Technical Series: A
Number: 1/2024-25

भारत सरकार
Government of India
जल शक्ति मंत्रालय
Ministry of Jal Shakti
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
Department of Water Resources, RD & GR

केंद्रीय भूमि जल बोर्ड, राज्य एकक कार्यालय, अगरतला
Central Ground Water Board, State Unit Office, Agartala

राज्य संकलन

त्रिपुरा के गत्यात्मक भूजल संसाधन - 2024

State Compilation on

DYNAMIC GROUND WATER RESOURCES OF TRIPURA

2024

Agartala, Tripura
February, 2025

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Central Ground Water Board, State Unit Office, Agartala

Agartala, Tripura
February, 2025

Kiran Gitte, IAS
Secretary, PW (WR)

त्रिपुरा सरकार
पी.डब्ल्यू.डी (डब्ल्यू.आर.)
Government of Tripura
PWD (WR)

Foreword

Groundwater is an important resource for meeting the water requirements for irrigation, domestic and industrial uses. The increasing reliance on groundwater as a dependable source of water has led to its extensive and sometimes unplanned exploitation. To ensure the sustainability of this critical resource, planning and implementation of proper management strategies and regulatory measures is the need of the hour. It is rightly said that "we can only manage what we can measure," highlighting the importance of proper monitoring and assessment in groundwater management.

The annual dynamic groundwