urban and due to agricultural activities in Silli blocks of Jharkhand state. The quality tagging of Fluoride and Arsenic affected blocks has also been done along with resources assessment of the blocks of the Jharkhand state.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND FOR RE-ESTIMATION OF THE GROUND WATER RESOURCE OF THE STATE OF JHARKHAND

The state of Jharkhand was carved out from erstwhile Bihar state on 15th November, 2000. The state covers the southern hilly part of the state of Bihar, spanning between 83°30' and 87°35' longitude and 21°55' and 25°15' latitude, covering an area of 79714 Sq. Km. The state of Bihar, West Bengal, Chattisgarh and Orissa bound the state Jharkhand in its north, east, west and south respectively. The state is divided into 24 districts and 260 community development blocks. Population of the state as per census 2011 is 32827461, of which about 26% of total population is tribal. Total rural population is 25004031 while urban population is 7823430. The population density varies from 160 persons per square km in Simdega to 1192 person per square km in Dhanbad district, with the overall of the state to be 415 persons per square km. Some of the important urban centres are Ranchi, Jamshedpur, Bokaro, Dhanbad, Hazaribagh, Daltonganj, Deoghar etc. A district statistical profile of the state is tabulated in Table 1.1. Administrative map of the state is given in Plate-1.

Ground Water has emerged as an important component of the socio-economic development in the state of Jharkhand as the dependency on ground water is increasing rapidly. Entire rural domestic water supply and about 1/6th of the urban water supply is being catered from ground water at present. The increase in dependency on ground water for irrigation is also manifested in surge in number of ground water abstraction structures in the recent past. However, due to wide variation in rock types, topography, climate and water use, ground water potential differs from place to place. The need for judicious and planned use of ground water is emphasized at various forums as the extraction of ground water is increasing at an alarming pace. This is particularly evident in some urban areas of the state. Hence ground water resources of Jharkhand urgently need a proper management guideline. Therefore, proper planning and management of ground water development in a state in a judicious and socio-economically equitable manner, principally depends on proper quantification of ground water resources and on assessment of status of ground water development.

Earlier exercises (1998 for undivided Bihar, 2004, 2009, 2011, 2013, 2017, 2020, 2022, 2023 and 2024) aimed to make an estimate of dynamic ground water resources considering recharge, draft for various uses and balance ground water resource available for further development. The methodologies utilised in those exercises, as recommended by Govt. of India, were GEC-1984 initially and later using GEC1997 and 2015. The present assessments (2024) have been carried out, through IN-GRES, the purpose built software developed by IIT Hyderabad and powered by Vassar Labs.IN-GRES software modules, were used in Computations which is based on GEC 2015 methodology. In contrast, present exercise aims to make a picture of entire water resource of the State, by estimating dynamic ground water resources. The Ground water resources have been estimated as on 2024 considering 2023-24 as the ground water year.

Table 1.1 District statistical profile of the state

Sl. No.	District	otal Area (Sq. Km.)	Community Development block	Population			Population Density (Pers. /Sq. Km)
				Rural	Urban	Total	
1	Bokaro	2859	9	1078686	983644	2062330	721
2	Chatra	3932	12	979932	62954	1042886	265
3	Deoghar	2551	10	1233712	258361	1492073	585
4	Dhanbad	2252	9	1124093	1560394	2684487	1192
5	Dumka	3716	10	1231264	90178	1321442	356
6	East Singhbhum	3633	11	1019328	1274591	2293919	631
7	Garhwa	4045	19	1190114	69670	1259784	311
8	Giridih	5085	13	2237450	208024	2445474	481
9	Godda	2111	9	1249230	64419	1313649	622
10	Gumla	5347	12	972061	16211	988272	185
11	Hazaribagh	4310	16	1459188	275307	1734495	402
12	Jamtara	1804	6	715296	75746	791042	438
13	Khunti	2600	6	486903	44982	531885	204
14	Koderma	1497	6	575013	141246	716259	478
15	Latehar	3613	9	675120	51858	726978	201
16	Lohardaga	1492	7	404379	57411	461790	309
17	Pakur	1806	6	832910	6751	839661	465
18	Palamau	4517	20	1713866	226003	1939869	429
19	Ramgarh	1396	6	530488	418955	949443	680
20	Ranchi	4963	18	1656858	1257335	2914193	587
21	Sahebganj	1702	9	990901	159666	1150567	676
22	Saraikela - Kharsawan	2725	9	806301	258746	1065047	391
23	Simdega	3752	10	556634	42944	599578	160
24	West Singhbhum	7222	18	1284304	218034	1502338	208
	State Summary	78930	260	25004031	7823430	32827461	416

1.2 CONSTITUTION OF STATE LEVEL COMMITTEE FOR GROUND WATER RESOURCE ESTIMATION

Based on resolution no. T-13014/1/2019-GW dated 08.02.2022 (Annexure-IA) of Ministry of Jal Shakti, Dept of Water Resources, River Development and Ganga Rejuvenation, Govt. of India, a Permanent Committee was constituted for the State of Jharkhand for ground water resource reestimation by notificationno.3/PMC/Misc-168 (Part-1)/2009-15, dated 09.01.2023 and letter no 3/PMC/Misc-168 (Part-1)/2009, dated 15.03.2023 by the Govt. of Jharkhand. The permanent SLC Committee constituted with the following members:

1.	Secretary, Water Resource Department., Govt. of Jharkhand, Ranchi	**Chairman**
2.	Engineer-in-Chief II, Water Resources Department, Govt. of Jharkhand, Ranchi	Member
3.	Chief Engineer, Minor Irrigation Department, Govt. of Jharkhand, Ranchi	Member
4.	Chief Engineer, Design, Master planning & Design Hydrology, Water Resources Department, Govt. of Jharkhand, Ranchi	Member
5.	Member Secretary, Jharkhand State Pollution Control Board, Govt. of Jharkhand, Ranchi	Member
6.	Director, Agriculture Department. Govt. of Jharkhand, Ranchi	Member
7.	Director, PMU, Drinking Water and Sanitation Department, Govt. of Jharkhand, Ranchi	Member
8.	Director, Industry Department. Govt. of Jharkhand, Ranchi	Member
9.	General Manager, NABARD, Ranchi	Member
10.	Director, Ground Water Directorate, Water Resources Department, Govt. of Jharkhand	Member
11.	Representative of Urban Development (Secretary) Department, Govt. of Jharkhand	Member
12.	Director, Jharkhand Space Application Centre, Ranchi or representative	Member
13.	Director, Directorate of Geology. Govt. of Jharkhand, Ranchi	Member
14.	Director, Indian Meteorological Department, Govt. of India, Ranchi	Member
15.	Director, Panchayati Raj Dept, Govt of Jharkhand, Ranchi	Member
16.	Representative of VC, Birsa Agriculture University, Ranchi	Member
17.	Regional Director, CGWB, Mid-Eastern Region, Patna	Member Secretary

1.3 BRIEF OUTLINE OF THE PROCEEDINGS OF THE RESOURCES ESTIMATION INCLUDING OUTCOME OF VARIOUS MEETINGS

First meeting of the State Level Committee of re-assessment of Groundwater resource of Jharkhand for the year 2024 was held on 10.05.2024 in the conference hall of Water Resources Department, Government of Jharkhand, Ranchi under Chairmanship of Shri Prashant Kumar, Secretary, Water Resources Dept, Govt. of Jharkhand. Major agendas discussed were briefing about Data Requirements and timelines for finalization of Estimation of Ground Water Resources as on March 2024. A presentation on Ground Water Resources Assessment- 2024 (Dynamic) and Data Requirements and timelines for finalization of Estimation of Ground Water Resources as on March 2024 was made by Sh. Atul Beck, Scientist-B, CGWB, SUO, Ranchi before the committee members. Minutes of the meeting has been given in **Annexure VII**.

The Second and final meeting of the State level committee for re-estimation of ground water resources as on March-2024 was held on 24.09.2024, at Ranchi under Chairmanship of Shri Prashant Kumar, Secretary, Water Resources Dept, Govt of Jharkhand. Smt Rose Anita Kujur OIC, CGWB, SUO, Ranchi welcomed the permanent state level committee members of Dynamic Ground Water Resosurce. A presentation on Dynamic Ground Water Resources Assessment- 2024 was made by Sh Atul Beck, Scientist-B, CGWB, SUO, Ranchi before the committee members. Chairman, State Level Committee finally approved the assessment of replenishable ground water resources of Jharkhand state jointly prepared by CGWB, SUO, Ranchi and Ground Water Directorate, WRD, Jharkhand. Minutes of the meeting has been given in **Annexure VII** Based on resolution no. T-13014/1/2019-GW dated 08.02.2022 of Ministry of Jal Shakti, Dept of Water Resources, River Development and Ganga Rejuvenation, Govt. of India, a Permanent Committee was constituted for the State of Jharkhand for ground water resource reestimation by notificationno.3/PMC/Misc-168 (Part-1)/2009-15, dated 09.01.2023 and letter no 3/PMC/Misc-168 (Part-1)/2009, dated 15.03.2023 by the Govt. of Jharkhand (Annexure-IB). The permanent SLC Committee constituted with the following members:

1.	Secretary, Water Resource Department., Govt. of Jharkhand, Ranchi	Chairm an
2.	Engineer-in-Chief II, Water Resources Department, Govt. of Jharkhand, Ranchi	Member
3.	Chief Engineer, Minor Irrigation Department, Govt. of Jharkhand, Ranchi	Member
4.	Chief Engineer, Design, Master planning & Design Hydrology, Water Resources Department, Govt. of Jharkhand, Ranchi	Member
5.	Member Secretary, Jharkhand State Pollution Control Board, Govt. of Jharkhand, Ranchi	Member
6.	Director, Agriculture Department. Govt. of Jharkhand, Ranchi	Member
7.	Director, PMU, Drinking Water and Sanitation Department, Govt. of Jharkhand, Ranchi	Member

8.	Director, Industry Department. Govt. of Jharkhand, Ranchi	Member
9.	General Manager, NABARD, Ranchi	Member
10.	Director, Ground Water Directorate, Water Resources Department, Govt. of Jharkhand	Member
11.	Representative of Urban Development (Secretary) Department, Govt. of Jharkhand	Member
12.	Director, Jharkhand Space Application Centre, Ranchi or representative	Member
13.	Director, Directorate of Geology. Govt. of Jharkhand, Ranchi	Member
14.	Director, Indian Meteorological Department, Govt. of India, Ranchi	Member
15.	Director, Panchayati Raj Dept, Govt of Jharkhand, Ranchi	Member
16.	Representative of VC, Birsa Agriculture University, Ranchi	Member
17.	Regional Director, CGWB, Mid-Eastern Region, Patna	Member Secretary

CHAPTER 2

2.0 GROUND WATER RESOURCE ESTIMATION METHODOLOGY

Ground water resource as in 2024 have been estimated following the guidelines mentioned in the GEC 2015 methodology using appropriate assumptions depending on data availability. The principal attributes of GEC 2015 methodology are given below:

It is also important to add that as it is advisable to restrict the groundwater development as far as possible to annual replenishable resources, the categorization also considers the relation between the annual replenishment and groundwater development. An area devoid of ground water potential may not be considered for development and may remain safe whereas an area with good groundwater potential may be developed and may become over exploited over a period. Thus, water augmentation efforts can be successful in such areas, where the groundwater potential is high and there is scope for augmentation.

2.1. GROUND WATER ASSESSMENT OF UNCONFINED AQUIFER

Though the assessment of ground water resources includes assessment of dynamic and in-storage resources, the development planning should mainly focus on dynamic resource as it gets replenished on an annual basis. Changes in static or in-storage resources normally reflect long-term impacts of ground water mining. Such resources may not be replenishable annually and may be allowed to be extracted only during exigencies with proper planning for augmentation in the succeeding excess rainfall years.

2.1.1. Assessment of Annually Replenishable or Dynamic Ground Water Resources

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

$$\boldsymbol{Inflow - Outflow = Change\ in\ Storage(of\ an\ aquifer)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(\mathbf{1})$$

Equation (1) can be further elaborated as –

$$\boldsymbol{\Delta S = R_{RF} + R_{STR} + R_C + R_{SWI} + R_{GWI} + R_{TP} + R_{WCS} \pm VF \pm LF - GE - T - E - B} \ldots\ldots..(\mathbf{2})$$

Where,
ΔS - Change is storage
R_{RF} - Rainfall recharge
R_{STR} - Recharge from stream channels
R_C - Recharge from canals
R_{SWI} - Recharge from surface water irrigation
R_{GWI} - Recharge from ground water irrigation
R_{TP} - Recharge from Tanks & Ponds
R_{WCS} - Recharge from water conservation structures
VF - Vertical flow across the aquifer system
LF - Lateral flow along the aquifer system (through flow)
GE - Ground Water Extraction
T - Transpiration

E - Evaporation
B - Base flow
Due to lack of data for all the components in most of the assessment units, at present the water budget has been assessed based on major components only, taking into consideration certain reasonable assumptions. The estimation has been carried out using lumped parameter estimation approach keeping in mind that data from many more sources if available may be used for refining the assessment.

2.1.1.1. Rainfall Recharge

Ground water recharge has been estimated on ground water level fluctuation and specific yield approach since this method considers the response of ground water levels to ground water input and output components. In units or subareas where adequate data on ground water level fluctuations are not available, ground water recharge is estimated using rainfall infiltration factor method only. The rainfall recharge during non-monsoon season has been estimated using rainfall infiltration factor method only.

2.1.1.1.1. Ground Water Level Fluctuation Method

The ground water level fluctuation method is used for assessment of rainfall recharge in the monsoon season. The ground water balance equation in non-command areas is given by

$$\Delta S = R_{RF} + R_{STR} + R_{SWI} + R_{GWI} + R_{TP} + R_{WCS} \pm VF \pm LF - GE - T - E - B \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(3)$$

Where,
ΔS - Change is storage
R_{RF} - Rainfall recharge
R_{STR} - Recharge from stream channels
R_{SWI} - Recharge from surface water irrigation
R_{GWI} - Recharge from ground water irrigation
R_{TP} - Recharge from Tanks& Ponds
R_{WCS} - Recharge from water conservation structures
VF - Vertical flow across the aquifer system
LF - Lateral flow along the aquifer system (through flow)
GE - Ground water extraction
T - Transpiration
E - Evaporation
B - Base flow
Whereas the water balance equation in command area have another term i.e., Recharge due to canals (R_C) and the equation is as follows:

$$\Delta S = R_{RF} + R_{STR} + R_C + R_{SWI} + R_{GWI} + R_{TP} + R_{WCS} \pm VF \pm LF - GE - T - E - B \ldots\ldots\ldots\ldots...(4)$$

The change in storage has been estimated using the following equation:

$$\Delta S = \Delta h \times A \times S_Y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(5)$$

Where,
ΔS - Change is storage
Δh - rise in water level in the monsoon season
A - Area for computation of recharge
S_Y - Specific Yield
Substituting the expression in equation (5) for storage increase ΔS in terms of water level fluctuation and specific yield, the equations (3) & (4) becomes (6) & (7) for non-command and command sub-units,

$$R_{RF} = \Delta h \times A \times S_Y - R_{STR} - R_{SWI} - R_{GWI} - R_{TP} - R_{WCS} \pm VF \pm LF + GE + T + E + B \ldots\ldots\ldots\ldots\ldots..(6)$$

$$R_{RF} = \Delta h \times A \times S_Y - R_{STR} - R_C - R_{SWI} - R_{GWI} - R_{TP} - R_{WCS} \pm VF \pm LF + GE + T + E + B \ldots\ldots\ldots.(7)$$

Where base flow/ recharge to/from streams have not been estimated, the same is assumed to be zero. The rainfall recharge obtained by using equation (6) and (7) provides the recharge in any particular monsoon season for the associated monsoon season rainfall. This estimate has been normalized for the normal monsoon season rainfall as per the procedure indicated below.

Normalization of Rainfall Recharge

Let R_i be the rainfall recharge and r_i be the associated rainfall. The subscript “i” takes values 1 to N where N is the number of years for which data is available. This should be at least 5. The rainfall recharge, R_i is obtained as per equation (6) & equation (7) depending on the sub-unit for which the normalization is being done.

After the pairs of data on R_i and r_i have been obtained as described above, a normalisation procedure is carried out for obtaining the rainfall recharge corresponding to the normal monsoon season rainfall. Let r(normal) be the normal monsoon season rainfall obtained as the average of recent 30 to 50 years of monsoon season rainfall. Two methods are possible for the normalisation procedure. The first method is based on a linear relationship between recharge and rainfall of the form

$$R = ar \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..\ldots\ldots\ldots.(8)$$

Where,

R = Rainfall recharge during monsoon season

r = Monsoon season rainfall

a = a constant

The computational procedure is followed in the first method is as given below:

$$R_{RF}(normal) = \frac{\sum_{i=1}^{N}\left[R_i \frac{r(normal)}{r_i}\right]}{N} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..\ldots\ldots\ldots\ldots\ldots\ldots..(9)$$

Where,

R_{RF}(normal) - Normalized Rainfall Recharge in the monsoon season

R_i- Rainfall Recharge in the monsoon season for the i^{th}year

r(normal) - Normal monsoon season rainfall

r_i- Rainfall in the monsoon season for the i^{th} year

N - No. of years for which data is available

The second method is also based on a linear relation between recharge and rainfall. However, this linear relationship is of the form,

$$R_{RF}(normal) = a \times r(normal) + b \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(10)$$

Where,

R_{RF}(normal) - Normalized Rainfall Recharge in the monsoon season

r(normal) - Normal monsoon season rainfall

a and b - Constants.

The two constants ‘a’ and ‘b’ in the above equation are obtained through a linear regression analysis. The computational procedure has been followed in the second method is as given below:

$$a = \frac{NS_4 - S_1 S_2}{NS_3 - S_1^2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (11)$$

$$b = \frac{S_2 - aS_1}{N} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (12)$$

Where,

$$S_1 = \sum_{i=1}^{N} r_i \ , \ S_2 = \sum_{i=1}^{N} R_i \ , \ S_3 = \sum_{i=1}^{N} r_i^2 \ , \ S_4 = \sum_{i=1}^{N} R_i r_i$$

2.1.1.1.2. Rainfall Infiltration Factor Method

The rainfall recharge estimation based on Water level fluctuation method reflects actual field conditions since it takes into account the response of ground water level. However the ground water extraction estimation included in the computation of rainfall recharge using water level fluctuation approach is often subject to uncertainties. Therefore, the rainfall recharge obtained from water level fluctuation approach has been compared with that estimated using rainfall infiltration factor method. Recharge from rainfall is estimated by using the following relationship –

$$R_{RF} = RFIF \times A \times \frac{(R - a)}{1000} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (13)$$

Where,

R_{RF} - Rainfall recharge in ham

A - Area in hectares

RFIF - Rainfall Infiltration Factor

R- Rainfall in mm

a - Minimum threshold value above which rainfall induces ground water recharge in mm

The threshold limit of minimum and maximum rainfall event which can induce recharge to the aquifer is considered while estimating ground water recharge using rainfall infiltration factor method. The minimum threshold limit is in accordance with the relation shown in equation (13) and the maximum threshold limit is based on the premise that after a certain limit, the rate of storm rain is too high to contribute to infiltration and they will only contribute to surface runoff. Thus, 10% of Normal annual rainfall has been taken as minimum rainfall threshold and 3000 mm as maximum rainfall limit. While computing the rainfall recharge, 10% of the normal annual rainfall has been deducted from the monsoon rainfall and balance rainfall is considered for computation of rainfall recharge. The same recharge factor is used for both monsoon and non-monsoon rainfall, with the condition that the recharge due to non-monsoon rainfall is taken as zero, if the normal rainfall during the non-monsoon season is less than 10% of normal annual rainfall. In using the method based on the specified norms, recharge due to both monsoon and non-monsoon rainfall has been estimated for normal rainfall, based on recent 30 to 50 years of data.

2.1.1.1.3. Percent Deviation

After computing the rainfall recharge for normal monsoon season rainfall using the ground water level fluctuation method and rainfall infiltration factor method these two estimates is compared with each other. A term, Percent Deviation (PD) which is the difference between the two expressed as a percentage of the later is computed as

$$PD = \frac{R_{RF}(normal, wtfm) - R_{RF}(normal, rifm)}{R_{RF}(normal, rifm)} \times 100 \dots\dots\dots\dots\dots\dots. \dots\dots\dots. (14)$$

Where,

R_{RF} (normal, wlfm) = Rainfall recharge for normal monsoon season rainfall estimated by the ground water level fluctuation method

R_{RF} (normal, rifm) = Rainfall recharge for normal monsoon season rainfall estimated by the rainfall infiltration factor method

The rainfall recharge for normal monsoon season rainfall is finally adopted as per the criteria given below:

- If PD is greater than or equal to -20%, and less than or equal to +20%, R_{RF} (normal) is taken as the value estimated by the ground water level fluctuation method.
- If PD is less than -20%, R_{RF} (normal) is taken as equal to 0.8 times the value estimated by the rainfall infiltration factor method.
- If PD is greater than +20%, R_{RF} (normal) is taken as equal to 1.2 times the value estimated by the rainfall infiltration factor method.

2.1.1.2. Recharge from Other Sources

Recharge from other sources constitutes recharges from canals, surface water irrigation, ground water irrigation, tanks & ponds and water conservation structures in command areas where as in non-command areas it constitutes the recharge due to surface water irrigation, ground water irrigation, tanks & ponds and water conservation structures. The methods of estimation of recharge from different sources are used in the assessment as follows.

Sl. No.	Source	Estimation Formula	Parameters
1	Recharge from Canals	$R_C = WA \times SF \times Days$	R_C = Recharge from Canals WA = Wetted Area SF = Seepage Factor Days = Number of Canal Running Days
2	Recharge from Surface Water Irrigation	$R_{SWI} = AD \times Days \times RFF$	R_{SWI} = Recharge due to applied surface water irrigation AD = Average Discharge Days = Number of days water is discharged to the Fields RFF = Return Flow Factor
3	Recharge from Ground Water Irrigation	$R_{GWI} = GE_{IRR} \times RFF$	R_{GWI} = Recharge due to applied ground water irrigation GE_{IRR} = Ground Water Extraction for Irrigation RFF = Return Flow Factor
4	Recharge due to Tanks & Ponds	$R_{TP} = AWSA \times N \times RF$	R_{TP} = Recharge due to Tanks & Ponds AWSA = Average Water Spread Area N = Number of days Water is available in the Tank/Pond RF = Recharge Factor

Sl. No.	Source	Estimation Formula	Parameters
5	Recharge due to Water Conservation Structures	$R_{WCS} = GS \times RF$	RWCS = Recharge due to Water Conservation Structures GS = Gross Storage = Storage Capacity multiplied by number of fillings. RF = Recharge Factor

2.1.1.3. Evaporation and Transpiration

Evaporation is estimated for the aquifer in the assessment unit if water levels in the aquifer are within the capillary zone. For areas with water levels within 1.0mbgl, evaporation is estimated using the evaporation rates available for other adjoining areas. If depth to water level is more than 1.0mbgl, the evaporation losses from the aquifer is taken as zero.

Transpiration through vegetation has been estimated if water levels in the aquifer are within the maximum root zone of the local vegetation. If water levels are within 3.5mbgl, transpiration is estimated using the transpiration rates available for other areas. If it is greater than3.5m bgl, the transpiration has been taken as zero.

2.1.1.4. Recharge During Monsoon Season

The sum of normalized monsoon rainfall recharge and the recharge from other sources and lateral and vertical flows into & out of the sub unit and stream inflows & outflows during monsoon season is the total recharge/ accumulation during monsoon season for the sub unit. Similarly, this is to be computed for all the sub units available in the assessment unit.

2.1.1.5. Recharge During Non-Monsoon Season

The rainfall recharge during non-monsoon season is estimated using rainfall infiltration factor Method only when the non-monsoon season rainfall is more than 10% of normal annual rainfall. The sum of non-monsoon rainfall recharge and the recharge from other sources and lateral and vertical flows into & out of the sub unit and stream inflows & outflows during non-monsoon season is the total recharge/ accumulation during non-monsoon season for the sub unit. Similarly, this is to be computed for all the sub units available in the assessment unit.

2.1.1.6. Total Annual Ground Water Recharge

The sum of the recharge/ accumulations during monsoon and non-monsoon seasons is the total annual ground water recharge/ accumulations for the sub unit. Similarly, this is computed for all the sub units available in the assessment unit.

2.1.1.7. Annual Extractable Ground Water Resource (EGR)

The Annual Extractable Ground Water Resource (EGR) is computed by deducting the Total Annual Natural Discharge from Total Annual Ground Water Recharge.
In the water level fluctuation method, a significant portion of base flow is already accounted for by taking the post monsoon water level one month after the end of rainfall. The base flow in the remaining non-

monsoon period is likely to be small, especially in hard rock areas. In the assessment units, where river stage data are not available and neither the detailed data for quantitative assessment of the natural discharge are available, allocation of unaccountable natural discharges to 5% or 10% of annual recharge is considered. If the rainfall recharge is assessed using water level fluctuation method this has been taken 5% of the annual recharge and if it is assessed using rainfall infiltration factor method, 10% of the annual recharge is considered. The balance is account for Annual Extractable Ground Water Resources (EGR).

2.1.1.8. Estimation of Ground Water Extraction

Ground water draft or extraction is assessed as follows.

$$GE_{ALL} = GE_{IRR} + GE_{DOM} + GE_{IND} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (15)$$

Where,

GE_{ALL} = Ground water extraction for all uses

GE_{IRR} = Ground water extraction for irrigation

GE_{DOM} = Ground water extraction for domestic uses

GE_{IND} = Ground water extraction for industrial uses

2.1.1.8.1. Ground Water Extraction for Irrigation (GE_{IRR})

The methods for estimation of ground water extraction are as follows.

Unit Draft Method: – In this method, season-wise unit draft of each type of well in an assessment unit is estimated. The unit draft of different types (eg. Dug well, Dug cum bore well, shallow tube well, deep tube well, bore well etc.) is multiplied with the number of wells of that particular type to obtain season-wise ground water extraction by that particular structure.

Crop Water Requirement Method: – For each crop, the season-wise net irrigation water requirement is determined. This is then multiplied with the area irrigated by ground water abstraction structures. The database on crop area is obtained from Revenue records in Tehsil office, Agriculture Census and also by using Remote Sensing techniques.

Power Consumption Method: –Ground water extraction for unit power consumption (electric) is determined. Extraction per unit power consumption is then multiplied with number of units of power consumed for agricultural pump sets to obtain total ground water extraction for irrigation.

2.1.1.8.2. Ground Water Extraction for Domestic Use (GE_{DOM})

There are several methods for estimation of extraction for domestic use(GEDOM). Some of the commonly adopted methods are described here.

Unit Draft Method: – In this method, unit draft of each type of well is multiplied by the number of wells used for domestic purpose to obtain the domestic ground water extraction.

Consumptive Use Method: – In this method, population is multiplied with per capita consumption usually expressed in litre per capita per day (lpcd). It can be expressed using following equation.

$$GE_{DOM} = Population \times Consumptive\ Requirement \times L_g \dots \dots \dots \dots \dots . \dots \dots \dots \dots \dots \dots . (16)$$

Where,

L_g = Fractional Load on Ground Water for Domestic Water Supply.

The Load on Ground water can be obtained from the Information based on Civic water supply agencies in urban areas.

2.1.1.8.3. Ground Water Extraction for Industrial Use (GE_{IND})

The commonly adopted methods for estimating the extraction for industrial use are as below:
Unit Draft Method: - In this method, unit draft of each type of well is multiplied by the number of wells used for industrial purpose to obtain the industrial ground water extraction.
Consumptive Use Pattern Method: – In this method, water consumption of different industrial units is determined. Numbers of Industrial units which are dependent on ground water are multiplied with unit water consumption to obtain ground water extraction for industrial use.

$$GE_{IND} = Number\ of\ Industrial\ Units \times Unit\ Water\ Consumption \times L_g \dots\dots\dots\dots\dots\dots (17)$$

Where,
L_g = Fractional load on ground water for industrial water supply.
The load on ground water for industrial water supply can be obtained from water supply agencies in the Industrial belt.
Ground water extraction obtained from different methods need to be compared and based on field checks, the seemingly best value may be adopted. At times, ground water extraction obtained by different methods may vary widely. In such cases, the value matching the field situation should be considered. The storage depletion during a season, where other recharges are negligible can be taken as ground water extraction during that particular period.

2.1.1.9. Stage of Ground Water Extraction

The stage of ground water extraction is defined by,

$$Stage\ of\ GW\ Extraction = \frac{Existing\ Gross\ GW\ Extraction\ for\ all\ Uses}{Annual\ Extractable\ GW\ Resources} \times 100 \dots\dots\dots\dots (18)$$

The existing gross ground water extraction for all uses refers to the total of existing gross ground water extraction for irrigation and all other purposes. The stage of ground water extraction should be obtained separately for command areas, non-command areas and poor ground water quality areas.

2.1.1.10. Validation of Stage of Ground Water Extraction

The assessment based on the stage of ground water extraction has inherent uncertainties. In view of this, it is desirable to validate the 'Stage of Ground Water Extraction' with long term trend of ground water levels. Long term Water Level trends are prepared for a minimum period of 10 years for both pre-monsoon and post-monsoon period. If the ground water resource assessment and the trend of long term water levels contradict each other, this anomalous situation requires a review of the ground water resource computation, as well as the reliability of water level data. The mismatch conditions are enumerated below.

SOGWE	Ground Water Level Trend	Remarks
≤ 70%	Significant decline in trend in both pre-monsoon and post-monsoon	Not acceptable and needs reassessment
> 100%	No significant decline in both pre-monsoon and post-monsoon long term trend	Not acceptable and needs reassessment

2.1.1.11. Categorisation of Assessment Unit

2.1.1.11.1. Categorisation of Assessment Unit Based on Quantity

The categorisation based on status of ground water quantity is defined by Stage of Ground Water Extraction as given below:

Stage of Ground Water Extraction	Category
≤ 70%	Safe
> 70% and ≤90%	Semi-critical
> 90% and ≤100%	Critical
> 100%	Over Exploited

2.1.1.11.2. Categorisation of Assessment Unit Based on Quality

As it is not possible to categorize the assessment units in terms of the extent of quality hazard, based on the available water quality monitoring mechanism and database on ground water quality, the Committee recommends that each assessment unit, in addition to the Quantity based categorization (safe, semi-critical, critical and over-exploited) should bear a quality hazard identifier. If any of the three quality hazards in terms of Arsenic, Fluoride and Salinity are encountered in the assessment sub unit in mappable units, the assessment sub unit has been tagged with the particular Quality hazard.

2.1.1.12. Allocation of Ground Water Resource for Utilisation

The Annual Extractable Ground Water Resources are to be apportioned between domestic, industrial and irrigation uses. Among these, as per the National Water Policy, requirement for domestic water supply is to be accorded priority. This requirement based on population has been projected to the year 2025, per capita requirement of water for domestic use, and relative load on ground water for urban and rural water supply. In situations where adequate data is not available to make this estimate, the following empirical relation has been utilized.

$$\boldsymbol{Alloc = 22 \times N \times L_g mm\ per\ year} \ldots\ldots\ldots\ldots\ldots\ldots\ldots.\ldots\ldots\ldots\ldots\ldots\ldots\ldots.\ (\mathbf{19})$$

Where,
Alloc = Allocation for domestic water requirement
N = population density in the unit in thousands per sq. km.
L_g= fractional load on ground water for domestic water supply (≤ 1.0)

2.1.1.13. Net Annual Ground Water Availability for Future Use

The water available for future use is obtained by deducting the allocation for domestic use and current extraction for Irrigation and Industrial uses from the Annual Extractable Ground Water Recharge. The resulting ground water potential is termed as the net annual ground water availability for future use. The Net annual ground water availability for future use is calculated separately for non-command areas and command areas. As per the recommendations of the R&D Advisory committee, the ground water available for future use can never be negative. If it becomes negative, the future allocation of Domestic needs can be reduced to current extraction for domestic use. Even then if it is still negative, then the ground water available for future uses has been projected as zero.

2.1.1.14. Additional Potential Resources under Specific Conditions

2.1.1.14.1. Potential Resource Due to Spring Discharge

Spring discharge occurs at the places where ground water level cuts the surface topography. The spring discharge is equal to the ground water recharge minus the outflow through evaporation and evapotranspiration and vertical and lateral sub-surface flow. Thus, Spring Discharge is a form of ‘Annual Extractable Ground Water Recharge’. It is a renewable resource, though has not been used for Categorisation. Spring discharge measurement has been carried out by volumetric measurement of discharge of the springs. Spring discharges multiplied with time in days of each season will give the quantum of spring resources available during that season.

$$\textbf{Potential ground water resource due to springs} = Q \times No.\,of days \ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

Where,
Q = Spring Discharge
No of days = No of days spring yields.

2.1.1.14.2. Potential Resource in Waterlogged and Shallow Water Table Areas

In the area where the ground water level is less than 5m below ground level or in waterlogged areas, the resources up to 5m below ground level are potential and would be available for development in addition to the annual recharge in the area. The computation of potential resource to ground water reservoir in shallow water table areas has been done by adopting the following equation:

$$\textbf{Potential groundwater resource in shallow water table areas} = (5 - D) \times A \times S_Y \ldots\ldots\ldots\ldots (21)$$

Where,
D = Depth to water table below ground surface in pre-monsoon period in shallow aquifers.
A = Area of shallow water table zone.
S_Y = Specific Yield

2.1.1.14.3. Potential Resource in Flood Prone Areas

Ground water recharge from a flood plain is mainly the function of the following parameters-

- Areal extent of flood plain
- Retention period of flood
- Type of sub-soil strata and silt charge in the river water which gets deposited and controls seepage

Since collection of data on all these factors is time taking and difficult, in the meantime, the potential resource from flood plain may be estimated on the same norms as for ponds, tanks and lakes. This has been calculated over the water spread area and only for the retention period using the following formula.

$$\textbf{Potential groundwater resource in Flood Prone Areas} = 1.4 \times N \times \frac{A}{1000} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (22)$$

Where,
N = No. of Days Water is Retained in the Area
A = Flood Prone Area

2.1.1.15. Apportioning of Ground Water Assessment from Watershed to Development Unit

Where the assessment unit is a watershed, there is a need to convert the ground water assessment in terms of an administrative unit such as block/ taluka/ mandal. This has been done as follows.
A block may comprise of one or more watersheds, in part or full. First, the ground water assessment in the subareas, command, non-command and poor ground water quality areas of the watershed has been converted into depth unit (mm), by dividing the annual recharge by the respective area. The contribution of this subarea of the watershed to the block, is now calculated by multiplying this depth with the area in the block occupied by this sub-area.

The total ground water resource of the block has been presented separately for each type of sub-area, namely for command areas, non-command areas and poor ground water quality areas, as in the case of the individual watersheds.

2.2. GROUND WATER ASSESSMENT IN URBAN AREAS

The Assessment of Ground Water Resources in urban areas is similar to that of rural areas. Because of the availability of draft data and slightly different infiltration process and recharge due to other sources, the following few points are to be considered.

- Even though the data on existing ground water abstraction structures are available, accuracy is somewhat doubtful and individuals cannot even enumerate the well census in urban areas. Hence the difference of the actual demand and the supply by surface water sources as the withdrawal from the ground water resources has been considered for the assessment.

- The urban areas are sometimes concrete jungles and rainfall infiltration is not equal to that of rural areas unless and until special measures are taken in the construction of roads and pavements. Hence, 30% of the rainfall infiltration factor has been taken into consideration for urban areas as an adhoc arrangement till field studies in these areas are done and documented field studies are available.

- Because of the water supply schemes, there are many pipelines available in the urban areas and the seepages from these channels or pipes are huge in some areas. Hence this component has been included in the other resources and the recharge has also been considered. The percent losses have been collected from the individual water supply agencies, 50% of which has been considered as recharge to the ground water system.

- In the urban areas in India, normally, there is no separate channels either open or sub surface for the drainage and flash floods. These channels also recharge to some extent the ground water reservoir. As on today, there is no documented field study to assess the recharge. The seepages from the sewerages, which normally contaminate the ground water resources with nitrate also contribute to the quantity of resources and hence same percent as in the case of water supply pipes has been taken as norm for the recharge on the quantity of sewerage when there is sub surface drainage system. If estimated flash flood data is available, the same percent has been used on the quantum of flash floods to estimate the recharge from the flash floods.

- Urban areas with population more than 10 lakhs, has been considered as urban assessment unit while assessing the dynamic ground water resources.

2.3. GROUND WATER ASSESSMENT IN WATER LEVEL DEPLETION ZONES

There are areas where ground water level shows a decline even in the monsoon season. The reasons for this may be any one of the following: (a) There is a genuine depletion in the ground water regime, with ground water extraction and natural ground water discharge in the monsoon season (outflow from the region and base flow) exceeding the recharge. (b) There may be an error in water level data due to inadequacy of observation wells.

If it is concluded that the water level data is erroneous, recharge assessment has been made based on rainfall infiltration factor method. If, on the other hand, water level data is assessed as reliable, the ground water level fluctuation method has been applied for recharge estimation. As ΔS in equation 3& 4 is negative, the estimated recharge will be less than the gross ground water extraction in the monsoon season. It must be noted that this recharge is the gross recharge minus the natural discharges in the monsoon season. The immediate conclusion from such an assessment in water depletion zones is that the area falls under the over-exploited category which requires micro level study.

2.4. NORMS USED IN THE ASSESSMENT

2.4.1. Specific Yield

Recently under Aquifer Mapping Project, Central Ground Water Board has classified all the aquifers into 14 Principal Aquifers which in turn were divided into 42 Major Aquifers. Hence, it is required to assign Specific Yield values to all these aquifer units. The values recommended in the ***Table-2.1*** has been followed in the present assessments, unless sufficient data based on field studies are available to justify the minimum, maximum or other intermediate values

Table-2.1: Norms Recommended for Specific Yield

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
1	Alluvium	AL01	Younger Alluvium (Clay/Silt/Sand/ Calcareous concretions)	Quaternary	10	8	12
2	Alluvium	AL02	Pebble / Gravel/ Bazada/ Kandi	Quaternary	16	12	20
3	Alluvium	AL03	Older Alluvium (Silt/Sand/Gravel/Lithomargic clay)	Quaternary	6	4	8
4	Alluvium	AL04	Aeolian Alluvium (Silt/ Sand)	Quaternary	16	12	20
5	Alluvium	AL05	Coastal Alluvium (Sand/Silt/Clay)	Quaternary	10	8	12
6	Alluvium	AL06	Valley Fills	Quaternary	16	12	20
7	Alluvium	AL07	Glacial Deposits	Quaternary	16	12	20
8	Laterite	LT01	Laterite / Ferruginous concretions	Quaternary	2.5	2	3
9	Basalt	BS01	Basic Rocks (Basalt) - Weathered, Vesicular or Jointed	Mesozoic to Cenozoic	2	1	3
10	Basalt	BS01	Basic Rocks (Basalt) - Massive Poorly Jointed	Mesozoic to Cenozoic	0.35	0.2	0.5
11	Basalt	BS02	Ultra Basic - Weathered, Vesicular or Jointed	Mesozoic to Cenozoic	2	1	3
12	Basalt	BS02	Ultra Basic - Massive Poorly Jointed	Mesozoic to Cenozoic	0.35	0.2	0.5
13	Sandstone	ST01	Sandstone/Conglomerate	Upper Palaeozoic to Cenozoic	3	1	5
14	Sandstone	ST02	Sandstone with Shale	Upper Palaeozoic to Cenozoic	3	1	5
15	Sandstone	ST03	Sandstone with shale/ coal beds	Upper Palaeozoic to Cenozoic	3	1	5

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
16	Sandstone	ST04	Sandstone with Clay	Upper Palaeozoic to Cenozoic	3	1	5
17	Sandstone	ST05	Sandstone/Conglomerate	Proterozoic to Cenozoic	3	1	5
18	Sandstone	ST06	Sandstone with Shale	Proterozoic to Cenozoic	3	1	5
19	Shale	SH01	Shale with limestone	Upper Palaeozoic to Cenozoic	1.5	1	2
20	Shale	SH02	Shale with Sandstone	Upper Palaeozoic to Cenozoic	1.5	1	2
21	Shale	SH03	Shale, limestone and sandstone	Upper Palaeozoic to Cenozoic	1.5	1	2
22	Shale	SH04	Shale	Upper Palaeozoic to Cenozoic	1.5	1	2
23	Shale	SH05	Shale/Shale with Sandstone	Proterozoic to Cenozoic	1.5	1	2
24	Shale	SH06	Shale with Limestone	Proterozoic to Cenozoic	1.5	1	2
25	Limestone	LS01	Miliolitic Limestone	Quarternary	2	1	3
26	Limestone	LS01	KarstifiedMiliolitic Limestone	Quarternary	10	5	15
27	Limestone	LS02	Limestone / Dolomite	Upper Palaeozoic to Cenozoic	2	1	3
28	Limestone	LS02	Karstified Limestone / Dolomite	Upper Palaeozoic to Cenozoic	10	5	15
29	Limestone	LS03	Limestone/Dolomite	Proterozoic	2	1	3
30	Limestone	LS03	Karstified Limestone/Dolomite	Proterozoic	10	5	15
31	Limestone	LS04	Limestone with Shale	Proterozoic	2	1	3
32	Limestone	LS04	Karstified Limestone with Shale	Proterozoic	10	5	15
33	Limestone	LS05	Marble	Azoic to Proterozoic	2	1	3
34	Limestone	LS05	Karstified Marble	Azoic to Proterozoic	10	5	15
35	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyolite etc.) - Weathered , Jointed	Mesozoic to Cenozoic	1.5	1	2
36	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyolite etc.)-Massive or Poorly Fractured	Mesozoic to Cenozoic	0.35	0.2	0.5

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
37	Granite	GR02	Acidic Rocks (Pegmatite, Granite, Syenite, Rhyolite etc.) - Weathered, Jointed	Proterozoic to Cenozoic	3	2	4
38	Granite	GR02	Acidic Rocks (Pegmatite, Granite, Syenite, Rhyolite etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.35	0.2	0.5
39	Schist	SC01	Schist - Weathered, Jointed	Azoic to Proterozoic	1.5	1	2
40	Schist	SC01	Schist - Massive, Poorly Fractured	Azoic to Proterozoic	0.35	0.2	0.5
41	Schist	SC02	Phyllite	Azoic to Proterozoic	1.5	1	2
42	Schist	SC03	Slate	Azoic to Proterozoic	1.5	1	2
43	Quartzite	QZ01	Quartzite - Weathered, Jointed	Proterozoic to Cenozoic	1.5	1	2
44	Quartzite	QZ01	Quartzite - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.3	0.2	0.4
45	Quartzite	QZ02	Quartzite - Weathered, Jointed	Azoic to Proterozoic	1.5	1	2
46	Quartzite	QZ02	Quartzite- Massive, Poorly Fractured	Azoic to Proterozoic	0.3	0.2	0.4
47	Charnockite	CK01	Charnockite - Weathered, Jointed	Azoic	3	2	4
48	Charnockite	CK01	Charnockite - Massive, Poorly Fractured	Azoic	0.3	0.2	0.4
49	Khondalite	KH01	Khondalites, Granulites - Weathered, Jointed	Azoic	1.5	1	2
50	Khondalite	KH01	Khondalites, Granulites - Mssive, Poorly Fractured	Azoic	0.3	0.2	0.4
51	Banded Gneissic Complex	BG01	Banded Gneissic Complex - Weathered, Jointed	Azoic	1.5	1	2
52	Banded Gneissic Complex	BG01	Banded Gneissic Complex - Massive, Poorly Fractured	Azoic	0.3	0.2	0.4
53	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Weathered, Jointed	Azoic to Proterozoic	1.5	1	2
54	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Massive, Poorly Fractured	Azoic to Proterozoic	0.3	0.2	0.4
55	Gneiss	GN02	Gneiss -Weathered, Jointed	Azoic to Proterozoic	3	2	4
56	Gneiss	GN02	Gneiss-Massive, Poorly Fractured	Azoic to Proterozoic	0.3	0.2	0.4

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
57	Gneiss	GN03	Migmatitic Gneiss - Weathered, Jointed	Azoic	1.5	1	2
58	Gneiss	GN03	Migmatitic Gneiss - Massive, Poorly Fractured	Azoic	0.3	0.2	0.4
59	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Weathered, Jointed	Proterozoic to Cenozoic	2	1	3
60	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.35	0.2	0.5
61	Intrusive	IN02	Ultrabasics (Epidiorite, Granophyre etc.) - Weathered, Jointed	Proterozoic to Cenozoic	2	1	3
62	Intrusive	IN02	Ultrabasics (Epidiorite, Granophyre etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	0.35	0.2	0.5

2.4.2. Rainfall Infiltration Factor

The values mentioned in ***Table-2.2*** has been used in the present assessment. The recommended Rainfall Infiltration Factor values has been used for assessment, unless sufficient data based on field studies are available to justify the minimum, maximum or other intermediate values.

Table-2.2: Norms Recommended for Rainfall Infiltration Factor

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
1	Alluvium	AL01	Younger Alluvium (Clay/Silt/Sand/ Calcareous concretions)	Quaternary	22	20	24
2	Alluvium	AL02	Pebble / Gravel/ Bazada/ Kandi	Quaternary	22	20	24
3	Alluvium	AL03	Older Alluvium (Silt/Sand/Gravel/Lithomargic clay)	Quaternary	22	20	24
4	Alluvium	AL04	Aeolian Alluvium (Silt/ Sand)	Quaternary	22	20	24
5	Alluvium	AL05	Coastal Alluvium (Sand/Silt/Clay) -East Coast	Quaternary	16	14	18
5	Alluvium	AL05	Coastal Alluvium (Sand/Silt/Clay) - West Coast	Quaternary	10	8	12
6	Alluvium	AL06	Valley Fills	Quaternary	22	20	24
7	Alluvium	AL07	Glacial Deposits	Quaternary	22	20	24

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
8	Laterite	LT01	Laterite / Ferruginous concretions	Quaternary	7	6	8
9	Basalt	BS01	Basic Rocks (Basalt) - Vesicular or Jointed	Mesozoic to Cenozoic	13	12	14
9	Basalt	BS01	Basic Rocks (Basalt) - Weathered	Mesozoic to Cenozoic	7	6	8
10	Basalt	BS01	Basic Rocks (Basalt) - Massive Poorly Jointed	Mesozoic to Cenozoic	2	1	3
11	Basalt	BS02	Ultra Basic - Vesicular or Jointed	Mesozoic to Cenozoic	13	12	14
11	Basalt	BS02	Ultra Basic - Weathered	Mesozoic to Cenozoic	7	6	8
12	Basalt	BS02	Ultra Basic - Massive Poorly Jointed	Mesozoic to Cenozoic	2	1	3
13	Sandstone	ST01	Sandstone/Conglomerate	Upper Palaeozoic to Cenozoic	12	10	14
14	Sandstone	ST02	Sandstone with Shale	Upper Palaeozoic to Cenozoic	12	10	14
15	Sandstone	ST03	Sandstone with shale/ coal beds	Upper Palaeozoic to Cenozoic	12	10	14
16	Sandstone	ST04	Sandstone with Clay	Upper Palaeozoic to Cenozoic	12	10	14
17	Sandstone	ST05	Sandstone/Conglomerate	Proterozoic to Cenozoic	6	5	7
18	Sandstone	ST06	Sandstone with Shale	Proterozoic to Cenozoic	6	5	7
19	Shale	SH01	Shale with limestone	Upper Palaeozoic to Cenozoic	4	3	5
20	Shale	SH02	Shale with Sandstone	Upper Palaeozoic to Cenozoic	4	3	5
21	Shale	SH03	Shale, limestone and sandstone	Upper Palaeozoic to Cenozoic	4	3	5

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
22	Shale	SH04	Shale	Upper Palaeozoic to Cenozoic	4	3	5
23	Shale	SH05	Shale/Shale with Sandstone	Proterozoic to Cenozoic	4	3	5
24	Shale	SH06	Shale with Limestone	Proterozoic to Cenozoic	4	3	5
25	Limestone	LS01	Miliolitic Limestone	Quarternary	6	5	7
27	Limestone	LS02	Limestone / Dolomite	Upper Palaeozoic to Cenozoic	6	5	7
29	Limestone	LS03	Limestone/Dolomite	Proterozoic	6	5	7
31	Limestone	LS04	Limestone with Shale	Proterozoic	6	5	7
33	Limestone	LS05	Marble	Azoic to Proterozoic	6	5	7
35	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyolite etc.) - Weathered , Jointed	Mesozoic to Cenozoic	7	5	9
36	Granite	GR01	Acidic Rocks (Granite,Syenite, Rhyolite etc.)-Massive or Poorly Fractured	Mesozoic to Cenozoic	2	1	3
37	Granite	GR02	Acidic Rocks (Pegmatite, Granite, Syenite, Rhyolite etc.) - Weathered, Jointed	Proterozoic to Cenozoic	11	10	12
38	Granite	GR02	Acidic Rocks (Pegmatite, Granite, Syenite, Rhyolite etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	2	1	3
39	Schist	SC01	Schist - Weathered, Jointed	Azoic to Proterozoic	7	5	9
40	Schist	SC01	Schist - Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
41	Schist	SC02	Phyllite	Azoic to Proterozoic	4	3	5
42	Schist	SC03	Slate	Azoic to Proterozoic	4	3	5
43	Quartzite	QZ01	Quartzite - Weathered, Jointed	Proterozoic to Cenozoic	6	5	7
44	Quartzite	QZ01	Quartzite - Massive, Poorly Fractured	Proterozoic to Cenozoic	2	1	3
45	Quartzite	QZ02	Quartzite - Weathered, Jointed	Azoic to Proterozoic	6	5	7

Sl. No.	Principal Aquifer	Major Aquifers		Age	Recommended (%)	Minimum (%)	Maximum (%)
		Code	Name				
46	Quartzite	QZ02	Quartzite- Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
47	Charnockite	CK01	Charnockite - Weathered, Jointed	Azoic	5	4	6
48	Charnockite	CK01	Charnockite - Massive, Poorly Fractured	Azoic	2	1	3
49	Khondalite	KH01	Khondalites, Granulites - Weathered, Jointed	Azoic	7	5	9
50	Khondalite	KH01	Khondalites, Granulites - Mssive, Poorly Fractured	Azoic	2	1	3
51	Banded Gneissic Complex	BG01	Banded Gneissic Complex - Weathered, Jointed	Azoic	7	5	9
52	Banded Gneissic Complex	BG01	Banded Gneissic Complex - Massive, Poorly Fractured	Azoic	2	1	3
53	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Weathered, Jointed	Azoic to Proterozoic	7	5	9
54	Gneiss	GN01	Undifferentiated metasedimentaries/ Undifferentiated metamorphic - Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
55	Gneiss	GN02	Gneiss -Weathered, Jointed	Azoic to Proterozoic	11	10	12
56	Gneiss	GN02	Gneiss-Massive, Poorly Fractured	Azoic to Proterozoic	2	1	3
57	Gneiss	GN03	Migmatitic Gneiss - Weathered, Jointed	Azoic	7	5	9
58	Gneiss	GN03	Migmatitic Gneiss - Massive, Poorly Fractured	Azoic	2	1	3
59	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Weathered, Jointed	Proterozoic to Cenozoic	7	6	8
60	Intrusive	IN01	Basic Rocks (Dolerite, Anorthosite etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	2	1	3
61	Intrusive	IN02	Ulrta Basics (Epidiorite, Granophyre etc.) - Weathered, Jointed	Proterozoic to Cenozoic	7	6	8
62	Intrusive	IN02	Ulrta Basics (Epidiorite, Granophyre etc.) - Massive, Poorly Fractured	Proterozoic to Cenozoic	2	1	3

2.4.3. Norms for Canal Recharge

The Norms suggested in ***Table-2.3*** has been used for estimating the recharge from Canals, where sufficient data based on field studies are not available.

Table-2.3: Norms Recommended for Recharge due to Canals

Formation	Canal Seepage factor ham/day/million square meters of wetted area		
	Recommended	Minimum	Maximum
Unlined canals in normal soils with some clay content along with sand	17.5	15	20
Unlined canals in sandy soil with some silt content	27.5	25	30
Lined canals in normal soils with some clay content along with sand	3.5	3	4
Lined canals in sandy soil with some silt content	5.5	5	6
All canals in hard rock area	3.5	3	4

2.4.4. Norms for Recharge Due to Irrigation

The Recommended Norms are presented in ***Table-2.4***.

Table-2.4: Norms Recommended for Recharge from Irrigation

DTW m bgl	**Ground Water**		**Surface Water**	
	Paddy	**Non-paddy**	**Paddy**	**Non-paddy**
≤ 10	45.0	25.0	50.0	30.0
11	43.3	23.7	48.3	28.7
12	40.4	22.1	45.1	26.8
13	37.7	20.6	42.1	25.0
14	35.2	19.2	39.3	23.3
15	32.9	17.9	36.7	21.7
16	30.7	16.7	34.3	20.3
17	28.7	15.6	32.0	18.9
18	26.8	14.6	29.9	17.6
19	25.0	13.6	27.9	16.4
20	23.3	12.7	26.0	15.3
21	21.7	11.9	24.3	14.3
22	20.3	11.1	22.7	13.3
23	18.9	10.4	21.2	12.4

DTW m bgl	Ground Water		Surface Water	
	Paddy	Non-paddy	Paddy	Non-paddy
24	17.6	9.7	19.8	11.6
≥ 25	20.0	5.0	25.0	10.0

2.4.5. Norms for Recharge due to Tanks & Ponds

As the data on the field studies for computing recharge from Tanks & Ponds are very limited, for Seepage from Tanks & Ponds has been used as 1.4 mm / day in the present assessment.

2.4.6. Norms for Recharge due to Water Conservation Structures

The data on the field studies for computing recharge from Water Conservation Structures are very limited, hence, the norm recommended by GEC-2015 for the seepage from Water Conservation Structures is 40% of gross storage during a year which means 20% during monsoon season and 20% during non-monsoon Season is adopted.

2.4.7. Unit Draft

The methodology recommends to use well census method for computing the ground water draft. The norm used for computing ground water draft is the unit draft. The unit draft can be computed by field studies. This method involves selecting representative abstraction structure and calculating the discharge from that particular type of structure and collecting the information on how many hours of pumping is being done in various seasons and number of such days during each season. The Unit Draft during a particular season is computed using the following equation:

$$\boldsymbol{Unit\ Draft = Discharge\ in\ m^3/hr \times No. of\ pumping\ hours\ in\ a\ day \times No. of\ days} \ldots\ldots\ldots (\mathbf{29})$$

But the procedure that is being followed for computing unit draft does not have any normalization procedure. Normally, if the year in which one collects the draft data in the field is an excess rainfall year, the abstraction from ground water will be less. Similarly, if the year of the computation of unit draft is a drought year the unit draft will be high. Hence, there is a requirement to devise a methodology that can be used for the normalization of unit draft figures. The following are the two simple techniques, which are followed for normalization of Unit Draft. Areas where, unit draft values for one rainfall cycle are available for at least 10 years second method shown in equation 31 is followed or else the first method shown in equation 30 has been used.

$$\boldsymbol{Normalised\ Unit\ Draft = \frac{Unit\ Draft \times Rainfall\ for\ the\ year}{Normal\ Rainfall}} \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{30})$$

$$\boldsymbol{Normalised\ Unit\ Draft = \frac{\sum_{i=1}^{n} Unit\ Draft_i}{Number\ of\ Years}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{31})$$

2.5. INDIA -GROUNDWATER RESOURCE ESTIMATION SYSTEM (IN-GRES)

"INDIA-GROUNDWATER RESOURCE ESTIMATION SYSTEM (IN-GRES) is a Software/Web-based Application developed by CGWB in collaboration with IIT-Hyderabad. It provides common and standardized platform for Ground Water Resource Estimation for the entire country and its pan-India operationalization (Central and State Governments). The system takes 'Data Input' through Excel as well as Forms, compute various ground water components (recharge, extraction etc.) and classify assessment units into appropriate categories (safe, semi-critical, critical and over-exploited). The Software uses GEC 2015 Methodology for estimation and calculation of Groundwater resources. It allows for unique and homogeneous representation of groundwater fluxes as well as categories for all the assessment units (AU) of the country.

URL of IN-GRES →http://ingres.iith.ac.in

CHAPTER 3

3.0 RAINFALL

3.1 Normal Rainfall of Jharkhand

The amount and distribution of rainfall have a strong bearing on the state economy, as the agricultural activity is mainly dependent on rainfall. In addition, rainfall is the main source of ground water recharge in the entire state. The annual normal rainfall for the state is 1301 mm. District-wise; it ranges from 1528 mm at Pakur to 1084.1 mm at Godda. District wise distribution of normal annual rainfall is given in **Table 3.1** The analysis of isohyets of mean annual rainfall indicates that in major part of the state, the rainfall remains between 1200 and 1400 mm/year. Major part of the annual downpour is from the south-western monsoon, which sets in the second week of June. This monsoon rainfall accounts for about 83% of the total annual rainfall of the state. District wise percentage of monsoon rainfall ranges from 79.13% in Dumka to as high as 87.98% at Chatra. Annual Normal Rainfall (cm) of Jharkhand State is showing in figure-1

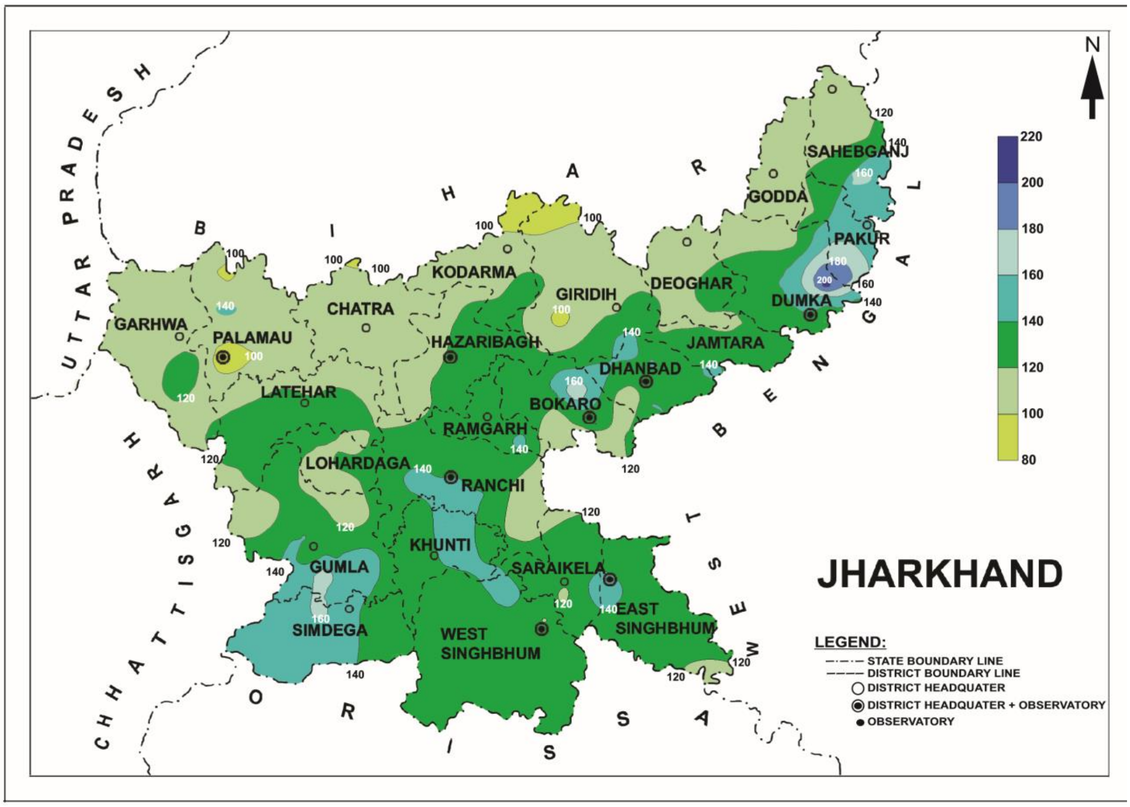

Figure1: Annual Normal Rainfall (cm) of Jharkhand State

3.2 District Wise Normal Rainfall of Jharkhand

District wise normal rainfall presented in table 3.1

Table 3.1 District-wise Normal Rainfall of Jharkhand State

Sl. No.	Name of the Districts	Normal Annual Rainfall (mm)	Normal Monsoon Rainfall (mm)
1.	Bokaro	1259.6	1040.2
2.	Chatra	1206.3	1061.3
3.	Deoghar	1220.7	993.3
4.	Dhanbad	1295.6	1074.7
5.	Dumka	1422.5	1125.6
6.	East Singhbhum	1403.4	1136.4
7.	Garhwa	1210.3	1047.7
8.	Giridih	1215.6	1024.2
9.	Godda	1084.1	883.6
10.	Gumla	1460.9	1208.5
11.	Hazaribagh	1251.2	1040.5
12.	Jamtara	1447.4	1182.5
13.	Khunti	1323.2	1086.4
14.	Koderma	1115.9	940.7
15.	Latehar	1237.2	1061.3
16.	Lohardaga	1194.3	985.3
17.	Pakur	1528.0	1215.3
18.	Palamau	1169.4	1014.5
19.	Ramgarh	1251.2	1040.5
20.	Ranchi	1323.2	1086.4
21.	Sahebganj	1410.6	1153.9
22.	Saraikela	1307.6	1068.7
23.	Simdega	1506.5	1317.0
24.	West Singhbhum	1351.6	

3.3 Rainfall during the Calendar Year 2023 of Jharkhand State ;

Rainfall during the Calendar Year 2023 of Jharkhand State is presented in table 3.2

Table 3.2 Rainfall during the Calendar Year 2023 of Jharkhand State

S.No.	District	Monsoon	Non- Monsoon
		*Actual (mm)	*Actual (mm)
1.	Bokaro	681.62	84.71
2.	Chatra	646.51	24.59
3.	Deoghar	678.98	127.03
4.	Dhanbad	577.72	105.69
5.	Dumka	715.55	16.47
6.	East Singhbhum	1034.93	38.08
7.	Garhwa	873.52	36.69
8.	Giridih	626.12	96.37
9.	Godda	748.74	130.97
10.	Gumla	694.11	64.63
11.	Hazaribagh	801.25	57.44
12.	Jamtara	711.00	96.23
13.	Khunti	866.71	126.12
14.	Koderma	736.73	41.53
15.	Latehar	1027.59	72.39
16.	Lohardaga	900.97	154.79
17.	Pakur	841.92	140.75
18.	Palamau	857.49	11.59
19.	Ramgarh	793.65	152.67
20.	Ranchi	763.77	109.63
21.	Sahebganj	814.29	127.23
22.	Saraikela Kharsawan	778.46	121.94
23.	Simdega	1073.11	125.47
24.	West Singhbhum	1030.23	262.98

3.4 District wise Rainfall during Ground Water Assessment Year 2023-24 for the Jharkhand State

District wise Rainfall during Ground Water Assessment Year 2023-24 for the Jharkhand State is presented in 3.3

Table 3.3 Rainfall during Ground Water Assessment Year 2023-24 for Jharkhand State

S.No.	District	Monsoon	Non- Monsoon
		*Actual (mm)	*Actual (mm)
1.	Bokaro	681.62	84.71
2.	Chatra	646.51	24.59
3.	Deoghar	678.98	127.03
4.	Dhanbad	577.72	105.69
5.	Dumka	715.55	16.47
6.	East Singhbhum	1034.93	38.08
7.	Garhwa	873.52	36.69
8.	Giridih	626.12	96.37
9.	Godda	748.74	130.97
10.	Gumla	694.11	64.63
11.	Hazaribagh	801.25	57.44
12.	Jamtara	711.00	96.23
13.	Khunti	866.71	126.12
14.	Koderma	736.73	41.53
15.	Latehar	1027.59	72.39
16.	Lohardaga	900.97	154.79
17.	Pakur	841.92	140.75
18.	Palamau	857.49	11.59
19.	Ramgarh	793.65	152.67
20.	Ranchi	763.77	109.63
21.	Sahebganj	814.29	127.23
22.	Saraikela Kharsawan	778.46	121.94
23.	Simdega	1073.11	125.47
24.	West Singhbhum	1030.23	262.98

CHAPTER 4

4.0 HYDROGEOLOGICAL SETUP OF JHARKHAND

Based on the hydrogeological setup, ground water conditions and aquifer hydraulic parameters, the state can broadly be divided into three hydrogeological units.

4.1 Categorisation of Hydrogeological units

(1) Fissured Formation (2) Semi-consolidated formation (3) Porous formation

Fissured formations are hard and compact rocks where ground water occurs only within secondary porosities or in overlying weathered mantle. On the other hand, rocks of Gondwana Super group, belongs to semi-consolidation formations, where in many places the rocks are friable and have significant primary porosity; however, with depth it becomes insignificant. Porous formation represents unconsolidated rocks, where ground water occurs within the primary porosity only. The alluvial deposits, valley fill deposits and the Tertiary beds of East Singhbhum district occurring in the south-eastern corner of the state are considered as Porous formation. The principal aquifer map has been presented in Plate-2. Different rock types belonging to different hydrogeological units are given below:

i) Fissured Formation

1. Granite Gneiss, Schist, Phyllites and other rocks belong to CGGC and Archaean cratonic mass of Singhbhum;
2. Rocks belong to Vindhyan Supergroup; and
3. Rajmahal Trap.

ii) Semi-consolidated formation

1. Gondwana Supergroup

iii) Porous formation

1. Laterite;
2. Tertiary deposits; and
3. Alluvial and valley fill deposit

4.1.1 Igneous & Metamorphic Rocks of Precambrian Age and Archaean Cratonic Mass

This is the major rock type of the state covering nearly 85 percent of the geographical area of the state. In these rock types, ground water occurs within the weathered zone and underlain secondary porosities like fractures, joints ad fissures. The thickness of weathered zone ranges generally between 10-25 m, but in localized patches, it exceeds even 30m. The weathered zone is a good repository of ground water; however, exploratory wells by CGWB revealed that the secondary porosities below the weathered zones also form potential aquifers. The deep fracture zones (generally below 40m bgl) are exploited particularly in urban areas. Common ground water abstraction structures are open dug wells and shallow bore wells and rarely deep bore wells. In general, 2 – 4 sets with a maximum of 8 sets of fracture zones may be encountered within 200m bgl.

Yield of exploratory wells range from negligible up to 151 m3/hr. Hydraulic parameters in different formations of Jharkhand state are given in Table 4.1. Hydrogeological conditions and Ground water potentials in different formations in Jharkhand state is given in Table 4.2 Yield varies most widely in Deoghar district (0.60 – 151 m3/hr) with a drawdown variation of 3.6 to 30.0m. High variation of yield is also observed for districts like Dumka, Dhanbad and Hazaribagh. However, by and large, yield remains below 30m3/hr in granites and gneisses, and below 15 m3/hr in schists, phyllites and other litho-units of volcano-sedimentary sequence. Draw-down varies from 02 – 46m, but in most of the cases limited within 20 m. Transmissivity values ranges from 0.9-186 m2/day. Storativity data indicates that at deeper level the ground water occurs under confined to semi-confined condition. The dug wells generally tap the weathered zone and if needed top 2-3 m of basement rocks. Dug wells tapping granite and gneiss have a discharge of 510 m3/hr.

4.1.2 Vindhyan Supergroup

The Vindhyan rocks do not form potential aquifer system as such. They are exposed in parts of Palamau and Garhwa districts over a limited area. Ground water occurs within the secondary porosities like fractures and joints. The Vindhyan sandstones, when fractured, bear a good ground water potentiality in comparison to the shales. The boreholes tapping the fracture zones of lower Vindhyans, between 50 and 75 mbgl, around Bhawnathpur area, shows more potentiality, with the recorded yield as high as 13 – 18 m3/hr.

4.1.3 Volcanic Rocks

The volcanic rocks occur in the north-eastern part of the state covering parts of Sahebganj, Pakur and Godda districts and in south-eastern part covering parts of East, West Singhbhum and Saraikela districts. Out of these areas, volcanic formations have been extensively exploited in the north-eastern part of the state (known as Rajmahal Traps) covering mainly Sahebganj and Pakur and parts of Dumka & Godda districts. In the Rajmahal traps, a series of flows are horizontally laid in a stack. In an individual flow, the lowest part remains massive, this grades upwards into vesicular variety. The thickness of individual flow varied from 20 – 70m, having an average of 23m. Thin inter-trappean beds are also present between the flows. In most of the cases, vesicles act as aquifers. The fissures, joints and fractures below the weathered zone have been found to be quite productive. The fractures are trapped between 15-120 m, where the cumulative yield ranges between 6 to 51 m3/hr but generally it remains within 20 m3/hr. The transmissivity values ranges from 3 to 176 m2/day. The storativity value indicates semi-confined to confined mode of ground water occurrence at deeper levels. CGWB well at Amrapara (depth 92.5 m) turned out to be an auto flow well having hydraulic head at 1.55 m agl.

4.1.4 Gondwana Supergroup

The sediments belonging to Gondwana Supergroup are semi-consolidated in nature where ground water occurs within inter-granular pore spaces as well as within the secondary porosities like fractures and joints. These formations are exposed as patches in the districts of Hazaribagh, Dhanbad, Giridih, Bokaro, Ranchi, Dumka, Jamtara, Latehar, Godda and Garhwa districts. The drilling data, of CGWB and other agencies involved in the ground water investigation, indicate that ground water occur in semi-confined to locally confined at deeper level and unconfined condition at shallow level. At places, auto flow condition is encountered. The shallow aquifer zone includes weathered zone (8 to 20m thick) and the underlying fractures. Shallow bore wells tapping fracture zones within 60m bgl are common ground water structures in the area. In deeper aquifer zone, CGWB exploratory drillings encountered 2 to 3 fractures within 200m bgl with an average discharge of about 20 m3/hr. However, CMPDIL (1992) has identified 5 confined aquifer system in the Barakar formation containing coal seams in Lalmatia sector, based on geological and hydrogeological consideration. The thickness of aquifer ranges from 10-70 m and the cumulated yield ranges from 50-135 m3/hr, however discharge of individual aquifer ranges from 10-60 m3/hr in general. Out of 5 confined aquifers, Aquifer–III, up to the depth of 50m is most potential capable of yield of 40-60 m3/hr of water under free flowing condition.

4.1.5 Laterites and Tertiary Sediments

Tertiary deposits occur in Chakulia-Bahragora-Dhalbhumgarh tract of East Singhbhum district. Exploratory drilling by CGWB indicates potential aquifer system within 133 m bgl encountering 04 granular zones. The cumulative yield ranges from 18 to 78 m3/hr. The transmissivity ranges from 208 to 570 m2/day. Water level ranges from 3.6m to 23 m bgl. Dug wells of 15 to 20 m deep and shallow tube wells of 40 to 50m depths are also used as ground water abstraction structures in this formation in the state.

4.1.6 Younger Alluvium

The Younger Alluvium deposits are confined in patches and occur, mainly in the districts Godda, Sahebganj, Pakur, Palamu and East Singhbhum. Except these, they occur as small patches in Latehar, Palamau, Deoghar and Garhwa districts. In Godda and Sahebganjthe alluvial deposits confined in northern and eastern part of the districts and merges with the Indo – Gangetic Plain. At some places these occur as valley fill deposits. The shallow aquifer is of good potential and dug wells, hand pumps and shallow tube wells are the common ground water structures. The depth of dug wells in general ranges between 10 – 15 m bgl while the depth of shallow tube wells varies between 20 – 40 m bgl. Hydraulic parameters of deeper aquifer are not available as CGWB has not carried out exploratory drilling in the alluvial areas so far. The data collected from different agencies indicate that discharge may go upto 40 m3/hr if sufficient thickness of aquifer is available. Principal Aquifer system of Jharkhand state is showing in figure-2

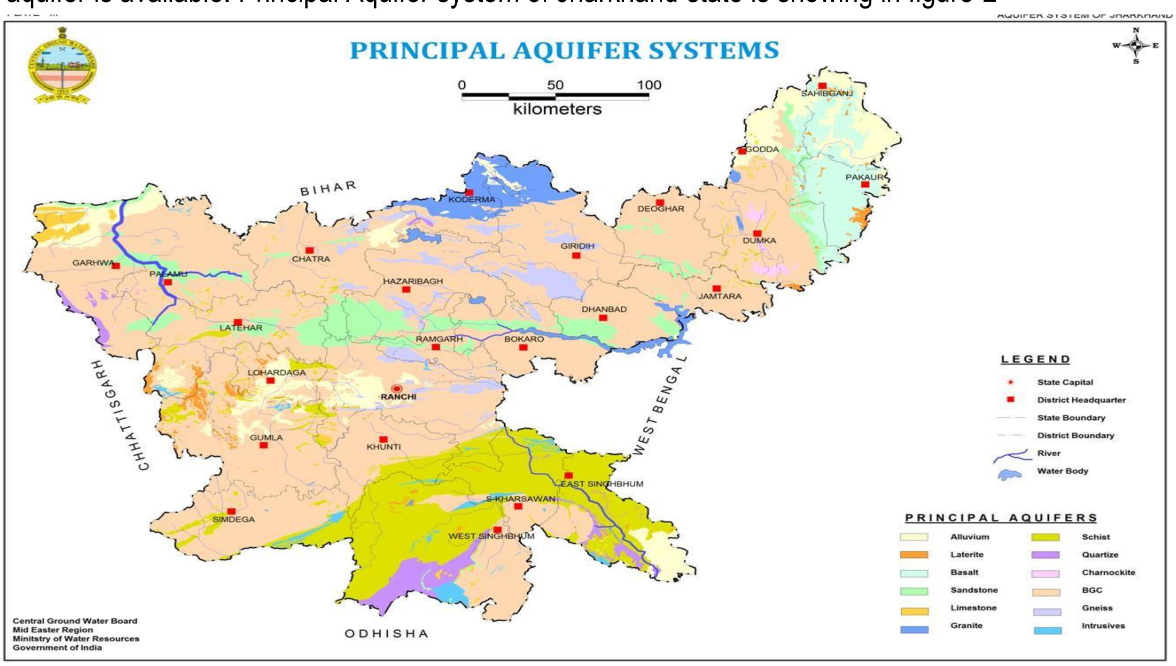

Figure 2 : Principal Aquifer system of Jharkhand

Table 4.1 Hydraulic parameters in different geological formations of Jharkhand State (Source: CGWB)

Formation	Depth drilled(m)	No. of fractures	SWL(m bgl)	Discharge (m3/hr)	Draw-Down(m)	T(m2/day)	S
Granite Gneiss	209	1-8	1.50-4.37	Negligible -151	1.68-45.84	0.9 - 186.0	1.4x10-2 - 1.01x10-5
Rajmahal Traps	**170**.3	2-5	1.55-1.36	1.10 - 51.6	3.67-36.00	17.0 - 176.0	1.4x10-4 to 7.3x10-5
Gondwana Sediments	198.5	2-4	3.30-17.90	0.9 - 4.5	16.50	3.0 - 4.5	1.3x10-2 - 6.1x 10-5
Tertiary Sediments	133.0	2-4	3.63-23.04	18.0-78.0	10.98-14.44	208.0-570.10	1.3 x 10-3

Table 4.2 Hydrogeological conditions and Ground water potentials in different formations in Jharkhand

HG. Fm.	Age Group	Lithology	Hydrogeological condition	Ground Water Potential
Porous formation	Quaternary	ALLUVIUM – clay, silt, gravel, pebbles, calc. concretions	Ground Water occurs under unconfined to locally semi-confined condition. Water level 2-10 m bgl. Multi-layered sandy aquifer down to depth of 80 m below ground.	Moderately low yield potential upto 40m3/hr.
		ALLUVIUM – very limited thickness, clay, silt, sand	Thickness of deposit 5 to 20 m in general. Ground water occurs under unconfined condition	Very limited yield prospect, up to 10 m3/hr
	Pleistocene – Tertiary	LATERITES – primary and secondary lithomarge	Thickness varies from 5 to 40 m. Ground water occurs under unconfined condition.	Very limited yield prospect. Generally within 10 m3/hr.

		TERTIARY DEPOSITS – sand, silt, clay, pebble, gravel	Thickness of deposit up to 130m. Multi-layered sandy aquifer, ground water under semi-confined condition. Water level 4 – 23 m bgl.	Moderate yield potential up to 80 m3/hr.
Semi-consolidated formation	L. Carboniferous - Early Cretaceous	GONDWANA – silt stone, clay stone, grit, sandstone, shale, conglomerate including intrusive	Ground Water within weathered zone under unconfined condition and at deeper level within primary and secondary porosity under semi – confined to confined condition	Limited yield potentialupto 30m3/hr.Subject to proper well location and construction,
Fissured Formation	Lower Jurassic - Early Cretaceous	RAJMAHAL BASALT – basalt flows with inter-trappeans of fine grained sediments	Ground Water restricted to weathered zone under unconfined condition and fractures /joints /vesicular zones at depth down to 130 m bgl under semi-confined condition. Water level generally within 10 m bgl, localized auto flow condition.	Very limited yield potential upto 20 m3/hr subject to proper well designing
	Proterozoic - Early Cambrian	VINDHYAN – quartzite, conglomerate, limestone, sandstone, dolomite, shale	Ground Water restricted to weathered zone under unconfined condition and semi-confined condition at deeper fractures / joints. Water level generally between 4 and 10 m bgl.	Very limited yield potential upto 20 m3/hr subject to proper well designing

	Proterozoic - Archaean	SINGHBHUM GRANITE, CHHOTANAGPUR GNEISSIC COMPLEX – variety of gneisses and granites	Ground Water restricted to weathered zone under unconfined condition and within deeper fractures/ joints down to 199 m under unconfined to semiconfined condition. Water level generally varies widely, up to 25 m bgl.	Limited yield.Generallywithin 30 m3/hr, subject to proper well designing.
		VOLCANO SEDIMENTARY SEQUENCE – schists, phyllites, basic and acidic intrusive	Ground Water restricted to weathered zone under unconfined condition and within deeper fractures/ joints down to 140 m under semi – confined condition. Water level varies between 5 and 20 m bgl in general.	Very limited yield potential. Generally within 15 m3/hr, subject to proper well designing.

CHAPTER-5

5.0 GROUND WATER LEVEL SCENARIO IN JHARKHAND

Ground Water level in the state of Jharkhand varies considerably depending upon the terrain, hydrogeological conditions. Central Ground Water Board is monitoring 460 (DW) hydrograph network stations four times in a year viz., January 1stto 10th, May 20th to 30th, August 20th to 30th and November 1stto 10th. All the monitoring stations are open dug wells and piezometers. The depth to water level map for Pre and post-monsoon (2023) has been shown in figure 3 & 4

5.1 Groundwater Level Scenario (2023)

Groundwater level data of pre-monsoon 2023

During Pre- Monsoon period (May 2023), 369 HNS were analysed. The Minimum depth to water level is 1 m bgl has been observed at Gumla district, and maximum is 15.79 m bgl at Ranchi district. The depth to water level rests in range of 5 – 10 m bgl in 86% of the area of Jharkhand State, which covers almost entire part of the state except very small part of Sahibganj, Pakur, Jamtara, Dhanbad, Bokaro, Chatra, East Singhbhum, W singhbhum, Simdega and Gumla districts and some other small patch like areas. The depth to water level rests in the range of 2-5 m bgl in only 14% of the area covering very small part of Sahibganj, Pakur, Jamtara, Dhanbad, Bokaro, Chatra, East Singhbhum, W singhbhum, Simdega and Gumla districts and some other small patch like areas. In ~ 12% of NHS well shows depth to water level > 10 m bgl has been recorded, which distributed as isolated patches mainly in West Singhbhum, Godda, Giridih, Ranchi and Lohardaga district. In only 14 Hydrograph Network Station (HNS) shows the depth to water level < 2 m bgl has been recorded.

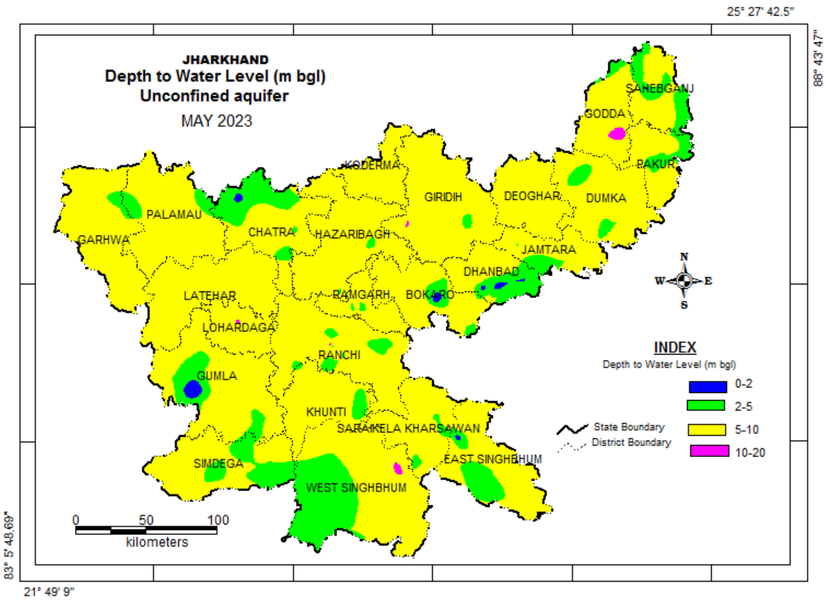

Figure 3: Pre-monsoon Depth to Water Level Map (2023)

Groundwater level data for post-monsoon 2023

Total 425 HNS wells were analysed during post-monsoon period (November 2023). The minimum and the maximum depth to water levels have been recorded as 0.19 m bgl (Gumla district) and 14.11 m bgl (Koderma district) respectively. In major area of the State (62%) water level rests in range of 2 – 5 m bgl which covers almost entire Southern part and major part of Northern part of Jharkhand State. The depth to water level in the range of 5-10 m bgl occurs in about 26 % of the area, which occurs in part of Dumka, Deoghar, Pakur, Giridih, Bokaro, Hazaribagh, Chatra, Latehar, Lohardaga, and some other small part of the state. The water level in the range of 0 – 2 m bgl has been observed in only 8% of HNS wells, spatially covers as small patches at many locations, E & W Singhbhum, Simdega, Gumla, and other small patches. There are 16 HNS stations in E Singhbhum, Koderma, jamtara, Hazaribagh and Bokaro where level has been observed more than 10 m bgl.

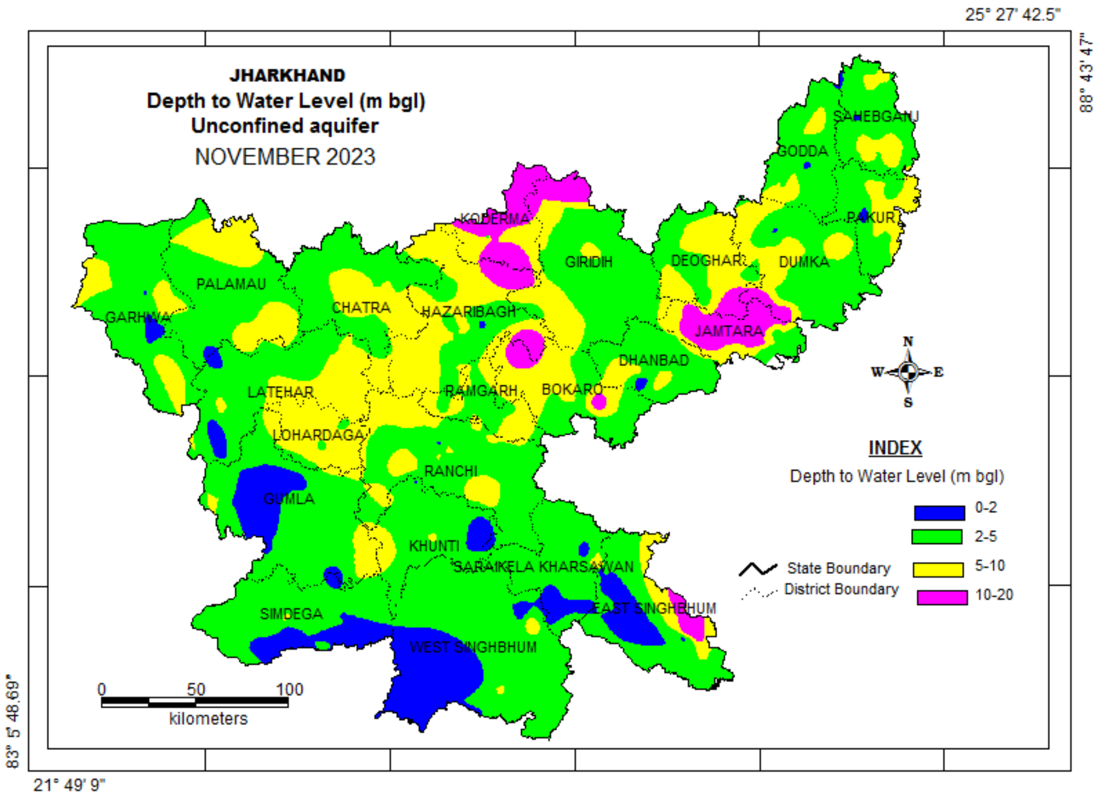

Figure 4:Post-monsoon Depth to Water Level Map (2023)

5.2 Fluctuation of Groundwater Level:

Comparison of Pre-monsoon 2023 to Pre-monsoon 2022

Fluctuation of ground water level between May 2022 and May 2023 of 248 HNS has been analysed which indicates rise in water level rise in 79 wells (33%) of the HNS and fall in water evel lin 169 No (67%) of HNS. Major part of the State has shown fall in water level. Fall to the tune of 0 – 2 m has covered maximum area (59%), which includes major parts of E and W Singhbhum, Saraikela-Kharsawan, Khunti, Gumla, Simdega, Latehar, Palamu, Garhwa, Chatra, Hazaribagh, Ramgarh, Dhanbad, Dumka, Godda, and Sahebganj districts. Parts of Simdega, Gumla, Garhwa, Palamu, Hazaribagh, Giridih, Godda and Sahebganj district and many other small parts of the state has shown water level fall between 2-4m. Major part of Gumla districts and small parts of Garhwa, Hazaribagh, Giridih and Ramgarh has shown water level fall >4m.

Area where rise of water level is within 2 m spread over mainly in mid-eastern and north-eastern part of the state, covering Ranchi, Saraikela, Bokkaro, Hazaribagh, Giridih, Dumka, Godda and Sahebganj district, parts of Palamu and Garhwa district in north west, part of Simdega district in south west part covering 21% of the state area. Major part of Palamu district and some parts of Jamtara, Simdega, Ranchi, Godda and Sahebganj shows water level rise in the range of 2-4 m and more than 4 m. only 7 and 4 wells show water level rise in the range of 2-4 m and more than 4 m respectively.

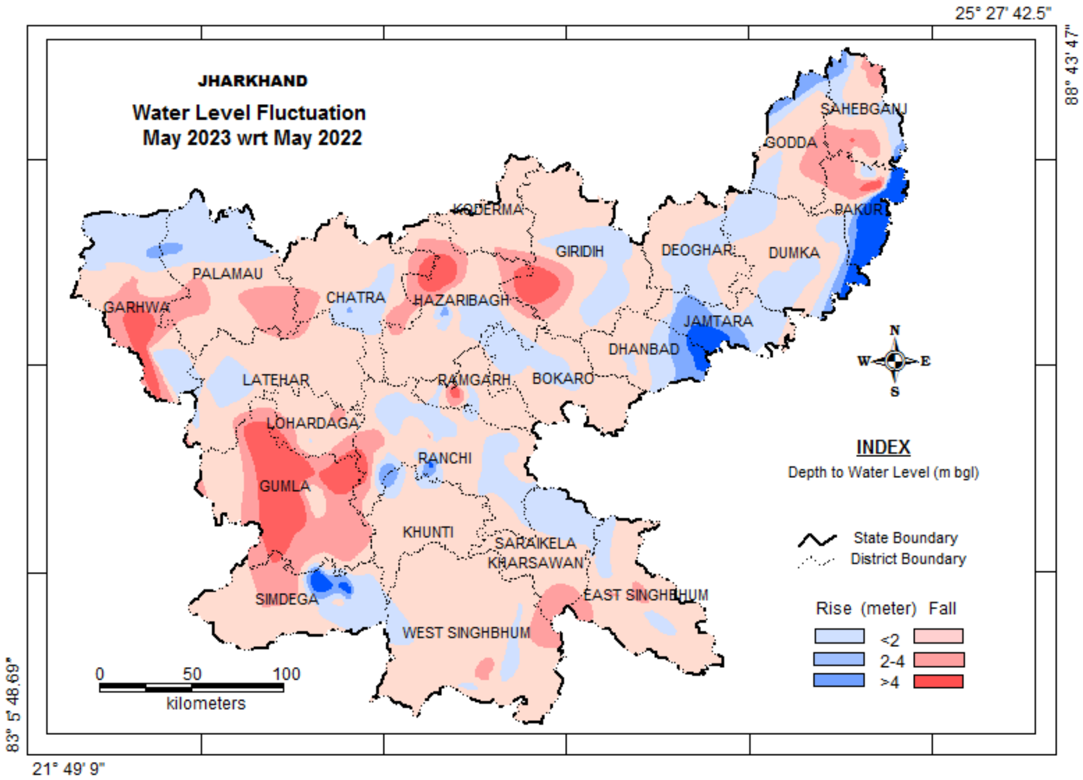

Figure 5: Groundwater Level Fluctuation: Pre-monsoon 2022 compared to Pre-monsoon 2023

Comparison of November 2023 to November 2022

Water level fluctuation between November 2022 and November 2023 has been analysed for 295 HNS, which indicates that there is a fall of water level in about 57% of the HNS and rise in only 43% of the HNS. The fall of water level of 0-2 m range shows in 42% NHS wells covering 46% area covers maximum parts Dumka, Deoghar, Giridih, Hazaribagh, Ranchi, Latehar, Lohardaga, W Singhbhum, Saraikela district and other small patch like area of the state. The segment of 2 to 4m fall shown in small parts of Lohardaga, Ranchi, Chatra, Giridih and Bokaro district. 14 nos of NHS well situated in Lohardaga and Chatra have shown water level fall >4m.

Total 46% area of the State shows rise in water level. Major parts of Godda, Sahibganj, Dumka, Pakur, Deoghar, Giridih, Hazaribagh, Chatra, Latehar, Lohardaga, Ranchi, W Singhbhum and some other small parts of state is covered by the range of 0-2 m rise in water level. Only 14 NHS wells covering very small parts of E. Singhbhum, Latehar and Garhwa has shown the rise of water level 2- 4 m. The range of > 4 m rise has been observed in only 4 wells located in Garhwa, Khunti, Palamu, Purba Singhbhum.

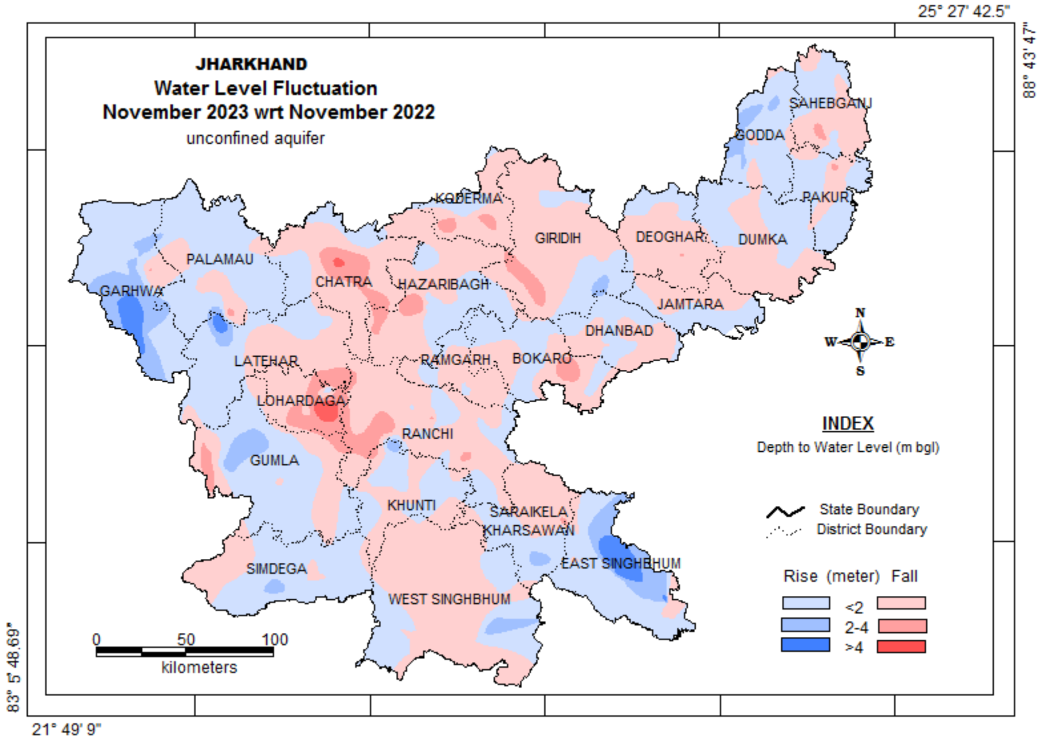

Figure 6: Groundwater Level Fluctuation: November 2022 compared to November 2023

Comparison of Pre-Monsoon 2023 with decadal mean of Pre-Monsoon (2013 to 2022)

Fluctuation in water level of May 2023 with respect to decadal mean of May 2013-2022 has been analysed for 177 HNS wells, which indicates fall in 59% and rise in the remaining 41% of the analysed HNS. The fall in the tune of 0 – 2 m is observed in the 49% of the HNS analysed, spatially covers the 52% area of the State and covers almost entire mid part, north eastern part and south eastern part of the state. In 16 HNS has shown fall in the tune of 2-4 m covering very small patches of Bokaro, Chatra, Deoghar, Hazaribagh, Dumka, Gumla Jamtara, Godda, Ranchi and Lohardaga district. Only 2 wells located in Ramgarh and Giridih district has recorded water level fall more than 4m.

40% area of the State has shown rise in water level less than 2 m covering major part of Deoghar, Giridih, Plalamu, Garhwa, W Singhbhum and Simdega district and small parts of Sahibganj, Pakur, Jamtara, Hazaribagh, Chatra, Ranchi, Khunti and E Singhbhum district, whereas the segment of 2 – 4 m observed in only 6 NHS wells. The rise of water level more than 4m has been recorded in only 4 wells located in Giridih, Pakur, Sahibganj and Simdega district.

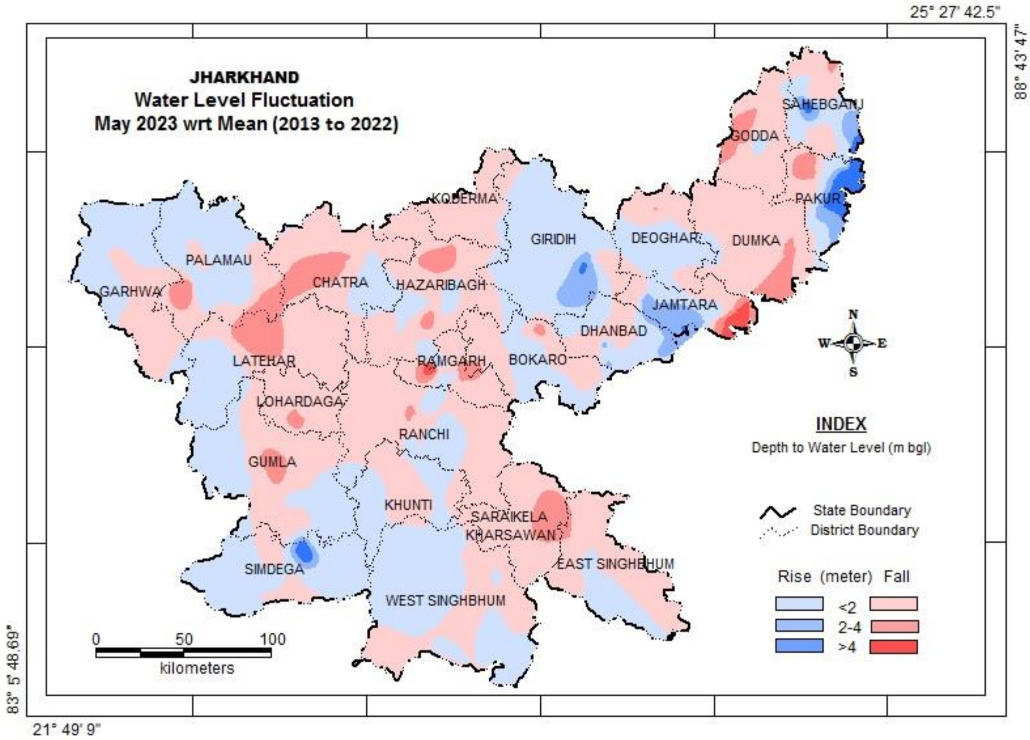

Figure 7: Decadal water level fluctuation with mean Pre-Monsoon (2013 to 2022) and Pre-Monsoon 2023

Comparison of Post-Monsoon 2023 with decadal mean of Post-Monsoon (2013 to 2022)

Fluctuation in water level of November 2023 with respect to decadal mean of November 2013-2022 has been analysed for 270 HNS. 51% of the HNS well shows rise and fall in the remaining 49 % of HNS. Maximum part (46% of total area) of the district shows water level rise in the range of 0 to2m, covering mainly southern part of the state. Water level rise in the range of 2 – 4 m has been observed in 6% NHS which covers only 4% area of the state including very small part of Khunti, Hazaribagh, Chatra, Garhwa, Palamu, Gumla, Latehar and Giridih. Rise >4m has been obsereved in only 3 NHS wells located in Palamu, Hazaribagh, Chatra district.

The fall in the range of 0-2 m has been shown by 50% HNS. The fall of water level ranged from 0 to 2 m covers 39% area of the State covers the major and adjoining part of Sahebganj, Pakur, Dumka, Deoghar, Dhanbad, Ramgarh, Ranchi, Latehar district and as patches at many locations. Fall within 2 to 4 m observed in very small parts of Chatra, Ranchi and Lohardaga distric and many other small patches. Only 11 well located at Giridih, Jamtara, Koderma, E Singhbhum has shown water level fall >4m.

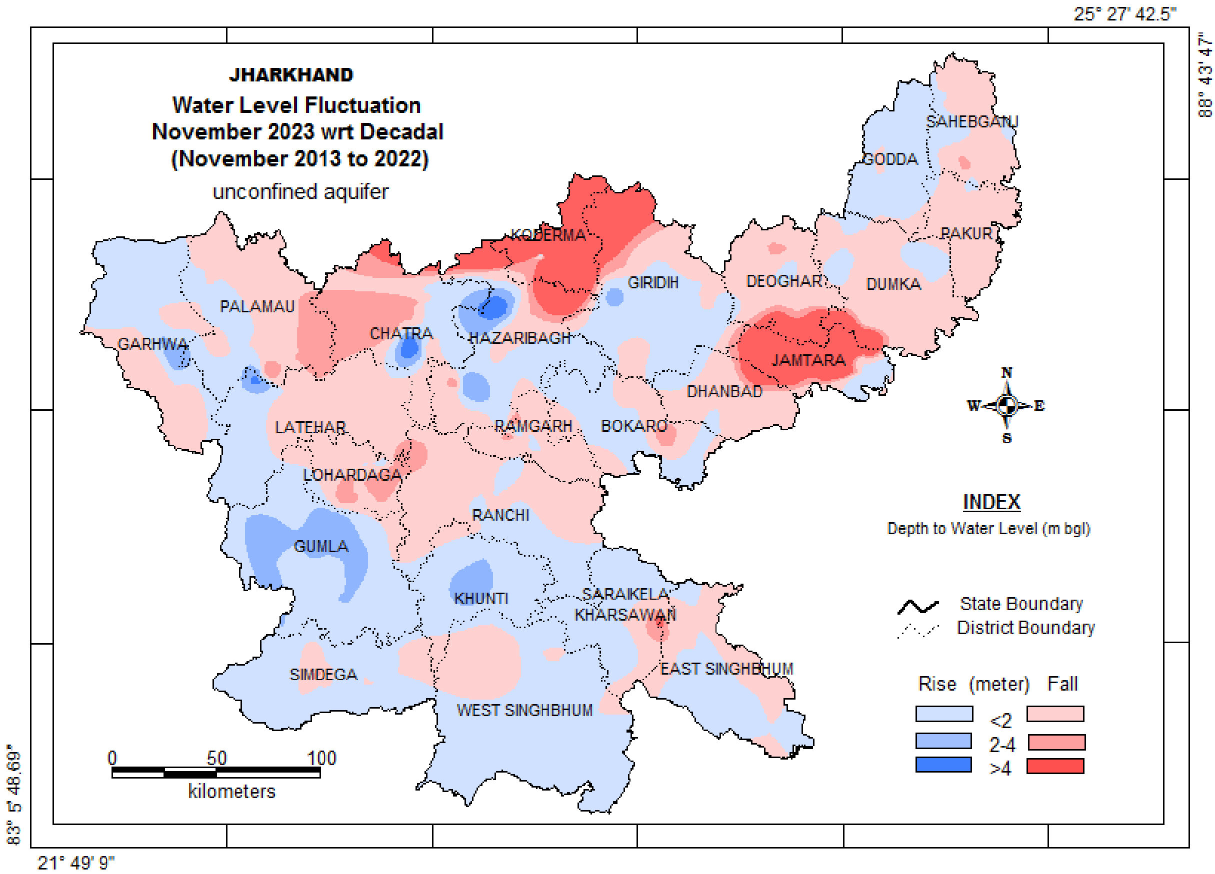

Figure 8: Decadal water level fluctuation with mean Post-Monsoon (2013 to 2022) and Post-Monsoon 2023

CHAPTER 6

6.0 GROUND WATER RESOURCES OF JHARKHAND

Ground Water resource of the Jharkhand State (2024) has been computed according to the methodology of GEC-2015. For recharge estimation, ground water worthy areas has been considered which is also named as ground water assessment areas. These areas exclude the hills and areas under backwater of tanks and dams. About 25% of the state geographical area has been demarcated as hills (> 20% slope). Ground Water resource of the state has been computed blockwise and then summarised district-wise. District-wise summary is given in Annexure II A and II B. Block-wise computations are given in Annexure III A.

6.1. ANNUAL GROUND WATER RECHARGE

Total Annual Ground Water Recharge in the State is 6.28 BCM. Considering the natural discharge as 0.52 BCM, Annual Extractable Ground Water Resource for the state of Jharkhand is 5.76 BCM. Volumetrically ground water recharge is highest in West Singhbhum district and lowest in Koderma district. Deviation of unit-area monsoon rainfall recharge from unit-area total recharge among districts shows recharge is mostly dominated by storage parameters of the aquifer, rainfall infiltration factor and fluctuation of water level. District-wise details of various components of Recharge is tabulated in Table 6.1 and graphically represented in Fig. 9.

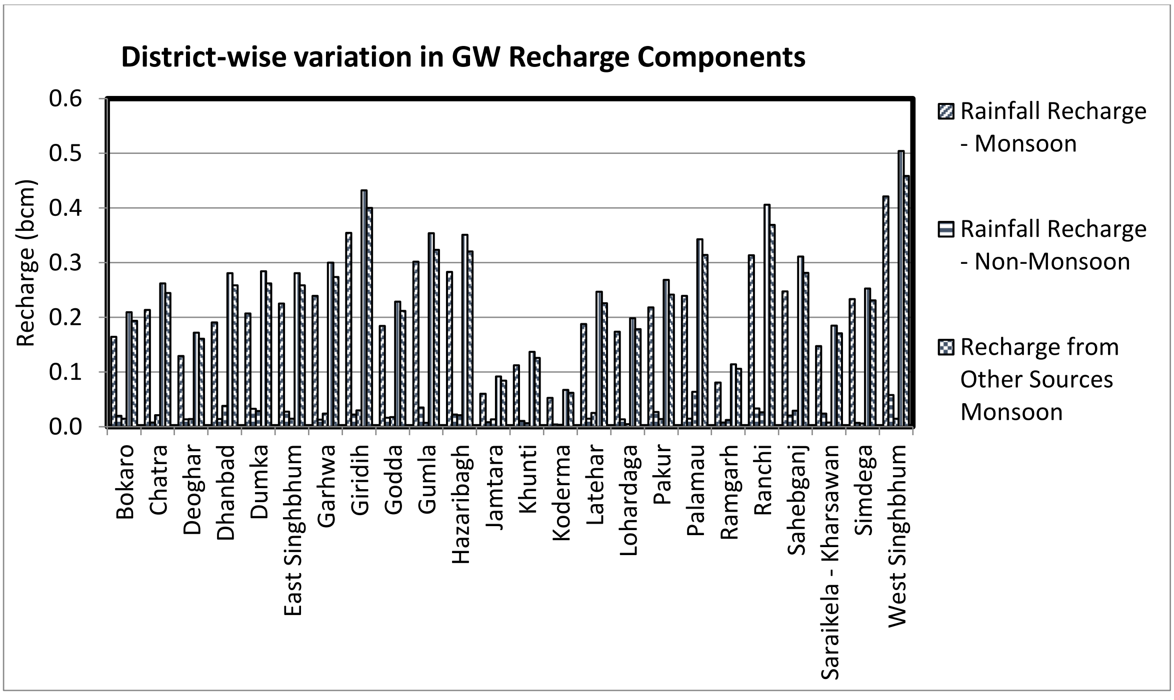

Figure 9: District-wise details of various components of Recharge

Table 6.1 District-wise details of various components of GW Recharge (in BCM)

S.NO	Name of District	Ground Water Recharge				
		Monsoon Season		Non-Monsoon Season		Total Annual Ground Water Recharge
		Recharge from rainfall	Recharge from other Sources	Recharge from Rainfall	Recharge from other Sources	
1	2	3	4	5	6	7
1	Bokaro	16452.33	1458.23	1993.99	1064.96	20969.51
2	Chatra	21383.47	2130.51	755.28	1956.66	26225.92
3	Deoghar	12962.21	1405.2	1331.1	1483.72	17182.23
4	Dhanbad	19101.71	3793.65	1409.48	3761.71	28066.55
5	Dumka	20690.54	2852.28	3265.87	1619.3	28427.99
6	East Singhbhum	22527.96	1469.56	2752.11	1350.14	28099.77
7	Garhwa	23951.07	2399.02	1295.9	2343.56	29989.55
8	Giridih	35467.44	3009.81	2204.78	2546.32	43228.35
9	Godda	18436.16	1757.05	1626.54	1032.54	22852.29
10	Gumla	30172.19	707.35	3499.41	998.65	35377.6
11	Hazaribagh	28297.63	2122.3	2209.45	2476.97	35106.35
12	Jamtara	6029.76	1368.34	829.68	947.7	9175.48
13	Khunti	11237.84	658.81	1075.88	738.68	13711.21
14	Koderma	5282.33	385.93	434.49	649.7	6752.45
15	Latehar	18767.64	2498.15	1493.79	1915.24	24674.82
16	Lohardaga	17367.93	505.26	1382.32	590.3	19845.81
17	Pakur	21805.05	1425.7	2685.38	908.5	26824.63
18	Palamau	23941.92	6359.2	1463.36	2515.88	34280.36
19	Ramgarh	8086.15	1240.98	779.56	1300.27	11406.96
20	Ranchi	31358.34	2637.21	3313.74	3301.72	40611.01
21	Sahebganj	24731.92	2920.8	2059.93	1390.49	31103.14
22	Saraikela Kharsawan	14767.01	791.54	2406.28	525.2	18490.03
23	Simdega	23326.88	569.18	737.13	626.96	25260.15
24	West Singhbhum	42143.1	1471.81	5800.96	979.78	50395.65
	Total(Ham)	498288.6	45937.87	46806.41	37024.95	628057.8
	Total(Bcm)	4.98	0.46	0.47	0.37	6.28

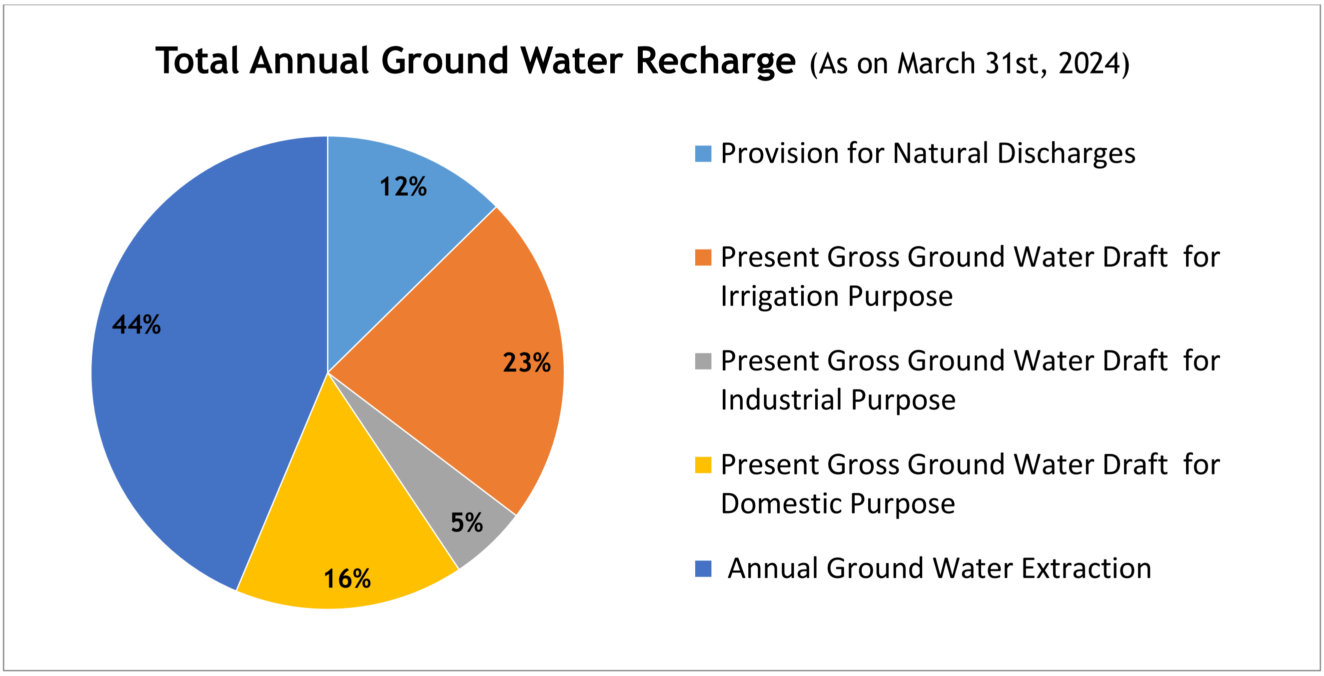

Figure 10 Summary of Dynamic Groundwater Resource Assessment (2024)

6.2. ANNUAL EXTRACTABLE GROUND WATER RESOURCES

Total Annual Ground Water Recharge of the Jharkhand State as on 2024 is 6.28 BCM. Considering natural discharge of 0.52 BCM, Annual Extractable Ground Water resource for the State of Jharkhand is 5.76 BCM. The Ground Water Extraction in the State of the Jharkhand is 1.81 BCM. Ground Water Extraction for Irrigation is 0.94 BCM, However0.65 BCM is drawn to meet up the domestic water demand and remaining 0.22 BCM is Ground Water Extraction for industrial processes. The average Stage of Ground Water Extraction as on 2024 is 31.42 %. The Annual Ground Water allocation for Domestic use as on 2025 is 0.65BCM. Net Ground Water Availability for Future use is 3.96 BCM. Monsoon has an overwhelming control over recharge of Jharkhand state. Monsoon rainfall contributes about 79.36% of total recharge, non-monsoon rainfall contributes 7.36% of total recharge and 13.28% of the total recharge is from the sources other than rainfall like recharge as return seepage from irrigation and from water harvesting structures. Summary of Dynamic Groundwater Resource Assessment (2024) has been tabulated in Table 6.2 and figure 10 & 11

Table 6.2 State Summary of Dynamic Groundwater Resource Assessment (2024)

	Dynamic GW Resource	
	(BCM)	(ham)
Annual ground water recharge	6.28	628058
Total Natural Discharges	0.52	52302
Annual Extractable Ground Water Resource	5.76	575755
Current Annual Ground Water Extraction for 'All Uses'	1.81	179836
Current Annual GW Extraction for Irrigation	0.94	94065

Current Annual GW Extraction for Domestic uses	0.65	64638
Current Annual GW Extraction for Industrial uses	0.22	22174
Stage of Ground WaterExtraction (%)	31.42 %	
Annual Ground Water allocation for Domestic use as on 2025	0.65	64948
Net Ground Water Availability for Future use	3.96	396097

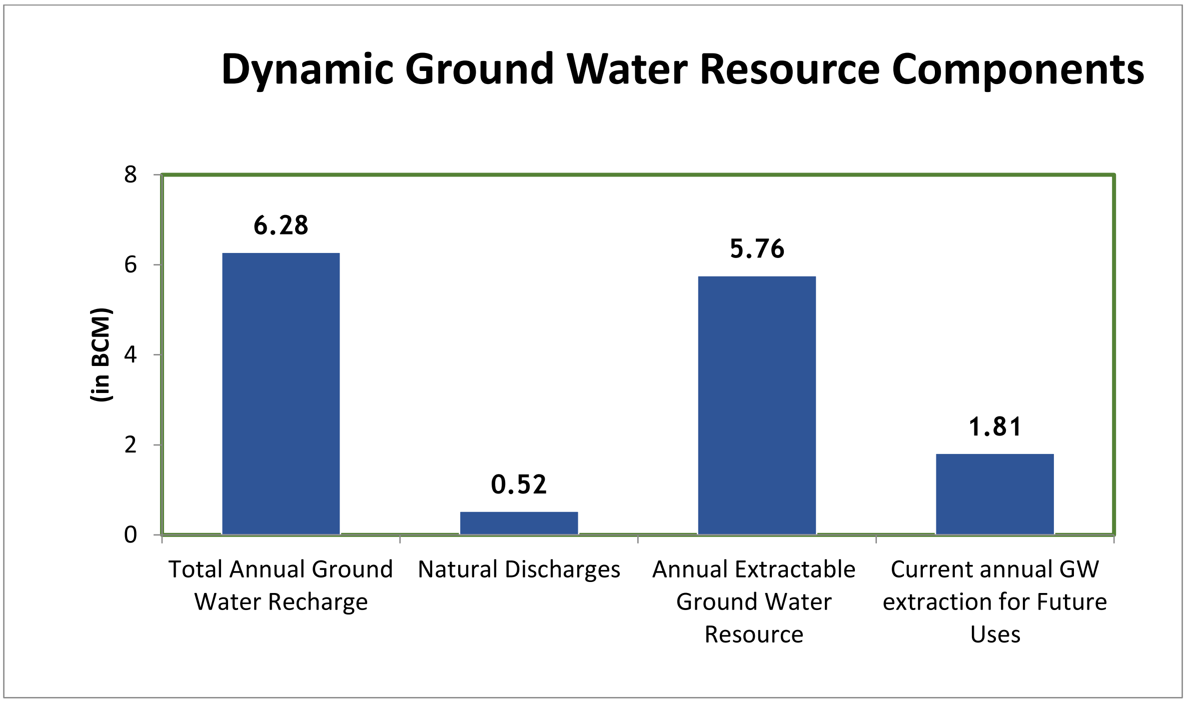

Figure. 11 Dynamic GW Resource component

The Dynamic Ground Water Resources of Jharkhand state as on 2024 has been estimated as 5.76 BCM. The district wise Dynamic resource of Jharkhand is given in Table 6.3. The same has been represented in figure. 5.6.

Table 6.3 District-wise Dynamic Groundwater Resource of Jharkhand

S.NO	Name of District	Annual Extractable Ground Water Resource (BCM)
1	Bokaro	0.19
2	Chatra	0.24
3	Deoghar	0.16
4	Dhanbad	0.26
5	Dumka	0.26
6	East Singhbhum	0.26

7	Garhwa	0.27
8	Giridih	0.40
9	Godda	0.21
10	Gumla	0.32
11	Hazaribagh	0.32
12	Jamtara	0.08
13	Khunti	0.13
14	Koderma	0.06
15	Latehar	0.23
16	Lohardaga	0.18
17	Pakur	0.24
18	Palamau	0.31
19	Ramgarh	0.11
20	Ranchi	0.37
21	Sahebganj	0.28
22	Saraikela Kharsawan	0.17
23	Simdega	0.23
24	West Singhbhum	0.46
	Total	5.76

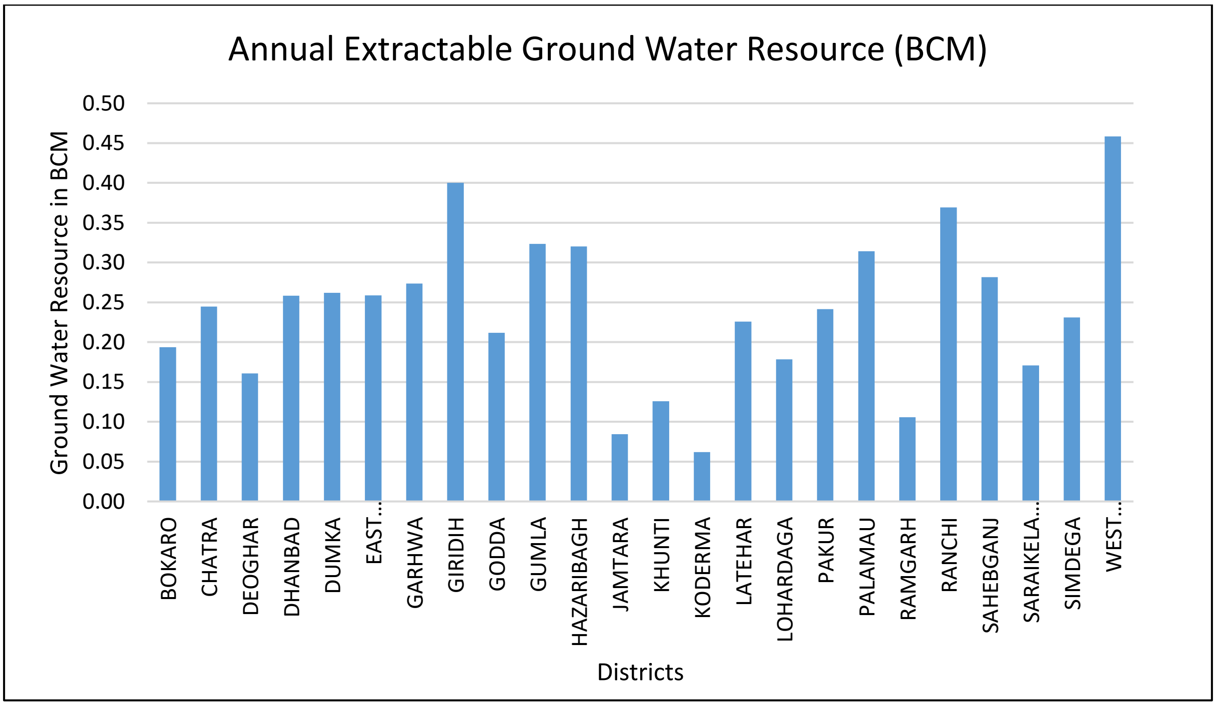

Figure. 12. Dynamic Ground Water Resources of Jharkhand

6.3 ANNUAL TOTAL GROUND WATER EXTRACTION

Existing Ground Water Extraction for "All Uses" for the state is ***1.81 BCM***. Of this, Ground Water Extraction for Irrigation is ***0.94BCM***, ***0.65 BCM*** is drawn to meet up the drinking water demand and remaining ***0.22 BCM*** is Ground Water Extraction for industrial processes. Volumetrically, highest total draft is in Dhanbad district and lowest is in Lohardaga district. On the other hand, unit-area total draft is highest at Dhanbad district but lowest in Lohardaga district. If individual components of draft are considered, then unit-area ground water extraction for irrigation is highest at Ranchi district and lowest in Ramgarh district; unit-area ground water extraction for domestic purposes is highest at Ranchi district and lowest in Lohardaga district and unit-area ground water extraction for industrial uses is highest at Dhanbad district and lowest in Simdega district. (Table 6.4) This shows control of population density, industrial activity including mining and agricultural activity on ground water draft component. The analysis shows that districts namely Dhanbad, Bokaro, Giridih, Hazaribagh, Palamu and Ranchi are main contributor of ground water extraction in the state due to industrial, mining, agricultural and urban population. Total 1.81 BCM annual ground water extraction of the state covering twenty four (24) districts. District-wise variation in various components of GW extraction in Jharkhand is shown in figure 12 & 13.

Table 6.4 District-wise details of various components of GW Extraction (in BCM)

District	Irrigation	Domestic	Industrial	Total
Bokaro	0.02	0.04	0.02	0.09
Chatra	0.06	0.02	0.01	0.09
Deoghar	0.05	0.03	0.00	0.08
Dhanbad	0.03	0.06	0.10	0.19
Dumka	0.04	0.02	0.00	0.06
East Singhbhum	0.02	0.05	0.01	0.08
Garhwa	0.08	0.02	0.00	0.10
Giridih	0.09	0.05	0.02	0.15
Godda	0.02	0.02	0.00	0.05
Gumla	0.04	0.02	0.00	0.06
Hazaribagh	0.08	0.03	0.00	0.12
Jamtara	0.02	0.01	0.00	0.04
Khunti	0.02	0.01	0.00	0.03
Koderma	0.03	0.01	0.00	0.04
Latehar	0.05	0.01	0.00	0.07
Lohardaga	0.02	0.01	0.00	0.03
Pakur	0.02	0.02	0.00	0.03
Palamau	0.07	0.04	0.00	0.11
Ramgarh	0.01	0.02	0.03	0.06
Ranchi	0.09	0.06	0.02	0.17

Sahebganj	0.02	0.02	0.00	0.04
Saraikela -Kharsawan	0.01	0.02	0.01	0.04
Simdega	0.02	0.01	0.00	0.03
West Singhbhum	0.02	0.03	0.00	0.05
Total	0.94	0.65	0.22	1.81

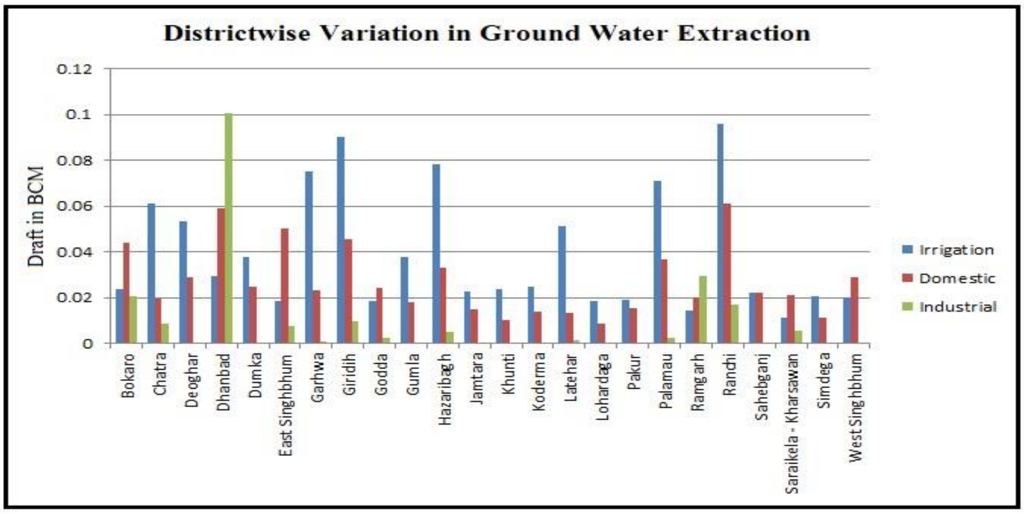

Figure.. 13 District-wise variation in various components of GW extraction in Jharkhand

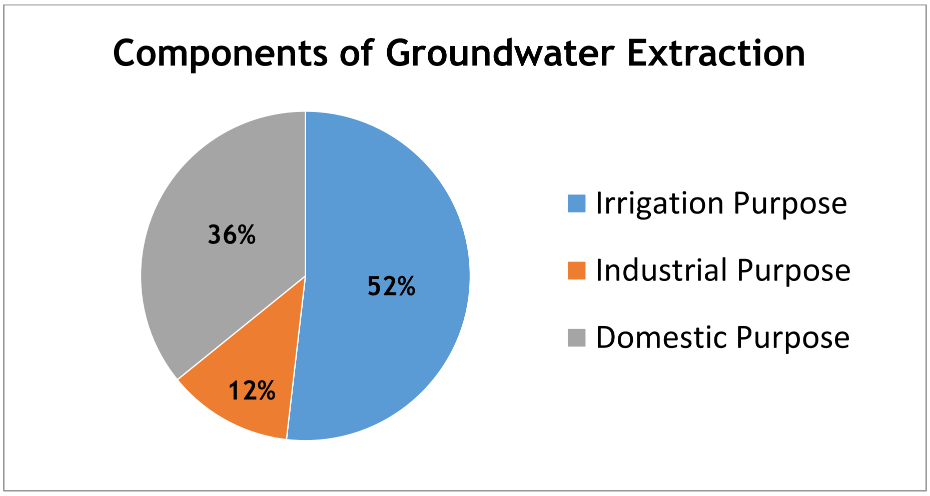

Figure. 14 District-wise variation in various components of GW extraction in Jharkhand

6.4 STAGE OF GROUND WATER EXTRACTION

Stage of Ground Water Extraction for the state is 31.42%. Maximum stage of ground water extraction has been observed in Dhanbad District (73.24 %) and lowest in West Singhbhum District (10.74 %). It is observed that stages of ground water extraction, even within broadly similar hydrogeological set up, are highly irregular. Very high stage of ground water extraction is mainly concentrated in areas of industrial and mining activity or high agricultural activity. The district level and year-wise Stage of Ground Water Extraction of Jharkhand State has been tabulated in Table 6.5 & 6.6 respectively and presented in Figure 14 &15.

Table 6.5 District-wise and Year-wise variation of SOD / SOGWE (in %) (2009 to 2024)

District	Stage of Ground Water Extraction (%)							
	2009	2011	2013	2017	2020	2022	2023	2024
Bokaro	31	34.5	46.37	48.79	43.87	30.51	42.55	45.62
Chatra	35	35.6	31.82	30.2	35.04	34.15	35.16	37.9
Deoghar	33	34.9	21.43	42.25	52.13	51.62	53.37	52.33
Dhanbad	52	55.8	76.66	76.3	67.12	75.08	74.34	73.24
Dumka	27	27.89	31.96	24.26	22.14	26.35	24.61	23.78
East Singhbhum	21	22.7	19.67	19.9	23.38	28.49	30.41	29.43
Garhwa	35	36.15	12.13	25.44	33.17	34.74	35.75	36.25
Giridih	36	23.69	16.52	26.65	34.14	37.8	37.75	37.85
Godda	39	44.99	16.05	20.82	20.63	24.03	21.28	21.47
Gumla	26	27.85	12.85	11.91	15.42	17.68	17.84	17.31
Hazaribagh	39	42.04	12.8	35.17	37.37	39.34	36.81	36.36
Jamtara	27	28.46	29.75	30.98	41.04	45.3	44.8	44.68
Khunti	28	29.47	22.45	23.13	25.56	30.09	27.05	26.92
Koderma	33	35.7	27.73	38.35	56.72	66.1	66.44	65.74
Latehar	26	27.53	16.24	29.12	28.32	28.75	29.2	29.08
Lohardaga	40	41.01	10	13.74	14.79	15.77	15.1	15.21
Pakur	14	14.8	20.27	19.95	13.85	16.46	14.47	14.36
Palamau	32	34.44	23.37	28.68	31.47	32.58	34.99	34.95
Ramgarh	39	39.91	63.41	70.53	55.32	58.8	62.3	60.12
Ranchi	40	47.52	26.63	33.34	41.5	48.3	46.94	46.37
Sahebganj	22	29.13	13.79	16.79	15.22	17.21	16	15.8
Saraikela - Kharsawan	12	23.21	20.15	19.73	19.53	23.62	22.9	21.82
Simdega	27	17.11	9.81	9.12	12.36	14.31	13.15	13.62
West Singhbhum	9	11.88	10.14	14.12	8.81	9.93%	10.45	10.74

Table 6.6 Stage of Ground Water Extraction/stage of Ground Water

2004	2009	2011	2013	2017	2020	2022	2023	2024
20.67	30.00	32.30	22.56	27.73	29.13	31.35	31.38	31.42

The main reason for this is change in MI Census. Earlier estimations (2009& 2011) based on 3rd MI Census (2001-02) and its projected figures. However, availability of 4th MI Census (2006-07) figures show a drastic decrease in number of agricultural wells which is very much reflected by decrease in irrigation draft of 1.32 BCM in 2011 to 0.63 BCM during 2013 estimation. In the estimation of 2017, 2020& 2022, 2023 6th MI Census (2012-13) with subsequent projection has been used. Temporal variation of district level Stage of Ground Water Extraction is presented in Fig-15

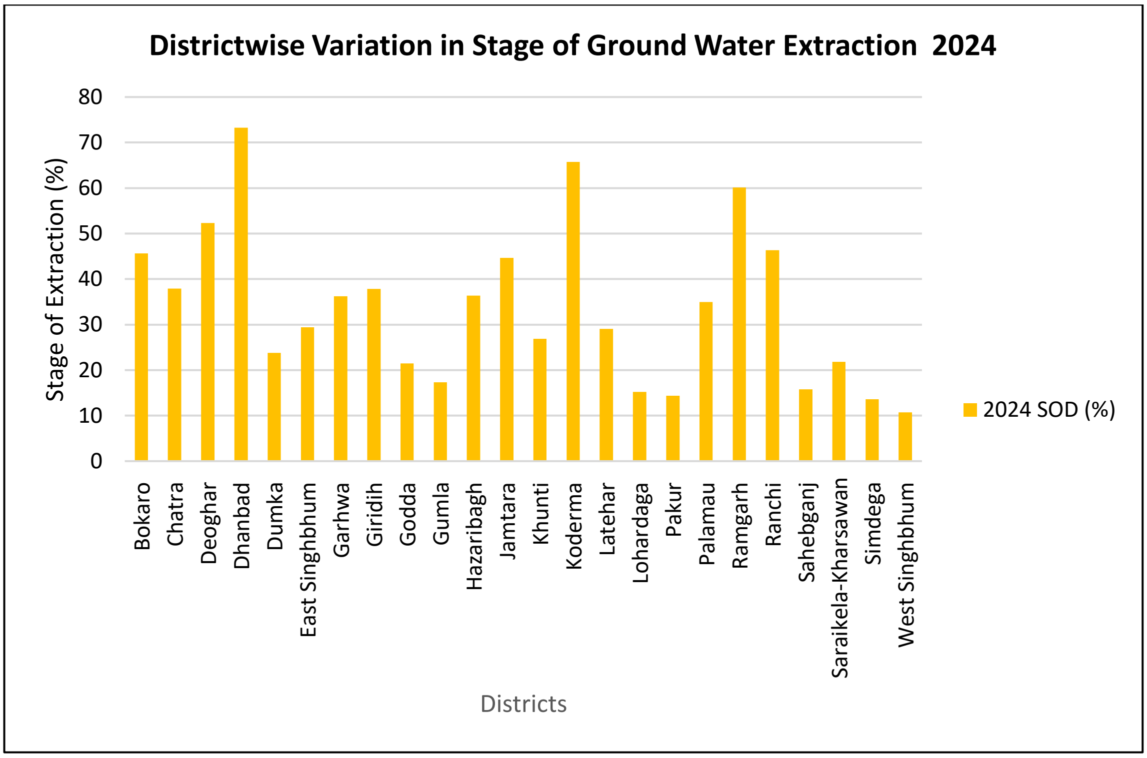

Figure. 15 District-wide variation of Stage of Ground Water Extraction

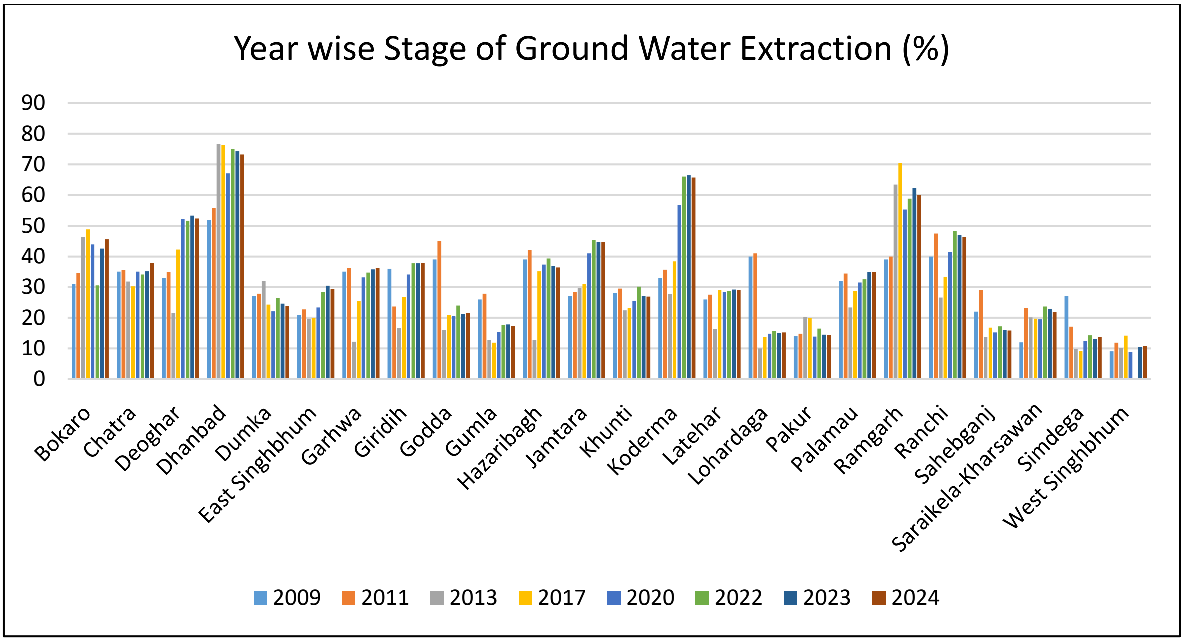

Figure. 16 Year-wise district-level variation of Stage of Ground Water Extraction

Variation in allocation for future ground water demand is mostly dependent on population growth and hence upon present population. Present day high population areas or urban centres influenced computation of annual allocation for future ground water demand for Domestic & Industrial water supply for 2025. However, use of state average of growth rate for the entire area somewhat controlled the scenario. District-wise variation in future groundwater availability for development is presented in figure. 17.

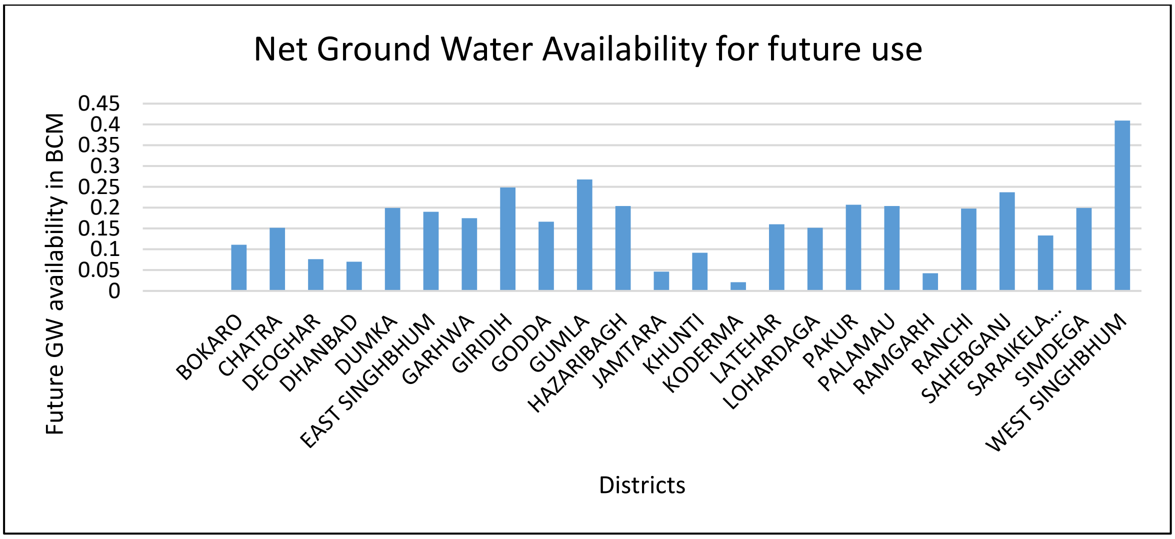

Figure. 17 District-wise variation in Future GW Availability for Development

6.5 CATEGORIZATION OF ASSESSMENT UNITS

In present estimation, a total number of 259 administrative units and 04 urban centres are assessed. Based on stage of ground water development and long term pre- and post- monsoon water level trend, assessed administrative units are categorised as per categorisation scheme . Out of 263 assessment units, represented by 259 CD Blocks and 4 urban centres, 05 units are categorized as *'Over Exploited'*, 06 units categorized as *'Critical'*, 12 units categorized as *'Semi Critical'* and rest 240 units are categorized as *'Safe'*.

Table 6.7 Summary of Assessment Units and Sub-units and Categorization

Sl	Name of the district	No of Asessment Units	Over-exploited	Critical	Semi-critical	Safe	Total No. of Quality Affected Blocks
1	Bokaro	9	1	0	0	8	3
2	Chatra	12	0	0	0	12	0
3	Deoghar	10	0	0	3	7	0
4	Dhanbad	9	1	2	3	3	2
5	Dumka	10	0	0	0	10	0
6	East Singhbhum	12	2	0	0	10	0
7	Garhwa	19	0	0	1	18	13
8	Giridih	13	0	0	1	12	2
9	Godda	9	0	0	0	9	5
10	Gumla	12	0	0	0	12	3
11	Hazaribagh	16	0	0	1	15	0
12	Jamtara	6	0	0	0	6	0
13	Khunti	6	0	0	0	6	2
14	Koderma	6	0	1	1	4	5
15	Latehar	9	0	0	0	9	0
16	Lohardaga	7	0	0	0	7	0
17	Pakur	6	0	0	0	6	3
18	Palamau	21	0	0	0	21	11
19	Ramgarh	6	1	1	0	4	2
20	Ranchi	19	0	2	2	15	3
21	Sahebganj	9	0	0	0	9	2
22	Saraikela - Kharsawan	9	0	0	0	9	2
23	Simdega	10	0	0	0	10	0
24	West Singhbhum	18	0	0	0	18	2
	State Total	263	5	6	12	240	54

Present exercise does not result any changes in block-wise categorization reflecting temporal variation in ground water recharge/discharge/draft pattern. As compare to earlier estimation (2023) 01 assessment unit (Baghmara block of Dhanbad District) added in semi-critical block in Ground Water Resource estimation 2024, earlier 11 assessment unit fall under semi-critical category and present estimation i.e GWRE 2024 12 assessment unit comes under semi-critical category.Based on categorization of the 263 assessment units (blocks-259, urban area-04) , 240 units have been categorized as safe while other 23 units fall into different categories. 05 units namely Bermo (140.14 %) of Bokaro district, Baliapur (110.03%) of Dhanbad district, Chitarpur (110.32%) of Ramgarh District & Golmuri-cum-Jugasalai (128.07%) and Jamshedpur Urban (135.07 %) of East Singhbhum district fall into over-exploited category with stage of ground water extraction more than 100 %. 06 assessmentunit namely Dhanbad Urban and Topchanchi block in Dhanbad district , Ramgarh block of Ramgarh District, Ranchi Urban and Silli block in Ranchi district, Jainagar block in Koderma district fall into critical category while other 12 assessment units namely Karon, Sarwan & Sonaraithadi (Deoghar district), Baghmara, Dhanbad and Gobindpur (Dhanbad district), Bhawnathpur (Garhwa district), Giridih (Giridih district), Daru (Hazaribagh District), Khelari & Ormanjhi(Ranchi), Koderma (Koderma District) fall in semi-critical category.

High stage of development is due to industrialisation and Mining activity in Bermo, Chitarpur, Ramgarh, Baliapur, Topchanchi, Khelari and due to urbanisation in Golmuri-cum Jugsalai, Jamshedpur urban, Ranchi Urban, Dhanbad urban and due to agricultural activities in Silli blocks of Jharkhand state.

Table 6.8 List of blocks categorised other than 'Safe' in Jharkhand State based on Dynamic Groundwater Resource Assessment (2024)

Sl.	District		Assessment Unit	SOD %	Category
1	Bokaro	1	Bermo	140.15%	Over Exploited
2	Dhanbad	1	Baliapur	110.03%	Over Exploited
		2	Dhanbad Urban	95.65%	Critical
		3	Topchanchi	93.46%	Critical
		4	Dhanbad	81.80%	Semi-Critical
		5	Gobindpur	77.30%	Semi-Critical
		6	Baghmara	70.54%	Semi-Critical
3	Deoghar	1	Sarwan	79.74%	Semi-Critical
		2	Sonaraitharhi	72.20%	Semi-Critical
		3	Karon	71.24%	Semi-Critical
4	East Singbhum	1	Golmuri-cum Jugsalai (Jamshedpur)	138.99%	Over Exploited
		2	Jamshedpur Urban	119.93%	Over Exploited
5	Garhwa	1	Bhawnathpur	81.04%	Semi-Critical

Sl.	District		Assessment Unit	SOD %	Category
6	Giridih	1	Giridih	81.09%	Semi-Critical
7	Hazaribagh	1	Daru	72.07%	Semi-Critical
8.	Koderma	1	Jainagar	97.46%	Critical
		2	Koderma	72.96%	Semi-Critical
9	Ramgarh	1	Chitarpur	112.60%	Over Exploited
		2	Ramgarh	95.43%	Critical
10	Ranchi	1	Silli	95.85%	Critical
		2	Ranchi Urban	94.73%	Critical
		3	Khelari	86.11%	Semi-Critical
		4	Ormanjhi	83.84%	Semi-Critical

6.6 COMPARISON WITH EARLIER DYNAMIC GROUND WATER RESOURCES ESTIMATES

It has been observed that significant change in Total Annual Ground Water Recharge of the State has occurred, which increases from 6.25 bcm (2023) to 6.28 bcm (2024) i.e as compared to the earlier estimation in the year 2023. Annual Extractable Ground Water resource after deducting natural discharge component also increased from 5.73bcm to 5.76bcm. Ground Water Extraction for industrial has increased from 0.21 bcm to 0.22 bcm. On the other hand, Ground Water Extraction for Domestic and irrigation showing very small changes. The marginal increase in recharge and increase in groundwater extraction resulted in change of average Stage of Ground Water Extraction of the State from 31.38 % to 31.42%. However, present estimation resulted into changes in assessment unit categorization reflecting temporal variation in ground water recharge/discharge/draft pattern. Resource estimation (2024) categorized 23 blocks other than 'Safe' out of 263 assessed blocks. Comparison of Salient features of Ground Water Resources of Jharkhand for the years 2004, 2009, 2011, 2013, 2017, 2020, 2022, 2023 and 2024 are presented in Table 6.9.

Table 6.9 Comparison of Salient features of Ground Water Resources of Jharkhand for the years 2004, 2009, 2011, 2013, 2017, 2020, 2022, 2023 & 2024

Descriptions	**2004**	**2009**	**2011**	**2013**	**2017**	**2020**	**2022**	**2023**	*2024*	***Change w.r.t 2023***
Total Annual Ground Water Recharge	5.58	5.96	6.31	6.56	6.21	6.15	6.2	6.25	6.28	-0.03
Provision for Natural Discharges	0.33	0.55	0.55	0.57	0.52	0.5	0.51	0.52	0.52	0
Net Annual Ground Water Availability(Annual Extractable Ground Water Resources)	5.25	5.41	5.76	5.99	5.69	5.64	5.69	5.73	5.76	-0.03
Gross Ground Water Draft for irrigation	0.71	1.17	1.32	0.63	0.8	0.92	0.93	0.94	0.94	0
Gross Ground Water Draft for domestic	0.38	0.44	0.52	0.5	0.56	0.51	0.65	0.65	0.65	0
Gross Ground Water Draft for All uses	1.09	1.61	1.86	1.35	1.58	0.2	1.78	1.79	1.81	-0.02
Net Annual Ground Water Availability for 'All Future Uses'	4.16	3.8	3.9	4.64	4.13	1.64	3.92	3.95	3.96	-0.01
Stage of Ground Water Development (%)	21%	30%	32.30 %	22.42 %	27.73%	29.13%	31.35%	31.38 %	31.42%	

(Resource figures are in BCM)

CHAPTER 7

7.0 CONCLUSIONS

- The re-estimation of ground water resources of Jharkhand as on March-2024 has been jointly made by Central Ground Water Board, State Unit office, Ranchi/Mid-Eastern Region, Patna with State Ground Water Directorate, Water Resources Dept. Govt. of Jharkhand
- In present estimation a total numbers of 263 assessment units (259 blocks and 4 urban centres-Ranchi urban, Dhanbad urban, Medininagar urban and Jamshedpur urban) have been assessed.
- The estimation is based on Ground Water Estimation methodologies as per GEC2015.The most of the blocks has been assessed using RIF (Rainfall Infiltration Factor) method in comparison to WLF (Water Level Fluctuation) method
- Total Replenishable Ground Water Recharge as on March 2024 has been assessed as ***6.28 BCM***. Considering natural discharge of ***0.52 BCM***, Annual extractable Ground Water Resources for the state of Jharkhand has been assessed as **5.76** ***BCM***.
- Current Annual Ground Water Extraction in the state of the Jharkhand has been assessed as ***1.81 BCM*** with Irrigation draft of ***0.94 BCM***, industrial draft of **0.22 BCM** and ***0.65 BCM*** is drawn to meet up the drinking water demand. The average Stage of Ground Water Extraction as on March 2024 is **31.42 %**.
- The net ground water availability for future use is **3.96** ***BCM***. Annual GW Allocation for Domestic Use as on 2025 is **0.65 BCM**. Monsoon has got an overwhelming control over recharge of Jharkhand state.
- Out of **263** assessment units (blocks-259, Urban area-04), 5 units (1.9 %) have been categorized as 'Over-exploited', 6 units (2.28 %) as 'Critical', 12 units (4.56 %) as 'Semi-critical' and rest 240 units (91.25 %) are under 'Safe' category and there is no saline assessment unit in the State.
- Similarly, out of 60646.73 sq km recharge worthy area of the State, 463.92 sq km (0.76 %) area are under 'Over-Exploited', 1068.48 sq km (1.76 %) under 'Critical', 2396.09 sq km (3.95 %) under 'Semi-critical' and 56718.24 sq km (93.52 %) under 'Safe' categories of assessment units. Out of total 5757.56 mcm annual extractable ground water resources of the State, 63.13mcm (1.1%) are under 'Over-exploited', 132.32mcm (2.3%) under 'Critical', 259.77mcm (4.51%) under 'Semi-critical' and 5302.35mcm (92.09%) are under 'Safe' categories of assessment units.
- As compared to 2023 assessment, Total Annual Ground Water Recharge and Annual Extractable Ground Water Resources have increased from 6.25 to 6.28 bcm and 5.73 to 5.76 bcm respectively. The Annual Ground Water Extraction for the State has increased from 1.79 to 1.81 bcm and the Stage of Ground Water Extraction has increased from 31.38% to 31.42%.
- The block-wise categorization reflecting temporal variation in ground water recharge/discharge/draft pattern. Results indicate that high stage of development is due to industrialisation and Mining activity in Bermo, Baliapur, Topchanchi, Khelari and due to urbanisation in Golmuri-cum Jugsalai, Jamshedpur urban, Ranchi Urban, Dhanbad urban and due to agricultural activities in Silli blocks of Jharkhand state.
- The quality tagging of Fluoride and Arsenic affected blocks has also been done along with resources assessment of the blocks of the Jharkhand state.

Annexure-I

Ground water resources availability, utilization and stage of extraction in Jharkhand (as in 2024)															
INDIA															
S.N	States / Union Territories	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction				Annual GW Allocation for Domestic use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction(%)
		Monsoon Season		Non-Monsoon Season		Total Annual Ground Water Recharge			Irrigation	Industrial	Domestic	Total			
		Recharge from rainfall	Recharge from other Sources	Recharge from Rainfall	Recharge from other Sources										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	JHARKHAND	4.98	0.46	0.47	0.37	6.28	0.52	5.76	0.94	0.22	0.65	1.81	0.65	3.96	31.42
	Total (bcm)	4.98	0.46	0.47	0.37	6.28	0.52	5.76	0.94	0.22	0.65	1.81	0.65	3.96	31.42

Annexure-II

District-wise ground water resources availability, utilization and stage of extraction in Jharkhand (as in 2024)

JHARKHAND

S. N	Name of District	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction				Annual GW Allocation for Domestic use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction(%)
		Monsoon Season		Non-Monsoon Season		Total Annual Ground Water Recharge									
		Recharge from rainfall	Recharge from other Sources	Recharge from Rainfall	Recharge from other Sources				Irrigation	Industrial	Domestic	Total			
1	BOKARO	16452.33	1458.23	1993.99	1064.96	20969.51	1599.35	19370.16	2393	2057.92	4385.1	8836.03	4406.13	11106.57	45.62
2	CHATRA	21383.47	2130.51	755.28	1956.66	26225.92	1753.02	24472.9	6228.5	1115.22	1931.2	9274.93	1940.46	15188.7	37.9
3	DEOGHAR	12962.21	1405.2	1331.1	1483.72	17182.23	1095.84	16086.39	5456.5	87.66	2873.89	8418.04	2887.67	7654.56	52.33
4	DHANBAD	19101.71	3793.65	1409.48	3761.71	28066.55	2210.43	25856.12	2962	10083.34	5892.49	18937.83	5920.74	7035.33	73.24
5	DUMKA	20690.54	2852.28	3265.87	1619.3	28427.99	2243.4	26184.59	3749.75	23.62	2453.89	6227.25	2465.65	19945.56	23.78
6	EAST SINGHBHUM	22527.96	1469.56	2752.11	1350.14	28099.77	2227.36	25872.41	1860	758.04	4996.45	7614.49	5020.41	18978.12	29.43
7	GARHWA	23951.07	2399.02	1295.9	2343.56	29989.55	2617.86	27371.69	7531.88	60.53	2328.64	9921.05	2339.79	17439.51	36.25
8	GIRIDIH	35467.44	3009.81	2204.78	2546.32	43228.35	3197.36	40030.99	9022.88	1561.76	4568.3	15152.91	4590.2	24856.2	37.85
9	GODDA	18436.16	1757.05	1626.54	1032.54	22852.29	1659.33	21192.96	1869	258.6	2422.79	4550.41	2434.43	16630.9	21.47
10	GUMLA	30172.19	707.35	3499.41	998.65	35377.6	3014.98	32362.62	3789.5	12.54	1801.44	5603.44	1810.09	26750.54	17.31
11	HAZARIBAGH	28297.63	2122.3	2209.45	2476.97	35106.35	3077.4	32028.95	7851.38	470.25	3324.33	11645.93	3340.24	20367.1	36.36
12	JAMTARA	6029.76	1368.34	829.68	947.7	9175.48	728.98	8446.5	2280.25	10.16	1483.28	3773.71	1490.39	4665.68	44.68
13	KHUNTI	11237.84	658.81	1075.88	738.68	13711.21	1112.93	12598.28	2385	12.59	993.42	3391.01	998.18	9202.51	26.92
14	KODERMA	5282.33	385.93	434.49	649.7	6752.45	543.71	6208.74	2591.88	98.94	1390.94	4081.75	1397.61	2120.31	65.74
15	LATEHAR	18767.64	2498.15	1493.79	1915.24	24674.82	2094.19	22580.63	5109	105.74	1351.46	6566.2	1357.96	16007.94	29.08
16	LOHARDAGA	17367.93	505.26	1382.32	590.3	19845.81	1984.59	17861.22	1833.5	8.17	874.6	2716.28	878.78	15140.75	15.21
17	PAKUR	21805.05	1425.7	2685.38	908.5	26824.63	2682.47	24142.16	1911.5	28.46	1525.92	3465.89	1533.24	20668.94	14.36
18	PALAMAU	23941.92	6359.2	1463.36	2515.88	34280.36	2874.65	31405.71	7094.5	217.36	3663.98	10975.84	3681.55	20412.31	34.95
19	RAMGARH	8086.15	1240.98	779.56	1300.27	11406.96	837.22	10569.74	1457	2901.56	1996.45	6355.02	2006.04	4253.15	60.12
20	RANCHI	31358.34	2637.21	3313.74	3301.72	40611.01	3677.76	36933.25	9322.13	1694.99	6109.02	17126.13	6138.3	19777.86	46.37
21	SAHEBGANJ	24731.92	2920.8	2059.93	1390.49	31103.14	2950.38	28152.76	2207	50.29	2190.05	4447.33	2200.55	23694.93	15.8
22	SARAIKELA KHARSAWAN	14767.01	791.54	2406.28	525.2	18490.03	1406.76	17083.27	1099.5	527.18	2100.37	3727.05	2110.44	13346.15	21.82
23	SIMDEGA	23326.88	569.18	737.13	626.96	25260.15	2149.42	23110.73	2034	0	1114.74	3148.74	1120.1	19956.64	13.62
24	WEST SINGHBHUM	42143.1	1471.81	5800.96	979.78	50395.65	4562.91	45832.74	2025.5	29.84	2865.92	4921.27	2879.66	40897.72	10.74
	Total(Ham)	498288.58	45937.87	46806.41	37024.95	628057.81	52302.3	575755.51	94065.13	22174.75	64638.68	180878.53	64948.61	396097.98	31.42

District-wise ground water resources availability, utilization and stage of extraction in Jharkhand (as in 2024)														
JHARKHAND														
S. N	Name of District	Ground Water Recharge					Total Natural Discharges	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction				Annual GW Allocation for Domestic use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction(%)
		Monsoon Season		Non-Monsoon Season		Total Annual Ground Water Recharge			Irrigation	Industrial	Domestic	Total			
		Recharge from rainfall	Recharge from other Sources	Recharge from Rainfall	Recharge from other Sources										
	Total(Bcm)	4.98	0.46	0.47	0.37	6.28	0.52	5.76	0.94	0.22	0.65	1.81	0.65	3.96	31.42

Annexure-III(A)

Categorization of blocks/ mandals/ taluks in Jharkhand (as in 2024)												
S.No	States / Union Territories	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	JHARKHAND	263	240	91.25	12	4.56	6	2.28	5	1.9	-	-
	Total	263	240	91.25	12	4.56	6	2.28	5	1.9	-	-
	Grand Total	263	240	91.25	12	4.56	6	2.28	5	1.9	-	-

Annexure III (B)

District Wise Categorization of blocks/ mandals/ taluks in Jharkhand (as in 2024)												
JHARKHAND												
S.No	Name of District	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			No	%	No.	%	No.	%	No.	%	No.	%
1	GODDA	9	9	100.0	-	-	-	-	-	-	-	-
2	GIRIDIH	13	12	92.31	1	7.69	-	-	-	-	-	-
3	SIMDEGA	10	10	100.0	-	-	-	-	-	-	-	-
4	GARHWA	19	18	94.74	1	5.26	-	-	-	-	-	-
5	PAKUR	6	6	100.0	-	-	-	-	-	-	-	-
6	RAMGARH	6	4	66.67	-	-	1	16.67	1	16.67	-	-
7	SAHEBGANJ	9	9	100.0	-	-	-	-	-	-	-	-
8	DUMKA	10	10	100.0	-	-	-	-	-	-	-	-

9	EAST SINGHBHUM	12	10	83.33	-	-	-	-	2	16.67	-	-
10	BOKARO	9	8	88.89	-	-	-	-	1	11.11	-	-
11	CHATRA	12	12	100.0	-	-	-	-	-	-	-	-
12	DEOGHAR	10	7	70.0	3	30.0	-	-	-	-	-	-
13	DHANBAD	9	3	33.33	3	33.33	2	22.22	1	11.11	-	-
14	GUMLA	12	12	100.0	-	-	-	-	-	-	-	-
15	HAZARIBAGH	16	15	93.75	1	6.25	-	-	-	-	-	-
16	JAMTARA	6	6	100.0	-	-	-	-	-	-	-	-
17	KHUNTI	6	6	100.0	-	-	-	-	-	-	-	-
18	KODERMA	6	4	66.67	1	16.67	1	16.67	-	-	-	-
19	LATEHAR	9	9	100.0	-	-	-	-	-	-	-	-
20	LOHARDAGA	7	7	100.0	-	-	-	-	-	-	-	-
21	PALAMAU	21	21	100.0	-	-	-	-	-	-	-	-
22	RANCHI	19	15	78.95	2	10.53	2	10.53	-	-	-	-
23	SARAIKELA KHARSAWAN	9	9	100.0	-	-	-	-	-	-	-	-
24	WEST SINGHBHUM	18	18	100.0	-	-	-	-	-	-	-	-
	Total	263	240	91.25	12	4.56	6	2.28	5	1.9	-	-

Annexure III (C)

Annual Extractable Ground Water Resource of Assessment Units under Different Category in Jharkhand (as in 2024)

S.No	State/Union Territories	Total Annual Extractable Resource of Assessed Units (in mcm)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Total Annual Extractable Resource (in mcm)	%	Total Annual Extractable Resource (in mcm)	%	Total Annual Extractable Resource (in mcm)	%	Total Annual Extractable Resource (in mcm)	%	Total Annual Extractable Resource (in mcm)	%
1	JHARKHAND	5757.56	5302.35	92.09	259.77	4.51	132.32	2.3	63.13	1.1	-	-
	Total	5757.56	5302.35	92.09	259.77	4.51	132.32	2.3	63.13	1.1	-	-
	Grand Total	5757.56	5302.35	92.09	259.77	4.51	132.32	2.3	63.13	1.1	-	-

Annexure- III (D)

District Wise Annual Extractable Ground Water Resource of Assessment Units under Different Category in Jharkhand (as in 2024)

JHARKHAND

S.No	Name of District	Total Recharge Worthy Area of Assessed Units (in sq.km)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%
1	GODDA	1664.02	1664.02	100.0	-	-	-	-	-	-	-	-
2	GIRIDIH	4400.79	4019.38	91.33	381.41	8.67	-	-	-	-	-	-
3	SIMDEGA	3090.6	3090.6	100.0	-	-	-	-	-	-	-	-
4	GARHWA	2916.43	2706.62	92.81	209.81	7.19	-	-	-	-	-	-
5	PAKUR	1277.59	1277.59	100.0	-	-	-	-	-	-	-	-
6	RAMGARH	1112.67	985.86	88.6	-	-	80.0	7.19	46.81	4.21	-	-
7	SAHEBGANJ	1144.09	1144.09	100.0	-	-	-	-	-	-	-	-
8	DUMKA	2813.67	2813.67	100.0	-	-	-	-	-	-	-	-
9	EAST SINGHBHUM	2509.93	2306.69	91.9	-	-	-	-	203.24	8.1	-	-
10	BOKARO	2624.43	2531.73	96.47	-	-	-	-	92.7	3.53	-	-
11	CHATRA	3260.87	3260.87	100.0	-	-	-	-	-	-	-	-
12	DEOGHAR	1906.98	1554.72	81.53	352.26	18.47	-	-	-	-	-	-
13	DHANBAD	1976.73	611.39	30.93	897.86	45.42	346.31	17.52	121.17	6.13	-	-
14	GUMLA	4071.15	4071.15	100.0	-	-	-	-	-	-	-	-
15	HAZARIBAGH	3526.62	3416.42	96.88	110.2	3.12	-	-	-	-	-	-
16	JAMTARA	983.46	983.46	100.0	-	-	-	-	-	-	-	-
17	KHUNTI	1670.05	1670.05	100.0	-	-	-	-	-	-	-	-
18	KODERMA	909.02	622.11	68.44	146.34	16.1	140.57	15.46	-	-	-	-
19	LATEHAR	2385.13	2385.13	100.0	-	-	-	-	-	-	-	-
20	LOHARDAGA	1275.63	1275.63	100.0	-	-	-	-	-	-	-	-
21	PALAMAU	3473.44	3473.44	100.0	-	-	-	-	-	-	-	-
22	RANCHI	3743.08	2943.27	78.63	298.21	7.97	501.6	13.4	-	-	-	-
23	SARAIKELA KHARSAWAN	2028.01	2028.01	100.0	-	-	-	-	-	-	-	-
24	WEST SINGHBHUM	5882.34	5882.34	100.0	-	-	-	-	-	-	-	-
	Total	60646.73	56718.24	93.52	2396.09	3.95	1068.48	1.76	463.92	0.76	-	-

Annexure- III (E)

Recharge Worthy Area of Assessment unit under Different Category in Jharkhand (as in 2024)													
S.No	States / Union Territories	Total Geographical Area of Assessed Units (in sq km)	Recharge Worthy Area (in sq km)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
				Recharge Worthy Area in sq km	%	Recharge Worthy Area in sq km	%	Recharge Worthy Area in sq km	%	Recharge Worthy Area in sq km	%	Recharge Worthy Area in sq km	%
1	JHARKHAND	79134.05	60646.73	56718.24	93.52	2396.09	3.95	1068.48	1.76	463.92	0.76	-	-
	Total	79134.05	60646.73	56718.24	93.52	2396.09	3.95	1068.48	1.76	463.92	0.76	-	-
	Grand Total	79134.05	60646.73	56718.24	93.52	2396.09	3.95	1068.48	1.76	463.92	0.76	-	-

Annexure III (F)

District Wise Recharge Worthy Area of Assessment unit under Different Category in Jharkhand (as in 2024)												
JHARKHAND												
S.No	Name of District	Total Recharge Worthy Area of Assessed Units (in sq.km)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%	Recharge Worthy Area of Assessed Units (in sq.km)	%
1	GODDA	1664.02	1664.02	100.0	-	-	-	-	-	-	-	-
2	GIRIDIH	4400.79	4019.38	91.33	381.41	8.67	-	-	-	-	-	-
3	SIMDEGA	3090.6	3090.6	100.0	-	-	-	-	-	-	-	-
4	GARHWA	2916.43	2706.62	92.81	209.81	7.19	-	-	-	-	-	-
5	PAKUR	1277.59	1277.59	100.0	-	-	-	-	-	-	-	-
6	RAMGARH	1112.67	985.86	88.6	-	-	80.0	7.19	46.81	4.21	-	-
7	SAHEBGANJ	1144.09	1144.09	100.0	-	-	-	-	-	-	-	-
8	DUMKA	2813.67	2813.67	100.0	-	-	-	-	-	-	-	-
9	EAST SINGHBHUM	2509.93	2306.69	91.9	-	-	-	-	203.24	8.1	-	-
10	BOKARO	2624.43	2531.73	96.47	-	-	-	-	92.7	3.53	-	-
11	CHATRA	3260.87	3260.87	100.0	-	-	-	-	-	-	-	-
12	DEOGHAR	1906.98	1554.72	81.53	352.26	18.47	-	-	-	-	-	-

13	DHANBAD	1976.73	611.39	30.93	897.86	45.42	346.31	17.52	121.17	6.13	-	-
14	GUMLA	4071.15	4071.15	100.0	-	-	-	-	-	-	-	-
15	HAZARIBAGH	3526.62	3416.42	96.88	110.2	3.12	-	-	-	-	-	-
16	JAMTARA	983.46	983.46	100.0	-	-	-	-	-	-	-	-
17	KHUNTI	1670.05	1670.05	100.0	-	-	-	-	-	-	-	-
18	KODERMA	909.02	622.11	68.44	146.34	16.1	140.57	15.46	-	-	-	-
19	LATEHAR	2385.13	2385.13	100.0	-	-	-	-	-	-	-	-
20	LOHARDAGA	1275.63	1275.63	100.0	-	-	-	-	-	-	-	-
21	PALAMAU	3473.44	3473.44	100.0	-	-	-	-	-	-	-	-
22	RANCHI	3743.08	2943.27	78.63	298.21	7.97	501.6	13.4	-	-	-	-
23	SARAIKELA KHARSAWAN	2028.01	2028.01	100.0	-	-	-	-	-	-	-	-
24	WEST SINGHBHUM	5882.34	5882.34	100.0	-	-	-	-	-	-	-	-
	Total	60646.73	56718.24	93.52	2396.09	3.95	1068.48	1.76	463.92	0.76	-	-

Annexure IV (A)

Categorization of Over Exploited, Critical and Semi Critical blocks/ mandals/ taluks in Jharkhand (as in 2024)

JHARKHAND

S.NO	Name of District	S.NO	Name of Semi-Critical Assessment Units	S.NO	Name of Critical Assessment Units	S.NO	Name of Over-Exploited Assessment Units
1	BOKARO					1	BERMO
2	DEOGHAR	1	KARON				
		2	SARWAN				
		3	SONARAITHADHI				
3	DHANBAD	1	GOBINDPUR	1	TOPCHANCHI	1	BALIAPUR
		2	BAGHMARA	2	DHANBAD URBAN		
		3	DHANBAD				
4	EAST SINGHBHUM					1	GOLMURI CUM JUGSALAI
						2	JAMSHEDPUR URBAN
5	GARHWA	1	BHAWANATHPUR				
6	GIRIDIH	1	GIRIDIH				
7	HAZARIBAGH	1	DARU				

8	KODERMA	1	KODERMA	1	JAINAGAR		
9	RAMGARH			1	RAMGARH	1	CHITARPUR
10	RANCHI	1	KHELARI	1	SILLI		
		2	ORMANJHI	2	RANCHI URBAN		

ABSTRACT

Total No. of Assessed Units	Number of Semicritical Assessment Units	Number of Critical Assessment Units	Number of Over Exploited Assessment Units
263	12	6	5

Annexure IV (B)

Quality problems in Assessment units in Jharkhand (as in 2024)

JHARKHAND

S.NO	Name of District	S.NO	Name of Assessment Units affected by Fluoride	S.NO	Name of Assessment Units affected by Arsenic	S.NO	Name of Assessment Units affected by Salinity
1	BOKARO	1	CHANDAN KIYARI				
		2	PETERBAR				
		3	CHAS				
2	DEOGHAR						
3	DHANBAD	1	BALIAPUR				
		2	DHANBAD				
4	EAST SINGHBHUM						
5	GARHWA	1	KANDI				
		2	BHANDARIA				
		3	BHAWANATHPUR				
		4	DHURKI				
		5	RAMNA				
		6	MAJHIAON				

		7	GARHWA				
		8	DANDAI				
		9	CHINIA				
		10	MERAL				
		11	RAMKANDA				
		12	UNTARI				
		13	RANKA				
6	GIRIDIH	1	TISRI				
		2	GIRIDIH				
7	GODDA	1	PATHARGAMA				
		2	GODDA				
		3	POREYAHAT				
		4	MAHAGAMA				
		5	BOARIJOR				
8	GUMLA	1	DUMRI				
		2	GUMLA				
		3	GHAGHRA				
9	JAMTARA						
10	KHUNTI	1	MURHU				
		2	KARRA				
11	KODERMA	1	MARKACHHO				
		2	JAINAGAR				
		3	CHANDWARA				
		4	KODERMA				
		5	SATGAWAN				
12	LATEHAR						
13	PAKUR	1	LITIPARA				
		2	AMRAPARA				
		3	PAKURIA				
14	PALAMAU	1	LESLIEGANJ				
		2	CHHATARPUR				
		3	BISHRAMPUR				
		4	HARIHARGANJ				
		5	PANKI				

		6	PATAN				
		7	DALTONGANJ				
		8	CHAINPUR				
		9	SATBARWA				
		10	PANDU				
		11	MANATU				
15	RAMGARH						
16	RANCHI	1	SILLI				
		2	NAMKUM				
		3	ORMANJHI				
17	SAHEBGANJ	1	BARHAIT				
		2	BORIO				
18	SARAIKELA KHARSAWAN						
19	WEST SINGHBHUM						

ABSTRACT

Total No. of Assessed Units	Number of Assessment Units affected by Fluoride	Number of Assessment Units affected by Arsenic	Number of Assessment Units affected by Salinity
54	54	0	0

Annexure V (A)

Summary of Assessment units improved or deteriorated from 2023 to 2024 assessment in Jharkhand (as in 2024)

S.No	Name of States / Union Territories	Number of Assessment Units Improved	Number of Assessment Units Deteriorated	Number of Assessment Units With No Change
1	JHARKHAND	0	1	263

Annexure V (B)

COMPARISON OF CATEGORIZATION OF ASSESSMENT UNITS (2023 AND 2024)									
JHARKHAND									
S.No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%)2023	Categorization in2023	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%)2024	Categorization in2024	Remark
1	DHANBAD	BAGHMARA	69.22822513180678	safe	DHANBAD	BAGHMARA	70.5383163751678	semi_critical	Deteriorated

Annexure VI

Assessment Unit Wise Report (Attribute Table)

Sl. No	District	Assessment Unit Name	Total Geographical Area	Recharge Worthy Area	Recharge from Rainfall-MON	Recharge from Other Sources-MON	Recharge from Rainfall-NM	Recharge from Other Sources -NM	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Irrigation Use (Ham)	Industrial Use (Ham)	Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (OE/Critical/Semicritical/Safe)
1	BOKARO	BERMO	10082	9270	949.47	299.53	89.26	298.02	1636.28	163.63	1472.65	20	1577.75	466.14	2063.89	468.38	0	140.15	over_exploited
2	BOKARO	CHANDAN KIYARI	37474	34848	1920.82	541.82	253.36	154.97	2870.97	143.55	2727.42	378	9.73	424.87	812.6	426.9	1912.79	29.79	safe
3	BOKARO	CHANDRAPURA	13512	12424	740.13	40.03	104.37	43.51	928.04	92.81	835.23	106.5	155.98	294.42	556.91	295.83	276.91	66.68	safe
4	BOKARO	CHAS	57395	54095	3188.88	34.5	370.83	42.44	3636.65	181.83	3454.82	161.5	29.03	1845.73	2036.27	1854.58	1409.7	58.94	safe
5	BOKARO	GUMIA	65070	56439	3480.21	192.18	490.74	216.22	4379.35	437.94	3941.41	641	250	484.99	1375.99	487.32	2563.09	34.91	safe
6	BOKARO	JARIDIH	21263	19627	1155.29	87.82	134.98	25.66	1403.75	70.19	1333.56	54.75	27.09	209.56	291.41	210.56	1041.15	21.85	safe
7	BOKARO	KASMAR	19529	18327	893.87	58.55	126.04	92.51	1170.97	117.1	1053.87	370.25	0	163.03	533.28	163.82	519.8	50.60	safe
8	BOKARO	NAWADIH	30892	28600	2436.12	139.75	229.01	97.53	2902.41	290.24	2612.17	305	4.57	253.91	563.5	255.13	2047.45	21.57	safe
9	BOKARO	PETERBAR	30721	28813	1687.54	64.05	195.4	94.1	2041.09	102.06	1939.03	356	3.74085	242.44	602.18	243.61	1335.68	31.06	safe
10	CHATRA	CHATRA	38285	27557	1562.12	186.14	57.44	144.88	1950.58	97.53	1853.05	434	0	306.55	740.55	308.02	1111.03	39.96	safe

Sl. No	District	Assessment Unit Name	Total Geographical Area	Recharge Worthy Area	Recharge from Rainfall-MON	Recharge from Other Sources-MON	Recharge from Rainfall-NM	Recharge from Other Sources-NM	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Irrigation Use (Ham)	Industrial Use (Ham)	Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (OE/Critical/Semicritical/Safe)
11	CHATRA	GIDHAUR	16732	13658	799.05	240.82	28.59	168.17	1236.63	61.83	1174.8	404.5	0	74.15	478.64	74.5	695.81	40.74	safe
12	CHATRA	HUNTERGANJ	50893	42763	3165.04	296.32	88.9	355.04	3905.3	195.27	3710.03	1422	0	339.91	1761.91	341.54	1946.49	47.49	safe
13	CHATRA	ITKHORI	17244	15044	753.24	213.72	31.13	187.91	1186	59.3	1126.7	508	0	135.77	643.78	136.42	482.27	57.14	safe
14	CHATRA	KANHACHATTI	25915	18653	1588.74	104.72	44.43	78.95	1816.84	181.69	1635.15	231	0	114.18	345.18	114.73	1289.42	21.11	safe
15	CHATRA	KUNDA	28567	21853	1222.64	98.7	51.29	75.22	1447.85	144.78	1303.07	239	0	54.39	293.39	54.65	1009.42	22.52	safe
16	CHATRA	LAWALONG	39913	33628	1775.44	53.91	70.38	59.44	1959.17	97.96	1861.21	234	0	91.60	325.6	92.04	1535.17	17.49	safe
17	CHATRA	MAYURHUND	12797	11164	737.84	187.34	23.1	155.32	1103.6	55.18	1048.42	470	0	106.77	576.77	107.28	471.14	55.01	safe
18	CHATRA	PATHALGODA	13698	12515	780.47	116.88	26.19	97.86	1021.4	102.15	919.25	386.5	0	57.13	443.63	57.41	475.34	48.26	safe
19	CHATRA	PRATAPPUR	37573	31730	1930.99	174.76	66.41	122.98	2295.14	114.77	2180.37	447.5	0	217.84	665.34	218.89	1513.98	30.52	safe
20	CHATRA	SIMARIA	52072	46890	3116.43	247.51	101.65	290.02	3755.61	187.78	3567.83	1019.5	0	195.46	1214.97	196.4	2351.92	34.05	safe
21	CHATRA	TANDWA	59500	50632	3951.47	209.69	165.77	220.87	4547.8	454.78	4093.02	432.5	1115.225	237.44	1785.17	238.58	2306.71	43.61	safe
22	DEOGHAR	DEOGHAR	44949	32745	2369	113.92	221.05	136.14	2840.11	142.01	2698.1	453.375	8.2601	760.96	1222.58	764.61	1471.87	45.31	safe
23	DEOGHAR	DEVIPUR	26315	21361	1234.57	102.25	144.2	114.55	1595.57	79.78	1515.79	396	0	193.91	589.91	194.84	924.95	38.92	safe
24	DEOGHAR	KARON	15015	9748	667.63	108.44	84.61	127.4	988.08	98.81	889.27	473.625	0	159.91	633.54	160.68	254.96	71.24	semi_critical
25	DEOGHAR	MADHUPUR	24604	19821	1457.01	143.19	133.81	125.54	1859.55	92.98	1766.57	445.25	0.918	382.04	828.2	383.87	936.54	46.88	safe
26	DEOGHAR	MARGOMUNDA	16217	10528	649.89	39.84	71.07	78.55	839.35	41.97	797.38	278.75	0	157.16	435.91	157.91	360.72	54.67	safe
27	DEOGHAR	MOHANPUR	35395	23713	1399.64	114.07	160.08	138.59	1812.38	90.62	1721.76	469.25	0	318.63	787.89	320.16	932.34	45.76	safe
28	DEOGHAR	PALOJORI	30298	24298	1391.46	128.18	164.03	164.75	1848.42	92.42	1756	658.125	0.324	292.24	950.69	293.65	803.9	54.14	safe
29	DEOGHAR	SARATH	31788	23006	2140.28	259.62	180.82	198.3	2779.02	277.9	2501.12	704.125	78.1605	306.66	1088.95	308.13	1410.7	43.54	safe
30	DEOGHAR	SARWAN	17040	14223	1055.15	224.38	95.7	277.45	1652.68	82.64	1570.04	1087.5	0	164.45	1251.95	165.24	317.3	79.74	semi_critical
31	DEOGHAR	SONARAITHADHI	13484	11255	597.58	171.31	75.73	122.45	967.07	96.71	870.36	490.5	0	137.92	628.42	138.58	241.28	72.20	semi_critical
32	DHANBAD	BAGHMARA	27112	22696	2063.84	308.37	203.57	279.83	2855.61	285.56	2570.05	256.5	877.0221	679.34	1812.87	682.6	753.92	70.54	semi_critical
33	DHANBAD	BALIAPUR	15117	12117	1126.89	188.34	74.1	196.93	1586.26	158.62	1427.64	160.5	1142.215	268.12	1570.83	269.41	0.81	110.03	over_exploited

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34	DHANBAD	CHIRKUNDA	43883	35994	3599.5	115.96	272.95	130.73	4119.14	205.95	3913.19	362	107.7375	881.57	1351.31	885.79	2557.66	34.53	safe
35	DHANBAD	DHANBAD	46729	43807	5703.71	861.55	375.06	849.86	7790.18	779.02	7011.16	85	5589.442	60.56	5735	60.85	1275.87	81.80	semi_critical
36	DHANBAD	GOBINDPUR	32934	23283	1402.23	556.68	128.63	533.89	2621.43	131.08	2490.35	309.5	1153.726	461.89	1925.12	464.1	563.02	77.30	semi_critical
37	DHANBAD	JHARIA	0	0	0	0	0	0	0	0	0	0	0	0.00	-	0	0	-	Hilly Area
38	DHANBAD	PURBI TUNDI	12087	7686	578.97	89.9	43.87	52.29	765.03	38.25	726.78	99	0	91.03	190.03	91.47	536.31	26.15	safe
39	DHANBAD	TOPCHANCHI	19927	12927	1246.15	570.31	86.43	606.26	2509.15	125.45	2383.7	852.5	1045.446	329.82	2227.76	331.4	154.36	93.46	critical
40	DHANBAD	TUNDI	27458	17459	1476.16	146.69	99.65	186.97	1909.47	95.47	1814	574	0	184.86	758.86	185.75	1054.25	41.83	safe
41	DHANBAD	DHANBAD URBAN	22604	21704	1904.26	955.85	125.22	924.95	3910.28	391.03	3519.25	263	167.75	2935.30	3366.05	2949.37	139.13	95.65	critical
42	DUMKA	DUMKA	37880	29981	1530.6	245.83	277.14	184.69	2238.26	223.83	2014.43	457.75	23.1625	430.08	911	432.14	1101.37	45.22	safe
43	DUMKA	GOPIKANDER	22060	20260	1286.77	53.84	232.99	48.22	1621.82	162.18	1459.64	87.75	0	76.22	163.97	76.58	1295.31	11.23	safe
44	DUMKA	JAMA	38590	36090	2203.33	257.45	377.3	237.64	3075.72	153.8	2921.92	814.25	0.453125	249.99	1064.69	251.19	1856.03	36.44	safe
45	DUMKA	JARMUNDI	39943	21635	1457.26	243.96	226.18	259.14	2186.54	109.33	2077.21	834.5	0	347.02	1181.52	348.69	894.02	56.88	safe
46	DUMKA	KATHIKUND	30620	22821	2908.17	257.9	356.17	85.95	3608.19	180.41	3427.78	117.5	0	129.48	246.98	130.1	3180.18	7.21	safe
47	DUMKA	MASALIA	46020	36719	2120.11	295.6	383.88	152.71	2952.3	295.23	2657.07	278.25	0	225.69	503.94	226.78	2152.04	18.97	safe
48	DUMKA	RAMGARH	48140	36241	3138.77	669.17	378.88	194.57	4381.39	438.15	3943.24	354.75	0	289.76	644.51	291.15	3297.34	16.34	safe
49	DUMKA	RANISHWAR	34660	22552	1483.43	150.08	215.53	49.81	1898.85	95.81	1803.04	60.75	0	184.22	244.97	185.1	1557.19	13.59	safe
50	DUMKA	SARAIYAHAT	29810	13611	831.38	134.03	142.3	139.35	1247.06	62.88	1184.18	488.75	0	283.20	771.95	284.56	410.87	65.19	safe
51	DUMKA	SHIKARIPARA	43920	41457	3730.72	544.42	675.5	267.22	5217.86	521.78	4696.08	255.5	0	238.21	493.72	239.36	4201.21	10.51	safe
52	EAST SINGHBHUM	BAHARAGORA	33508	28555	6062.38	103.71	619.66	199.61	6985.36	349.26	6636.1	873.5	1.777913	277.33	1152.61	278.66	5482.16	17.37	safe
53	EAST SINGHBHUM	BORAM	24575	12167	1000.43	37.15	104.66	31.78	1174.02	58.7	1115.32	77	0	125.05	202.05	125.65	912.67	18.12	safe
54	EAST SINGHBHUM	CHAKULIA	42776	38168	3656.4	65.72	363.48	88.32	4173.92	417.39	3756.53	313.5	0	237.45	550.95	238.59	3204.44	14.67	safe

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55	EAST SINGHBHUM	DHALBHUMGARH	17613	11253	789.98	55.55	95.81	41.58	982.92	49.15	933.77	160.5	0	112.22	272.72	112.76	660.51	29.21	safe
56	EAST SINGHBHUM	DUMARIA	31670	22049	1533.53	47.7	228.67	24.01	1833.91	183.39	1650.52	35	0	112.58	147.57	113.12	1502.41	8.94	safe
57	EAST SINGHBHUM	GHATSILA	34635	22222	1269.17	166.82	189.25	56.41	1681.65	168.17	1513.48	108.25	40.34691	262.16	410.76	263.41	1101.47	27.14	safe
58	EAST SINGHBHUM	GOLMURI CUM JUGSALAI	20519	7404	549.12	58.84	81.88	34.5	724.34	72.44	651.9	92.25	627.8501	185.95	906.05	186.85	0	138.99	over_exploited
59	EAST SINGHBHUM	GURABANDHA	24620	15729	1123.9	19.68	167.59	12.19	1323.36	132.34	1191.02	13.5	0	77.92	91.42	78.29	1099.23	7.68	safe
60	EAST SINGHBHUM	MUSABANI	24499	16599	1025.9	21.86	101.98	4.43	1154.17	115.42	1038.75	34	0	226.72	260.72	227.81	776.94	25.10	safe
61	EAST SINGHBHUM	PATAMDA	36578	18110	1044.67	58.79	155.77	49.3	1308.53	130.86	1177.67	147.5	0	150.17	297.67	150.89	879.28	25.28	safe
62	EAST SINGHBHUM	POTKA	59422	45817	3624.59	46.88	540.48	35.23	4247.18	424.72	3822.46	5	88.06915	368.61	461.68	370.38	3359.01	12.08	safe
63	EAST SINGHBHUM	JAMSHEDPUR URBAN	12920	12920	847.89	786.86	102.88	772.78	2510.41	125.52	2384.89	0	0	2860.29	2860.29	2874	0	119.93	over_exploited
64	GARHWA	BARDIHA	9770	3602	378.95	37.82	19.25	44.25	480.27	48.03	432.24	104.5	0	68.73	173.22	69.06	258.69	40.07	safe
65	GARHWA	BHANDARIA	66118	53018	3900.86	117.51	198.2	149.25	4365.82	436.58	3929.24	425.25	0	119.76	545.01	120.33	3383.66	13.87	safe
66	GARHWA	BHAWANATHPUR	28688	20981	2139.27	310.58	108.69	475.63	3034.17	303.42	2730.75	2050.25	4.64865	158.07	2212.97	158.82	517.03	81.04	semi_critical
67	GARHWA	BISHUNPURA	7923	6158	1077.18	167.17	54.73	90.42	1389.5	138.96	1250.54	204.75	0	58.42	263.17	58.7	987.09	21.04	safe
68	GARHWA	CHINIA	28583	24783	1451.56	47.22	87.15	44.33	1630.26	81.51	1548.75	66	0	70.37	136.37	70.7	1412.05	8.81	safe
69	GARHWA	DANDA	3186	2049	192.29	6.98	9.77	4.59	213.63	21.37	192.26	37	0	32.36	69.36	32.51	122.75	36.08	safe
70	GARHWA	DANDAI	13833	10233	670.81	51.22	34.08	64.59	820.7	82.07	738.63	242.5	0	115.36	357.86	115.91	380.22	48.45	safe
71	GARHWA	DHURKI	21146	16255	757.36	94.55	57.72	100.06	1009.69	100.97	908.72	261	0	100.51	361.52	100.99	546.72	39.78	safe
72	GARHWA	GARHWA	27355	17591	1224.32	364.75	69.76	154.35	1813.18	90.66	1722.52	228.5	55.88035	395.70	680.08	397.6	1040.54	39.48	safe
73	GARHWA	KANDI	17698	12943	2089.54	109.4	106.17	126.36	2431.47	243.14	2188.33	277	0	33.56	310.56	33.72	1877.61	14.19	safe
74	GARHWA	KETAR	15405	11266	1790.69	77.73	90.98	125.5	2084.9	208.49	1876.41	539.625	0	92.09	631.7	92.53	1244.27	33.67	safe
75	GARHWA	KHARAONDHI	14108	11108	1007.61	97.03	51.2	156.64	1312.48	131.24	1181.24	696.5	0	93.28	789.78	93.73	391.01	66.86	safe

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76	GARHWA	MAJHIAON	14147	5215	585.35	45.74	29.74	68.28	729.11	72.91	656.2	233	0	140.62	373.62	141.3	281.9	56.94	safe
77	GARHWA	MERAL	26387	17287	1586.5	89.22	80.61	93.1	1849.43	184.94	1664.49	261.5	0	236.12	497.62	237.25	1165.74	29.90	safe
78	GARHWA	RAMKANDA	22185	17171	955.38	186.08	61.55	88.3	1291.31	64.56	1226.75	162	0	80.55	242.55	80.93	983.82	19.77	safe
79	GARHWA	RAMNA	15421	11986	789.76	213.31	41.55	161.05	1205.67	60.34	1145.33	487.5	0	127.90	615.4	128.51	529.32	53.73	safe
80	GARHWA	RANKA	42743	27027	1427.4	76.67	96.88	83.14	1684.09	84.28	1599.81	162.5	0	163.96	326.46	164.74	1272.57	20.41	safe
81	GARHWA	SAGMA	9983	7674	536.34	124.77	27.25	105.02	793.38	79.34	714.04	330.5	0	55.08	385.58	55.34	328.2	54.00	safe
82	GARHWA	UNTARI	19796	15296	1389.9	181.27	70.62	208.7	1850.49	185.05	1665.44	762	0	186.22	948.22	187.12	716.32	56.94	safe
83	GIRIDIH	BAGODAR	28749	27983	2094.01	85.33	131.61	70.4	2381.35	119.07	2262.28	162	0	286.47	448.47	287.84	1812.44	19.82	safe
84	GIRIDIH	BENGABAD	40255	36154	2813.69	170.92	170.04	188.59	3343.24	334.32	3008.92	703.375	0	277.60	980.98	278.93	2026.61	32.60	safe
85	GIRIDIH	BIRNI	31998	27997	1760.42	207.33	131.68	228.88	2328.31	116.51	2211.8	853	0	307.05	1160.04	308.52	1050.29	52.45	safe
86	GIRIDIH	DEORI	42381	35876	2911.43	354.72	183.2	138.8	3588.15	179.6	3408.55	508.25	0	330.74	838.99	332.33	2567.97	24.61	safe
87	GIRIDIH	DHANWAR	35241	34771	2618.89	263.03	163.54	288.89	3334.35	166.72	3167.63	1285.75	8.63175	490.23	1784.62	492.58	1380.66	56.34	safe
88	GIRIDIH	DUMRI	43058	34158	2658.35	141.57	160.66	136.3	3096.88	309.69	2787.19	474.5	15.22	420.07	909.79	422.09	1875.38	32.64	safe
89	GIRIDIH	GANDE	36610	32910	2542.71	376.07	154.79	156.13	3229.7	161.52	3068.18	358.875	0	317.26	676.13	318.78	2390.53	22.04	safe
90	GIRIDIH	GAWAN	42956	35175	3095.68	210.79	193.8	429.71	3929.98	196.5	3733.48	2030.375	0	210.13	2240.49	211.13	1491.99	60.01	safe
91	GIRIDIH	GIRIDIH	39141	38141	3366.93	248.6	203.48	233.25	4052.26	405.22	3647.04	658.125	1516.029	783.37	2957.52	787.12	685.77	81.09	semi_critical
92	GIRIDIH	JAMUA	47847	38548	2810.32	423.01	180.46	312.75	3726.54	186.44	3540.1	1044.75	0	492.08	1536.82	494.44	2000.92	43.41	safe
93	GIRIDIH	PIRTANR	49286	38245	2976.42	290.85	179.88	190.93	3638.08	363.82	3274.26	411.375	0	198.44	609.81	199.39	2663.5	18.62	safe
94	GIRIDIH	SARIA	28012	27266	2121.98	77.83	128.24	88.5	2416.55	241.65	2174.9	293.625	21.879	282.59	598.1	283.94	1575.45	27.50	safe
95	GIRIDIH	TISRI	42956	32855	3696.61	159.76	223.4	83.19	4162.96	416.3	3746.66	238.875	0	172.29	411.15	173.11	3334.69	10.97	safe
96	GODDA	BASANTRAI	8887	8149	1831.54	51.18	134.6	41.77	2059.09	205.91	1853.18	92.75	0	169.32	262.08	170.14	1590.28	14.14	safe
97	GODDA	BOARIJOR	34390	25990	2309.74	171.75	254.6	143.63	2879.72	287.97	2591.75	208.25	242.95	250.66	701.86	251.86	1888.69	27.08	safe
98	GODDA	GODDA	35530	29930	3945.42	99.32	306.84	117.09	4468.67	223.62	4245.05	325.25	5.93335	524.92	856.1	527.44	3386.43	20.17	safe

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99	GODDA	MAHAGAMA	15955	12955	2291.45	171.88	168.39	79.01	2710.73	271.07	2439.66	111.25	9.71295	364.15	485.12	365.9	1952.79	19.88	safe
100	GODDA	MEHERMA	12963	9962	1380.81	149.27	135.5	81.36	1746.94	87.4	1659.54	112.5	0	265.32	377.83	266.6	1280.43	22.77	safe
101	GODDA	PATHARGAMA	15256	13989	1598.77	310.11	144.41	120.73	2174.02	108.72	2065.3	173.75	0	209.58	383.33	210.59	1680.96	18.56	safe
102	GODDA	POREYAHAT	47005	35205	1763.02	443.67	194.34	273.23	2674.26	267.43	2406.83	515	0	339.73	854.74	341.36	1550.46	35.51	safe
103	GODDA	SUNDERPAHARI	32679	24979	2407.03	154.33	209.2	87.22	2857.78	142.89	2714.89	152.25	0	118.62	270.87	119.19	2443.45	9.98	safe
104	GODDA	THAKURGHANTI	8444	5243	908.38	205.54	78.66	88.5	1281.08	64.32	1216.76	178	0	180.48	358.48	181.35	857.41	29.46	safe
105	GUMLA	ALBERT EKKA	20901	16232	901.17	25.96	129.76	56.19	1113.08	111.3	1001.78	276.5	0	56.04	332.54	56.31	668.97	33.19	safe
106	GUMLA	BASIA	40276	33816	2791.71	38.42	267.98	67.38	3165.49	316.55	2848.94	322.125	0	146.29	468.41	146.99	2379.83	16.44	safe
107	GUMLA	BHARNO	30185	24244	1201.75	6.38	173.04	21.64	1402.81	140.28	1262.53	10.875	0	115.56	126.43	116.11	1135.55	10.01	safe
108	GUMLA	BISHUNPUR	61035	41105	2274.87	73.64	327.55	117.67	2793.73	279.37	2514.36	402.5	0.43875	112.92	515.87	113.46	1997.95	20.52	safe
109	GUMLA	CHAINPUR	50344	35608	1968.63	77.89	283.46	82.87	2412.85	241.28	2171.57	174.75	0	102.54	277.29	103.04	1893.78	12.77	safe
110	GUMLA	DUMRI	37163	28861	2115.62	91.45	230.71	38.91	2476.69	123.86	2352.83	130.125	0	89.03	219.15	89.46	2133.25	9.31	safe
111	GUMLA	GHAGHRA	53014	42608	4006.63	92.93	461.01	156.06	4716.63	235.86	4480.77	645.5	7.59405	212.95	866.03	213.97	3613.72	19.33	safe
112	GUMLA	GUMLA	53974	36891	3796.35	84.38	364.42	120.34	4365.49	436.55	3928.94	553.25	4.50585	303.56	861.32	305.01	3066.17	21.92	safe
113	GUMLA	KAMDARA	36468	27687	2305.71	59.59	221.33	110.48	2697.11	269.71	2427.4	403.875	0	174.86	578.73	175.7	1847.83	23.84	safe
114	GUMLA	PALKOT	57735	42978	3555.87	18.99	341.34	41.61	3957.81	395.79	3562.02	206.25	0	146.52	352.76	147.22	3208.56	9.90	safe
115	GUMLA	RAIDIH	51096	42648	2768.43	59.06	340.93	95.06	3263.48	163.19	3100.29	262.875	0	129.46	392.32	130.08	2707.35	12.65	safe
116	GUMLA	SISAI	42535	34437	2485.45	78.66	357.88	90.44	3012.43	301.24	2711.19	400.875	0	211.72	612.59	212.74	2097.58	22.59	safe
117	HAZARIBAGH	BARHI	36617	27499	1725.14	179.02	146.26	215.99	2266.41	113.32	2153.09	764.875	19.57345	251.85	1036.3	253.05	1115.59	48.13	safe
118	HAZARIBAGH	BARKAGAON	44788	38988	3362.44	212	318.78	232.38	4125.6	412.56	3713.04	433.25	43.00819	251.21	727.47	252.42	2984.36	19.59	safe
119	HAZARIBAGH	BARKATHA	28103	22810	1279.63	184.99	121.32	203.69	1789.63	178.96	1610.67	720.25	0	221.55	941.8	222.62	667.8	58.47	safe
120	HAZARIBAGH	BISHNUGARH	41700	28084	1570.51	169.1	148.89	227.92	2116.42	211.64	1904.78	840	9.43755	290.21	1139.64	291.6	763.75	59.83	safe
121	HAZARIBAGH	CHALKUSHA	14907	12100	678.81	101.38	64.36	60.45	905	90.5	814.5	145	0.4375	94.35	239.79	94.8	574.26	29.44	safe

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122	HAZARIBAGH	CHAUPARAN	48102	39540	4926.44	223.31	311.37	245.94	5707.06	570.71	5136.35	697	5.031 15	296.74	998.77	298.16	4136.16	19.45	safe
123	HAZARIBAGH	CHURCHU	20140	16708	1068.54	93.96	101.3	135.88	1399.68	139.97	1259.71	521.25	90.58 605	101.82	713.65	102.31	545.57	56.65	safe
124	HAZARIBAGH	DARI	14552	12072	1039.15	70.1	85.3	92.9	1287.45	64.37	1223.08	374.125	41.14 58	159.37	574.63	160.13	647.69	46.98	safe
125	HAZARIBAGH	DARU	12813	11020	732.59	82.11	58.61	145.86	1019.17	50.96	968.21	603	0	94.78	697.78	95.23	269.98	72.07	semi_critical
126	HAZARIBAGH	HAZARIBAGH	26227	24128	2204.39	162.29	139.33	147.7	2653.71	265.37	2388.34	472.625	30.47 545	638.88	1141.97	641.94	1243.31	47.81	safe
127	HAZARIBAGH	ICHAK	28668	24217	1392.69	118.84	128.8	130.52	1770.85	88.55	1682.3	423.125	0	204.42	627.55	205.4	1053.77	37.30	safe
128	HAZARIBAGH	KATKAMDAG	16306	13246	1102.11	55.4	69.66	116.12	1343.29	134.33	1208.96	357.25	25.79 49	158.00	541.05	158.76	667.15	44.75	safe
129	HAZARIBAGH	KATKAMSANDI	30059	24419	1938.79	126.59	132.99	122.27	2320.64	116.03	2204.61	375.75	11.49 54	206.13	593.38	207.12	1610.24	26.92	safe
130	HAZARIBAGH	KEREDARI	35492	29446	3726.08	213.26	235.5	223.7	4398.54	439.85	3958.69	508.875	193.2 675	165.54	867.68	166.33	3090.22	21.92	safe
131	HAZARIBAGH	PADMA	12657	11257	589.44	49.98	55.88	41.26	736.56	73.65	662.91	120	0	101.50	221.5	101.98	440.93	33.41	safe
132	HAZARIBAGH	TATIJHARIA	19915	17128	960.88	79.97	91.1	134.39	1266.34	126.63	1139.71	495	0	87.97	582.97	88.39	556.32	51.15	safe
133	JAMTARA	FATEPUR	28109	13563	785.75	255.77	114.42	199.26	1355.2	135.52	1219.68	576.375	0	162.44	738.82	163.22	480.08	60.57	safe
134	JAMTARA	JAMTARA	32875	17267	1297.52	145.75	145.67	104.16	1693.1	84.65	1608.45	195.75	4.443 75	412.93	613.13	414.91	993.34	38.12	safe
135	JAMTARA	KUNDAHIT	29874	7770	450.14	209.38	65.55	129.86	854.93	85.49	769.44	272.25	0	153.85	426.11	154.59	342.59	55.38	safe
136	JAMTARA	NALA	41384	27665	1602.72	338.58	233.39	185.94	2360.63	236.06	2124.57	288	0	244.22	532.23	245.39	1591.17	25.05	safe
137	JAMTARA	NARAYANPUR	31065	23088	1372.64	279.36	194.78	231.4	2078.18	103.91	1974.27	691.25	0	297.11	988.36	298.53	984.49	50.06	safe
138	JAMTARA	VIDYASAGAR	17122	8993	520.99	139.5	75.87	97.08	833.44	83.35	750.09	256.625	5.712 5	212.73	475.06	213.75	274.01	63.33	safe
139	KHUNTI	ERKI	51500	29999	1768.06	119.97	196.45	103.13	2187.61	218.76	1968.85	272.625	0	146.03	418.65	146.73	1549.5	21.26	safe
140	KHUNTI	KARRA	50745	27745	1861.21	126.21	171.54	172.93	2331.89	116.59	2215.3	526.5	0	197.66	724.16	198.61	1490.19	32.69	safe
141	KHUNTI	KHUNTI	45400	35413	2448.7	70.19	224.29	88.44	2831.62	141.58	2690.04	246.375	3.327 5	249.37	499.07	250.56	2189.78	18.55	safe
142	KHUNTI	MURHU	40400	26103	1538.44	129.34	170.94	131.5	1970.22	197.02	1773.2	461.375	0.091 25	154.90	616.37	155.64	1156.09	34.76	safe

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143	KHUNTI	RANIA	26743	20344	1199.02	125	133.22	130.88	1588.12	158.81	1429.31	536.125	0	71.30	607.43	71.64	821.54	42.50	safe
144	KHUNTI	TORPA	45229	27401	2422.41	88.1	179.44	111.8	2801.75	280.17	2521.58	342	9.175	174.16	525.33	175	1995.41	20.83	safe
145	KODERMA	CHANDWARA	22889	22206	1140.67	106.91	96.75	224.96	1569.29	78.47	1490.82	804.625	11.25	153.86	969.74	154.6	520.34	65.05	safe
146	KODERMA	DOMCHANCH	32804	18793	1027.22	44.02	94.98	54.91	1221.13	122.11	1099.02	216	13.21155	237.62	466.83	238.76	631.05	42.48	safe
147	KODERMA	JAINAGAR	18419	14057	662.37	88.11	61.24	144.35	956.07	95.61	860.46	600.75	0	237.88	838.63	239.02	20.69	97.46	critical
148	KODERMA	KODERMA	29012	14634	903.26	39.57	70.32	49.35	1062.5	53.18	1009.32	206.5	74.4795	455.45	736.43	457.64	270.7	72.96	semi_critical
149	KODERMA	MARKACHHO	16171	10837	510.65	22.56	47.21	28.43	608.85	60.88	547.97	104.75	0	171.09	275.84	171.91	271.31	50.34	safe
150	KODERMA	SATGAWAN	30375	10375	1038.16	84.76	63.99	147.7	1334.61	133.46	1201.15	659.25	0	135.03	794.28	135.68	406.22	66.13	safe
151	LATEHAR	BALUMATH	35151	25848	2158.31	245.38	129.79	188.81	2722.29	136.11	2586.18	535	82.38963	161.29	778.68	162.06	1806.73	30.11	safe
152	LATEHAR	BARIATU	33740	24811	1357.89	301.07	363.04	205.08	2227.08	111.36	2115.72	537.5	0	108.89	646.39	109.42	1468.8	30.55	safe
153	LATEHAR	BARWADIH	43536	30933	1945.08	195.19	115.32	261.27	2516.86	125.84	2391.02	940	6.60195	184.57	1131.17	185.46	1258.96	47.31	safe
154	LATEHAR	CHANDWA	58786	39886	3749.22	473.13	166.68	304.47	4693.5	469.36	4224.14	771.5	16.7459	204.45	992.7	205.43	3230.46	23.50	safe
155	LATEHAR	GARU	22298	14098	750.58	185.03	50.05	181.12	1166.78	116.68	1050.1	624	0	54.86	678.85	55.12	370.99	64.65	safe
156	LATEHAR	HERHANG	25197	18529	1023.57	141.7	286.61	93.64	1545.52	154.55	1390.97	193.5	0	62.75	256.25	63.05	1134.42	18.42	safe
157	LATEHAR	LATEHAR	44884	24439	1632.44	400.61	108.86	284.2	2426.11	242.62	2183.49	825.5	0	279.61	1105.11	280.95	1077.04	50.61	safe
158	LATEHAR	MAHUADANR	63783	35583	4036.15	423.05	179.44	266.07	4904.71	490.47	4414.24	379	0	135.42	514.42	136.07	3899.17	11.65	safe
159	LATEHAR	MANIKA	33886	24386	2114.4	132.99	94	130.58	2471.97	247.2	2224.77	303	0	159.63	462.63	160.4	1761.37	20.79	safe
160	LOHARDAGA	BHANDRA	16066	14127	2421.91	82.62	184	98.36	2786.89	278.69	2508.2	332.25	5.625	103.83	441.7	104.33	2066	17.61	safe
161	LOHARDAGA	KARRO	10228	8943	1477.7	77.74	112.26	61.01	1728.71	172.87	1555.84	159	0	68.61	227.62	68.94	1327.89	14.63	safe
162	LOHARDAGA	KISKO	25330	21074	2972.93	96.06	225.86	98.03	3392.88	339.29	3053.59	241.5	1.91625	99.59	343.01	100.06	2710.11	11.23	safe
163	LOHARDAGA	KURU	21741	19550	2251.6	61.67	171.06	91.34	2575.67	257.57	2318.1	301.25	0	153.71	454.96	154.44	1862.41	19.63	safe
164	LOHARDAGA	LOHARDAGA	16168	13444	3037.45	74.24	230.76	101.37	3443.82	344.38	3099.44	375.75	0	266.16	641.91	267.43	2456.26	20.71	safe
165	LOHARDAGA	PESHRAR	38467	32330	1654.36	44.02	188.53	46.93	1933.84	193.39	1740.45	108	0	56.27	164.28	56.55	1575.89	9.44	safe

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166	LOHARDAGA	SENHA	21246	18095	3551.98	68.91	269.85	93.26	3984	398.4	3585.6	315.75	0.628764	126.42	442.8	127.03	3142.19	12.35	safe
167	PAKUR	AMRAPARA	27329	20529	2526.99	209.3	383.98	133.98	3254.25	325.43	2928.82	174.5	0	118.30	292.81	118.87	2635.44	10.00	safe
168	PAKUR	HIRANPUR	16960	15160	1883.49	107.36	286.2	86.1	2363.15	236.32	2126.83	211	0	152.35	363.35	153.08	1762.75	17.08	safe
169	PAKUR	LITIPARA	41305	18905	2237.38	198.92	339.98	87.31	2863.59	286.36	2577.23	54.5	0	191.53	246.03	192.45	2330.28	9.55	safe
170	PAKUR	MAHESHPUR	44893	35193	8257.94	579.72	836.54	339.28	10013.48	1001.35	9012.13	952	0.410625	378.46	1330.87	380.28	7679.44	14.77	safe
171	PAKUR	PAKUR	22171	16071	3498.01	190.83	425.22	148.41	4262.47	426.24	3836.23	339	28.04613	488.53	855.59	490.88	2978.29	22.30	safe
172	PAKUR	PAKURIA	27901	21901	3401.24	139.57	413.46	113.42	4067.69	406.77	3660.92	180.5	0	196.74	377.24	197.68	3282.74	10.30	safe
173	PALAMAU	BISHRAMPUR	22856	17120	1192.48	214.54	78.66	35.99	1521.67	76.08	1445.59	67	0	218.51	285.51	219.56	1159.03	19.75	safe
174	PALAMAU	CHAINPUR	66140	51969	2356.82	475.34	189.53	261.11	3282.8	328.28	2954.52	633	18.1356	424.81	1075.95	426.85	1876.53	36.42	safe
175	PALAMAU	CHHATARPUR	42320	32503	1866.42	210.62	114.03	208.18	2399.25	119.96	2279.29	794	0	267.20	1061.2	268.48	1216.81	46.56	safe
176	PALAMAU	DALTONGANJ	13282	12502	686.8	1147.35	44.19	134.93	2013.27	201.33	1811.94	590.5	35.47815	147.26	773.24	147.97	1037.99	42.67	safe
177	PALAMAU	HAIDERNAGAR	10263	6749	1330.61	266.26	71.34	47.33	1715.54	171.56	1543.98	41	0	134.15	175.15	134.79	1368.19	11.34	safe
178	PALAMAU	HARIHARGANJ	11962	9802	606.05	89.86	34.64	81.49	812.04	40.61	771.43	185	8.89185	142.24	336.12	142.92	434.63	43.57	safe
179	PALAMAU	HUSAINABAD	27760	18254	2025.09	513.04	130.29	159.72	2828.14	282.81	2545.33	282.5	0	313.34	595.84	314.84	1947.99	23.41	safe
180	PALAMAU	LESLIEGANJ	17173	14573	640.46	378.35	51.51	207.46	1277.78	127.78	1150	590.5	0	181.60	772.1	182.47	377.03	67.14	safe
181	PALAMAU	MANATU	29530	21150	1374.17	157.57	74.75	148.14	1754.63	87.73	1666.9	483	0	84.90	567.9	85.31	1098.59	34.07	safe
182	PALAMAU	MOHAMMEDGANJ	10217	6718	1202.87	100.47	64.49	101.94	1469.77	146.97	1322.8	308	0	85.74	393.73	86.15	928.66	29.76	safe
183	PALAMAU	NAWABAZAR	16076	12347	801.82	78.28	43.32	55.22	978.64	49.13	929.51	197	0	91.23	288.23	91.66	640.85	31.01	safe
184	PALAMAU	NAWADIH	22970	17205	1320.53	92.85	70.8	52.68	1536.86	153.69	1383.17	112.5	125	133.72	371.23	134.37	1011.29	26.84	safe
185	PALAMAU	PANDU	13989	11230	529.67	188.66	39.69	46.74	804.76	40.24	764.52	142	0	123.01	265.01	123.6	498.92	34.66	safe
186	PALAMAU	PANDWA	17638	14283	1399.15	79.44	75.01	82.43	1636.03	163.6	1472.43	306.5	0	85.09	391.59	85.49	1080.44	26.59	safe
187	PALAMAU	PANKI	42508	32208	2184.98	404.71	117.14	327.02	3033.85	303.39	2730.46	987.5	0	286.03	1273.53	287.4	1455.56	46.64	safe
188	PALAMAU	PATAN	31498	25506	1949.78	196.26	104.53	141.56	2392.13	239.21	2152.92	457	29.85	243.78	730.63	244.95	1421.12	33.94	safe

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189	PALAMAU	PIPRA	10249	8398	369.08	116.3	29.68	72.83	587.89	58.79	529.1	118	0	65.94	183.94	66.25	344.85	34.76	safe
190	PALAMAU	SATBARWA	13935	10535	474.24	128.61	26.84	88.72	718.41	35.92	682.49	282	0	120.35	402.35	120.93	279.56	58.95	safe
191	PALAMAU	TARHASI	14946	10704	893.16	252.65	52.96	108.1	1306.87	65.34	1241.53	421	0	147.31	568.31	148.02	672.51	45.77	safe
192	PALAMAU	UTARIOR	13989	11230	635.44	54.77	43.38	41.87	775.46	38.77	736.69	96.5	0	70.47	166.97	70.8	569.39	22.66	safe
193	PALAMAU	MEDINAGAR URBAN	2358	2358	102.3	1213.27	6.58	112.42	1434.57	143.46	1291.11	0	0	297.31	297.31	298.74	992.37	23.03	safe
194	RAMGARH	CHITARPUR	6570	4681	306.24	24.98	26.14	37.89	395.25	19.76	375.49	126.25	148.2101	148.35	422.8	149.06	0	112.60	over_exploited
195	RAMGARH	DULMI	11349	8085	438.08	29.21	45.15	49.32	561.76	56.18	505.58	183.5	0	120.02	303.53	120.6	201.47	60.04	safe
196	RAMGARH	GOLA	34058	27165	1902.58	114.07	173.46	133.5	2323.61	116.18	2207.43	446	71.925	271.46	789.39	272.76	1416.74	35.76	safe
197	RAMGARH	MANDU	44236	34896	2363.53	728.65	243.6	742.85	4078.63	407.87	3670.76	357	1457.375	537.09	2351.47	539.67	1316.71	64.06	safe
198	RAMGARH	PATRATU	32123	28440	2561.74	279.71	238.24	270.84	3350.53	167.52	3183.01	260.5	1077.277	551.23	1889.01	553.88	1291.35	59.35	safe
199	RAMGARH	RAMGARH	11229	8000	513.98	64.36	52.97	65.87	697.18	69.71	627.47	83.75	146.7685	368.30	598.82	370.07	26.88	95.43	critical
200	RANCHI	ANGARA	40158	29959	1809.37	205.5	245.61	162.89	2423.37	242.34	2181.03	501.125	1.892917	204.32	707.33	205.3	1472.72	32.43	safe
201	RANCHI	BERO	28805	23529	3354.21	128.97	303.55	218.02	4004.75	400.48	3604.27	891.5	8.81875	204.92	1105.23	205.9	2498.06	30.66	safe
202	RANCHI	BUNDU	26419	19919	1562.75	148.51	141.42	85.8	1938.48	193.85	1744.63	233.5	0	164.22	397.72	165.01	1346.12	22.80	safe
203	RANCHI	BURMU	32077	26602	1427.2	65.87	193.74	82.73	1769.54	176.96	1592.58	256.5	0	162.88	419.38	163.66	1172.42	26.33	safe
204	RANCHI	CHANHO	27285	21185	1119.95	85.22	152.03	132.47	1489.67	148.97	1340.7	531.75	0	194.80	726.54	195.73	613.23	54.19	safe
205	RANCHI	ITKI	9959	8135	1917.24	62.3	173.5	51.69	2204.73	220.47	1984.26	206.75	0.942917	90.71	298.4	91.14	1685.43	15.04	safe
206	RANCHI	KANKE	29468	18709	1986.99	99.84	191.73	151.92	2430.48	121.64	2308.84	360.25	328.2102	393.08	1081.54	394.96	1225.42	46.84	safe
207	RANCHI	KHELARI	13034	10809	579.91	154.58	78.72	158.86	972.07	97.21	874.86	74.625	500	178.76	753.38	179.61	120.63	86.11	semi_critical
208	RANCHI	LAPUNG	30086	22286	1793.47	98.29	162.3	157.47	2211.53	221.16	1990.37	630	0	114.25	744.25	114.8	1245.57	37.39	safe
209	RANCHI	MANDAR	23822	20122	3146.12	94.06	284.72	215.71	3740.61	374.06	3366.55	594.75	0	233.00	827.74	234.12	2537.69	24.59	safe
210	RANCHI	NAGRI	10100	8041	1673.22	46.27	151.42	64.29	1935.2	193.52	1741.68	250.125	2.19	118.24	370.55	118.8	1370.57	21.28	safe

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211	RANCHI	NAMKUM	38386	26186	1776.7	141.06	190.71	172.84	2281.31	114.07	2167.24	574.5	643.6226	213.82	1431.95	214.85	734.26	66.07	safe
212	RANCHI	ORMANJHI	22812	19012	1020	124.4	138.46	211.73	1494.59	149.45	1345.14	948.75	5.07045	174.01	1127.83	174.84	216.48	83.84	semi_critical
213	RANCHI	RAHE	17905	12877	667.25	34.53	90.58	37.66	830.02	83	747.02	94.875	0	97.70	192.58	98.16	553.98	25.78	safe
214	RANCHI	RATU	10100	8378	1152.6	25.14	156.46	41.46	1375.66	137.56	1238.1	153.5	190.1886	98.19	441.88	98.66	795.75	35.69	safe
215	RANCHI	SILLI	28959	19575	1929.99	283.74	188.08	555.78	2957.59	147.88	2809.71	2465	13.54815	214.60	2693.15	215.63	115.53	95.85	critical
216	RANCHI	SONAHATU	26912	18837	911.68	133.66	123.76	125.31	1294.41	129.44	1164.97	414	0	139.98	553.98	140.65	610.32	47.55	safe
217	RANCHI	TAMAR	51349	29562	1520.89	116.49	165.16	86.68	1889.22	188.92	1700.3	140.625	0.425	240.40	381.47	241.56	1317.67	22.44	safe
218	RANCHI	RANCHI URBAN	30585	30585	2008.8	588.78	181.79	588.41	3367.78	336.78	3031	0	0.0755	2871.16	2871.23	2884.92	146.01	94.73	critical
219	SAHEBGANJ	BARHAIT	30882	23682	3480.84	236.95	372.5	114.48	4204.77	420.48	3784.29	104	13.36455	245.52	362.89	246.69	3420.23	9.59	safe
220	SAHEBGANJ	BARHARWA	18725	13525	3921.28	554.45	279.75	257.02	5012.5	501.25	4511.25	174.5	13.7751	335.87	524.15	337.48	3985.49	11.62	safe
221	SAHEBGANJ	BORIO	26174	9374	1281.26	467.25	137.11	115.47	2001.09	200.11	1800.98	125.5	7.2573	181.88	314.64	182.76	1485.46	17.47	safe
222	SAHEBGANJ	MANDRO	12352	5352	758.27	592.77	64.92	208.19	1624.15	162.41	1461.74	342.5	0	137.09	479.59	137.75	981.49	32.81	safe
223	SAHEBGANJ	PATHNA	16316	14316	2060.36	116.64	220.49	83.86	2481.35	248.14	2233.21	125	0	148.48	273.48	149.19	1959.02	12.25	safe
224	SAHEBGANJ	RAJMAHAL	12693	9693	2664.94	216.06	211.75	105.8	3198.55	159.93	3038.62	63.5	4.7583	323.52	391.77	325.07	2645.3	12.89	safe
225	SAHEBGANJ	SAHEBGANJ	17327	16627	4716.5	112.29	336.49	179.12	5344.4	534.44	4809.96	741.5	0.005875	351.89	1093.39	353.58	3714.88	22.73	safe
226	SAHEBGANJ	TALJHARI	15823	3727	551.61	280.01	59.03	86.41	977.06	97.7	879.36	107	0	138.31	245.31	138.97	633.39	27.90	safe
227	SAHEBGANJ	UDHUA	19913	18113	5296.86	344.38	377.89	240.14	6259.27	625.92	5633.35	423.5	11.13075	327.49	762.11	329.06	4869.67	13.53	safe
228	SARAIKELA KHARSAWAN	ADITYAPUR (GAMHARIA)	31197	23767	1603.84	249.7	180.16	154.19	2187.89	109.44	2078.45	104	260.4521	685.25	1049.7	688.53	1025.47	50.50	safe
229	SARAIKELA KHARSAWAN	Chandil	37373	27069	2129.61	10.86	205.19	17.88	2363.54	236.36	2127.18	65	87.59018	317.88	470.47	319.4	1655.19	22.12	safe
230	SARAIKELA KHARSAWAN	GOBINDPUR	45842	32409	3070.35	26.74	1095.22	30.04	4222.35	211.11	4011.24	121.75	0	247.52	369.27	248.71	3640.78	9.21	safe

Sl. No	District	Assessment Unit Name	Total Geographical Area	Recharge Worthy Area	Recharge from Rainfall-MON	Recharge from Other Sources-MON	Recharge from Rainfall-NM	Recharge from Other Sources-NM	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Irrigation Use (Ham)	Industrial Use (Ham)	Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (OE/Critical/Semicritical/Safe)
231	SARAIKELA KHARSAWAN	ICHAGARH	27178	23512	1196.42	7.09	172.91	15.43	1391.85	139.18	1252.67	76.625	0	150.58	227.2	151.3	1024.75	18.14	safe
232	SARAIKELA KHARSAWAN	KHARSAWAN	23283	17074	1265.54	120.24	121.94	47.29	1555.01	155.5	1399.51	139.875	21.2375	160.62	321.73	161.39	1077.01	22.99	safe
233	SARAIKELA KHARSAWAN	KUCHAI	38403	29340	2114.67	51	235.11	34.67	2435.45	121.77	2313.68	142.875	0	116.55	259.42	117.11	2053.7	11.21	safe
234	SARAIKELA KHARSAWAN	KUKRU	13691	11507	741.83	4.21	85.77	7.41	839.22	83.92	755.3	34.875	0	95.99	130.86	96.45	623.98	17.33	safe
235	SARAIKELA KHARSAWAN	NIMDIH	23502	19065	1499.91	19.64	144.52	16.46	1680.53	168.06	1512.47	55.125	125	142.49	322.63	143.18	1189.15	21.33	safe
236	SARAIKELA KHARSAWAN	SERAIKELA	27748	19058	1144.84	302.06	165.46	201.83	1814.19	181.42	1632.77	359.375	32.90335	183.49	575.77	184.37	1056.12	35.26	safe
237	SIMDEGA	BANO	54977	47177	4150.28	60.14	112.91	64.53	4387.86	219.39	4168.47	165	0	145.80	310.8	146.5	3856.97	7.46	safe
238	SIMDEGA	BANSJOR	16450	13480	912.11	18.66	32.26	10.18	973.21	97.32	875.89	30.5	0	46.24	76.74	46.46	798.93	8.76	safe
239	SIMDEGA	BOLBA	28863	17249	1167.14	41.42	41.28	55.58	1305.42	130.55	1174.87	176	0	55.79	231.79	56.05	942.82	19.73	safe
240	SIMDEGA	JALDEGA	42820	35089	2374.27	50.87	83.98	39.48	2548.6	254.86	2293.74	242.5	0	116.49	358.99	117.05	1934.19	15.65	safe
241	SIMDEGA	KERSAI	24940	16022	1084.12	23.3	38.35	25.63	1171.4	117.14	1054.26	51.5	0	71.06	122.56	71.4	931.36	11.63	safe
242	SIMDEGA	KOLEBIRA	43736	38336	3857.47	55.53	90.96	83.43	4087.39	408.74	3678.65	300	0	129.17	429.16	129.79	3248.87	11.67	safe
243	SIMDEGA	KURDEG	26230	16850	1140.14	53.87	40.33	39.82	1274.16	127.42	1146.74	125.5	0	86.95	212.45	87.37	933.87	18.53	safe
244	SIMDEGA	PAKARDANR	30131	26765	1790.94	33.32	63.35	42.99	1930.6	193.06	1737.54	123	0	67.96	190.96	68.29	1546.25	10.99	safe
245	SIMDEGA	SIMDEGA	44667	39677	2897.8	67.25	93.91	85.26	3144.22	157.21	2987.01	250	0	236.81	486.81	237.95	2499.06	16.30	safe
246	SIMDEGA	THETHAITANGAR	62415	58415	3952.61	164.82	139.8	180.06	4437.29	443.73	3993.56	570	0	158.48	728.48	159.24	3264.32	18.24	safe
247	WEST SINGHBHUM	ANANDPUR	31606	24689	1109.7	37.39	132.33	50.99	1330.41	133.04	1197.37	100	0	80.46	180.47	80.85	1016.51	15.07	safe
248	WEST SINGHBHUM	BANDGAON	47008	31108	1814.44	52.6	303.95	74.38	2245.37	112.27	2133.1	246	0	157.78	403.78	158.53	1728.57	18.93	safe
249	WEST SINGHBHUM	CHAIBASA	21372	15472	1454.23	25.58	173.42	30.07	1683.3	168.33	1514.97	68.5	0.998625	328.43	397.93	330	1115.47	26.27	safe
250	WEST SINGHBHUM	CHAKRADHARPUR	37995	24869	2209.42	84.62	263.48	78.93	2636.45	263.65	2372.8	210	0.731	395.94	606.68	397.84	1764.22	25.57	safe
251	WEST SINGHBHUM	GOELKERA	54938	45474	3747.2	91.71	670.29	23.22	4532.42	453.24	4079.18	69	0	134.12	203.12	134.77	3875.41	4.98	safe

Sl. No	District	Assessment Unit Name	Total Geographical Area	Recharge Worthy Area	Recharge from Rainfall-MON	Recharge from Other Sources-MON	Recharge from Rainfall-NM	Recharge from Other Sources-NM	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Irrigation Use (Ham)	Industrial Use (Ham)	Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (OE/Critical/Semicritical/Safe)
252	WEST SINGHBHUM	GUDRI	41648	35755	1582.68	41.48	188.74	39.01	1851.91	185.2	1666.71	63.5	0	69.37	132.87	69.7	1533.51	7.97	safe
253	WEST SINGHBHUM	HATGAMARIA	30358	26114	2488.35	33.13	296.74	27.92	2846.14	284.62	2561.52	27.5	0	121.81	149.31	122.4	2411.62	5.83	safe
254	WEST SINGHBHUM	JAGANNATHPUR	30996	23396	876.32	32.44	156.75	32.68	1098.19	109.82	988.37	62.5	0	187.55	250.04	188.45	737.43	25.30	safe
255	WEST SINGHBHUM	JHINKPANI	12357	10059	1130.31	37.7	134.79	48.66	1351.46	135.14	1216.32	170.5	13.3314	106.08	289.92	106.59	925.89	23.84	safe
256	WEST SINGHBHUM	KHUNTPANI	41399	30399	3757.46	154.99	448.08	72.9	4433.43	443.34	3990.09	147.5	0	150.48	297.98	151.2	3691.39	7.47	safe
257	WEST SINGHBHUM	KUMARDUNGI	29324	25786	3036.6	52.92	362.12	47.75	3499.39	349.94	3149.45	78.5	0	100.30	178.8	100.78	2970.17	5.68	safe
258	WEST SINGHBHUM	MAJHGAON	27423	24423	2165.95	196.47	263.31	71.41	2697.14	135.11	2562.03	131	0	131.58	262.58	132.21	2298.82	10.25	safe
259	WEST SINGHBHUM	MANJHARI	31362	27202	3135.68	80.3	373.93	31.92	3621.83	362.19	3259.64	43	0	124.03	167.03	124.63	3092.01	5.12	safe
260	WEST SINGHBHUM	MANOHARPUR	96115	90561	4748.87	86.95	849.46	91.01	5776.29	577.63	5198.66	287.5	14.77725	171.54	473.83	172.37	4724	9.11	safe
261	WEST SINGHBHUM	NOAMUNDI	62520	42221	2372.14	44.02	282.88	28.24	2727.28	272.73	2454.55	66	0	241.27	307.27	242.43	2146.12	12.52	safe
262	WEST SINGHBHUM	SONUA	41266	35297	1561.78	271.09	186.24	135.16	2154.27	215.42	1938.85	111	0	140.79	251.79	141.46	1686.39	12.99	safe
263	WEST SINGHBHUM	TANTNAGAR	20103	16503	989.02	99.16	176.91	49.17	1314.26	131.43	1182.83	72.5	0	115.81	188.3	116.36	993.98	15.92	safe
264	WEST SINGHBHUM	TONTO	64430	58906	3962.95	49.26	537.54	46.36	4596.11	229.81	4366.3	71	0	108.57	179.57	109.09	4186.21	4.11	safe
		Total	**7913405**	**6064673**	**498288.6**	**45937.87**	**46806.41**	**37024.95**	**628057.8**	**52302.3**	**575755.5**	**94065.13**	**22174.75**	**64638.676**	**180878.5**	**64948.61**	**396098**	**31.42**	

Plate-1

Minutes of the Meeting of the SLC Committee.

केंद्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची एवं भू-गर्भ जल निदेशालय, जल संसाधन विभाग, झारखण्ड सरकार राँची द्वारा संयुक्त रूप से दिनांक 10.05.2024 को मार्च-2024 तक झारखंड राज्य के गतिशील भू-जल संसाधन के आकलन के लिए राज्य स्तरीय समिति की प्रथम बैठक का कार्यवृत्त

झारखंड राज्य के गतिशील भू-जल संसाधन के आकलन के लिए राज्य स्तरीय समिति की पहली बैठक केंद्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची एवं भू-गर्भ जल निदेशालय, जल संसाधन विभाग, झारखण्ड सरकार द्वारा संयुक्त रूप से नेपाल हाउस, सचिवालय, राँची में प्रथम तल्ला में स्थित सभागार में दिनांक 10.05.2024 को अप्राहन 01:00 बजे आयोजित की गई थी। बैठक की अध्यक्षता जल संसाधन विभाग, झारखंड सरकार के सचिव श्री प्रशांत कुमार (भा॰प्र॰से॰) द्वारा की गई। बैठक में उपस्थित सदस्यों की सूची अनुबंध-1 में दी गई है।

श्री राजीव रंजन शुक्ला, क्षेत्रीय निदेशक, केंद्रीय भूमि जल बोर्ड, मध्य पूर्वी क्षेत्र, पटना, ने सभी सदस्यों का स्वागत किया। श्री अतुल बेक, वैज्ञानिक-ख, केंद्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची, ने समिति के सदस्यों के सामने झारखंड के गतिशील भूजल संसाधन आकलन -2024 पर एक प्रस्तुति दी। श्री बेक ने संसाधन के आकलन की समय सीमा और आकलन के लिए आवश्यक आंकड़ो के बारे में जानकारी दी, संसाधन मूल्यांकन 2024 की पृष्ठभूमि पर प्रस्तुति दी और जीईसी-2015 पद्धति का व्याख्यान दिया। उन्होने बताया कि यह आकलन भारतीय प्रौद्योगिकी संस्थान (IIT) हैदराबाद और VASAR लैब द्वारा विकसित IN-GRESS सॉफ्टवेयर के माध्यम से किया जाएगा।

बैठक मे निम्नलिखित बिंदुओ पर चर्चा की गयी -

- वर्तमान में कुल 263 प्रशासनिक इकाइयों (259 ब्लॉक और 4 शहरी क्षेत्र) का आकलन किया जाना है।
- आकलन सितंबर 2024 तक पूर्ण किया जाना है।
- आकलन के लिए ब्लॉक स्तर पर रिवर स्टेज, नहर प्रणाली से पुनर्भरण और फ़सलों मे जल की आवश्यकता के आंकड़ो को मुहैया कराने की मांग की गयी|
- पेयजल एवं स्वच्छता विभाग, झारखंड को शहरी क्षेत्र में पाइपलाइनों के माध्यम से जल आपूर्ति, भूजल पर जनसंख्या की निर्भरता और भूजल की गुणवत्ता के संबंध में आंकड़े मुहैया कराने की मांग की गयी|
- उद्योग विभाग से राज्य में औद्योगिक इकाइयों के माध्यम से भूजल निकासी के संबंध में आंकड़ो को उपलब्ध कराने की मांग की ।
- खनन विभाग से राज्य में खनन इकाइयों के माध्यम से भूजल निर्जलीकरण के संबंध में आंकड़ो को उपलब्ध कराने की मांग की ।
- पंचायती राज से भूजल पुनर्भरण और संरक्षण संरचनाओं की संख्या एवं उनकी भंडारण क्षमता उपलब्ध कराने का अनुरोध किया गया।

- भूगर्भ जल निदेशालय से डेटा संग्रह, संकलन, सत्यापन, प्रविष्टि और मूल्यांकन के लिए दो अधिकारियों को नियुक्त करने का अनुरोध किया गया। इसके जवाब में भूगर्भ जल निदेशालय के निदेशक ने सूचना दी कि अधिकारियों का नाम नामित किया जा चुका है |
- श्री प्रशांत कुमार, सचिव, जल संसाधन विभाग, झारखंड सरकार ने सभी विभागों को अतिशीघ्र आंकड़े मुहैया कराने का निर्देश दिया तथा जिस विभाग के पदाधिकारी उपस्थित नही थे उनसे पत्राचार द्वारा आंकड़े एकत्र करने का निर्देश दिया।

श्री अनुकरण कुजूर, वैज्ञानिक-ख, केंद्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची के द्वारा धन्यवाद ज्ञापन के साथ बैठक का समापन किया गया।

08/08/24

प्रशांत कुमार

सचिव, जल संसाधन विभाग, झारखंड सरकार

1/2

ATTENDANCE SHEET

First meeting (on 10.05.2024) of State Level Committee (SLC) For Estimation of Dynamic Ground Water Resources of Jharkhand State under the Chairmanship of Shri. Prashant Kumar (I.A.S), Secretary- Water Resources, Dept, Govt. of Jharkhand .

SL. NO.	NAME	DESIGNATION	DEPARTMENT	CONTACT NO.	e-mail address	SIGNATURE
1	Shri. Prashant Kumar	Secretary	Water Resources, Dept, Govt. of Jharkhand			**Chair**
2		Engineer-in-Chief	Water Resources, Dept, Govt. of Jharkhand			
3	Sh. Abhishek Anand	Director IMD, Ranchi	IMD, MoES, GoI	8826934847	metranchi@gmail.com	[signature]
4	Rajesh Kr. Pandey	Dy Director Geology Deptt Jharkhand	Department of Mines & Geology	7870240212	rajesh.9A@yahoo.com	[signature]
5	Atul Kumar	Under Secretary Urban develop & Housing	UDHD	9934672289	116.atul@gmail.com	[signature]
6	Nirupam Nath	State Coordinator (WQ)	DWSD	9669269689	NATH.NIRUPAM@gmail.com	[signature]
7	Anuradha S. Sui	Asst. Engineer	Water Resources Dept.	9572887196	anuradhasuin@gmail.com	[signature]
8	DK Rusia	Asso. Dean Ag. Engg College	BAU Kanke	9431543781	dkrusia@gmail.com	[signature]
9	A.N. Tigga	Exe. Engineer WRD	W.R.D Ranchi	9931061969	apursnit@gmail.com	[signature]
10	A.N. Kujur	Dy. Director	W.R.D. Ranchi	9431820956	[illegible]	[signature]
11	Rohit Singh Bhadouria	Hydrologist	WRD Ranchi	9690976983	rohitsingh4195@gmail	[signature]
12	Rakesh Sinha	AGM	NABARD, RANCHI	9464556837	rakesh.sinha@nabard.org	[signature]
13	Suman S. Sahu	DGM	NABARD Ranchi	[illegible]	suman.sahu@nabard.org	[signature]
14	MANOHAR PRASAD	Director	Ground Water Directorate (WRD)	9434-03735	manohar prasad31@gmail.com	[signature]
15	Arun Kr. Rai	S.E. P. Plan Monitoring	WRD	7464831761	[illegible]	[signature]
16	Mithilesh Kr.	Chief Eng. M.I Ranchi	WRD	9431305701		[signature]
17	Anand Nadan	Hydrogeologist DWSD PMU	D.W.S.D	9434507938	anandnadan@gmail.com	[signature]
18	Rajesh Kaswani	Programmer	JSAC	7766905213	rajesh-kaswani	[signature]
19	Naveen Bhagat	Executive Engineer (Moni)	DWS.S Deptt Nepal House	8002114576	naveen bhagat@gmail.com	[signature]

SL. NO.	NAME	DESIGNATION	DEPARTMENT	CONTACT NO.	e-mail address	SIGNATURE
20	Dr. Tarachand	Director, Agriculture	Agriculture, Animal Husb. & Cooperation	9971801915		[illegible] 10/05/24
21	R.R. Shukla	Regional Director CGWB, MER	CGWB, MER, Patna	9608558184	rajivrshukla-cgwb@gov.in	[illegible] 10/05/24
22	R. A. Kujur	Officer in charge CGWB, SUO, Ranchi	CGWB	8430049213	Kujurra-cgwb@nic.in	[illegible] 10.5.2024
23	Dr. Anukaran Kujur	Scientist-'B'	CGWB	8789669460	anukaran-cgwb@gov.in	[illegible]
24	Arul Beck	Scientist- B	C.GW.B	8825315122	arulbeck-cgwb@gov.in	ABeck
25.	Sapna Sakshi	Scientist- B	CGWB	9074913363	sapna.sakshi-cgwb@gov.in	[illegible]
26.	Md. Shadman	Assistant-Hydrogeologist	C.G.W.B.	8791834527	shadmd.94-cgwb@gov.in	[illegible] 10.05.2024

मुख्य अभियंता का कार्यालय,
योजना आयोजन एवं मोनिटरिंग,
जल संसाधन विभाग, राँची।

पत्रांकः–3/पी०एम०सी०/विविध–168/(पार्ट–I-A) /2009 27 **/राँची, दिनांकः** 17/01/2025

प्रेषकः

ई० मोतीलाल पिंगुआ,
मुख्य अभियंता (मो०)

सेवा में,

प्रभारी अधिकारी,
राज्य एकंक कार्यालय,
केन्द्रीय भूमि जल बोर्ड,
राँची, झारखण्ड।

विषयः **झारखण्ड राज्य के गतिशील भू–जल संसाधन के आकलन के लिए राज्य स्तरीय समिति की द्वितीय बैठक की कार्यवृत्त के संबंध में।**

प्रसंगः आपका पत्रांक–के०भू०ज०बो०/रा०ए०का०/GWRE-2024-390 दिनांक–01.10.2024

महाशय,

उपर्युक्त विषयक एवं प्रसांगिक पत्र द्वारा प्राप्त झारखण्ड राज्य के गतिशील भू–जल संसाधन के आकलन हेतु दिनांक–24.09.2024 को सम्पन्न राज्य स्तरीय समिति की द्वितीय बैठक की कार्यवाही की मूल प्रति सचिव, जल संसाधन विभाग के अनुमोदनोपरांत संलग्न कर आवश्यक कार्रवाई हेतु प्रेषित की जा रही है।

अनु०–यथोक्त।

विश्वासभाजन,

17/01/25

(मोतीलाल पिंगुआ)
मुख्य अभियंता (मो०)

(85)

सचिव, जल संसाधन विभाग, राँची की अध्यक्षता में मार्च–2024 तक झारखण्ड राज्य के गतिशील भू–जल संसाधन (Dynamic Ground Water Resource) के आकलन के लिए दिनांक–24.09.2024 को सम्पन्न राज्य स्तरीय समिति (State Level Committee) की द्वितीय बैठक की कार्यवाही ।

केन्द्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची एवं भू–गर्भ जल निदेशालय, जल संसाधन विभाग, झारखण्ड सरकार द्वारा संयुक्त रूप से झारखण्ड राज्य के आंकलित गतिशील भू–जल संसाधन की स्वीकृति हेतु सचिव, जल संसाधन विभाग, झारखण्ड सरकार की अध्यक्षता में नेपाल हाउस, सचिवालय, राँची के प्रथम तल्ला में स्थित सभागार में दिनांक–24.09.2024 को अपराहन् 04:30 बजे राज्य स्तरीय समिति की द्वितीय बैठक का आयोजन किया गया। बैठक में उपस्थित सदस्यों की सूची परिशिष्ट–I पर संलग्न है।

श्रीमती रोज अनिता कुजूर, कार्यालय प्रमुख, केन्द्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची द्वारा बैठक में उपस्थित सभी सदस्यों का स्वागत किया गया। श्री अतुल बेक, वैज्ञानिक–'ख', केन्द्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची द्वारा भू–जल संसाधन (Dynamic Ground Water Resource) आकलन–2024 का प्रस्तुतिकरण दिया गया।

प्रस्तुति के दौरान समिति के सदस्यों द्वारा विभिन्न बिन्दुओं पर चर्चा की गई, जिनका उत्तर कार्यालय प्रमुख एवं केन्द्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची के अधिकारियों द्वारा विस्तारपूर्वक दिया गया।

गतिशील भू–जल संसाधन आकलन–2024 के कुछ महत्वपूर्ण बिंदु निम्नलिखित हैं:–

- वर्तमान में झारखण्ड राज्य के अंतर्गत कुल 263 प्रशासनिक इकाईयों (259 ब्लॉक और 4 शहरी क्षेत्र) का आकलन GEC-2015 के आधार पर किया गया।
- राज्य अंतर्गत कुल 263 मूल्यांकन इकाईयों के वर्गीकरण के आधार पर, 240 इकाईयां सुरक्षित हैं जबकि 12 सेमीकिटिकल (धनबाद जिला के प्रखण्ड–धनबाद, बाधमारा और गोविंदपुर, देवघर जिला के प्रखण्ड–करों, सरगंवा और सोनारायथारी, गढ़वा जिला के प्रखण्ड–भवनाथपुर, गिरिडीह जिला के प्रखण्ड–गिरिडीह, हजारीबाग जिला के प्रखण्ड–दारू, राँची जिला के प्रखण्ड–खेलारी और ओरमांझी और कोडरमा जिला के प्रखण्ड–कोडरमा, 6 किटिकल (धनबाद जिला के धनबाद शहरी और प्रखण्ड–तोपचाची, रामगढ़ जिला के प्रखण्ड–रामगढ़, राँची जिला के प्रखण्ड–सिल्ली और राँची शहरी, कोडरमा जिला के प्रखण्ड–जयनगर) और 5 (बोकारो जिला प्रखण्ड–बेरमो, धनबाद जिला प्रखण्ड–बलियापुर, रामगढ़ जिला, प्रखण्ड–चितरपुर, पूर्वी सिंहभूम जिला प्रखण्ड–गोलमूरी–सह–जुगलसलाई) अतिशोषित हैं।
- सचिव महोदय द्वारा आगामी भू–जल संसाधन आकलन हेतु सभी संबंधित विभागों को सभी आवश्यक आंकडों को उपलब्ध करने तथा हर संभव सहयोग के लिए निर्देशित किया।
- अंत में सर्वसम्मति से झारखंड के गतिशील भू–जल संसाधन आकलन –2024 (Dynamic Ground Water Resource Estimation-2024) को स्वीकृति प्रदान की गई।

श्री अनुकरण कुजूर, वैज्ञानिक–ग, केंद्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, राँची के धन्यवाद ज्ञापन के पश्चात् बैठक की कार्यवाही समाप्त की गई ।

25/12/24

(प्रशांत कुमार)
सचिव,
जल संसाधन विभाग,
झारखण्ड, सरकार

ATTENDANCE SHEET

Final and Second meeting (on 24.09.2024) of State level Committee (SLC) for estimation of Dynamic Ground Water Resources of Jharkhand State under the Chairmanship of Shri. Prashant Kumar (I.A.S), Secretary- Water Reources, Dept, Govt. of Jharkhand.

SL. NO.	NAME	DESIGNATION	DEPARTMENT	CONTACT NO.	e-mail address	SIGNATURE
1	Prashant Kumar	Secretary	Water Resources, Dept, Govt. of Jharkhand			
2	VIJAY SHANKAR	E-I.C.-II	WRD			
3	R. Ranjan	Director	JSAC, IT Dept			
4	R. A. Kujur	DIC	CGWB, SUO			
5	Ajay Kumar Rai	S.E. WRD	WRD			
6	Manohar Prasad	S.E./Director GW Directorate Ranchi	WRD			
7	Suman S. Sahu	DGM	NABARD			

SL. NO.	NAME	DESIGNATION	DEPARTMENT	CONTACT NO.	e-mail address	SIGNATURE
8	ROHIT SINGH BHADOURIA	ASSISTANT ENGINEER	GWID RANCHI	9690976983	rohitsingh4195@gmail.com	[signature]
9	Mahesh Kujur	Deputy Director GWID Ranchi	W.R.D	8789034733	MKjr2909@gmail.com.	[signature]
10	Arpana N. Kujur	Deputy Director	W.R.D.	9431320956	arpana.nisha@gmail.com	[signature] 24/9/24
11	A.K. Pandey	Ex. Engr.	W.R.D.	8709571303	pandeyajaykumar23@gmail.com	[signature] 24/09/2024
12	A. N. Tigga	Executive Engineer	W.R.D	9931061969	apurb.nitesh@gmail.com	[signature] 24/09/2024
13	MITHUN HEMBRAM	JUNIOR ENGINEER	DW&SD	9973179392	koendabadali23@gmail.com	[signature] 24/09/24
14	LALIT INDWAR	DEPUTY DIRECTOR-1	DW&SD	8580335410	swsm.Jharkhand@gmail.com	[signature] 24.09.24
15	Ravish kumar	Jr. Scientist	JSAC	7781805209	directorjsac@gmail.com	[signature] 24-9-24
16	Gautam Singh Munda	Assistant Engineer	W.R.D	9546913030	gautam_munda_bokaro@yahoo.co.in	G.S. Munda 24/9/24

SL. NO.	NAME	DESIGNATION	DEPARTMENT	CONTACT NO.	e-mail address	SIGNATURE
17	Er. Anubha S. Swain	Asst. Engineer	W.R.D	9572887196	anubhaswain14@gmail.com	[illegible]
18	Er. Keneth Toppo	Asst. Engineer	W.R.D	7979061689		[illegible]
19	Er. Paritosh Ashish	Junior Engineer	WRD	8935949250	paritoshmit2k10@gmail.com	Paritosh
20	DK Rusia	Associate Dean & Head	BAU Ranchi	9431543781	dkrusia@gmail.com	[illegible]
21	Fulendra Prasad sharma	Under Secretary	Panchayati Raj (Directorate)	9835138938		[illegible]
22	Abhishek Anand	Director IMD Ranchi	IMD, GoI	8826934847	mcranchi@gmail.com	[illegible]
23	Dr. Anukaran Kujur	Scientist-C	CWWB	8789669460	anukaran.kujur@rediff-mail.com	[illegible]
24	ATUL BECK	Scientist-B	CGWB	8825315122	atulbeck-cgwb@gov.in	[illegible]
25	Md. Shadman	Assistant Hydrogeologist	CGWB	8791834527	shadmd.94-cgwb@gov.in	[illegible]
26	Sapna Sakshi	Sc-B.	CGWB	8822312294	sapna.sakshi-cgwb@gov.in	[illegible]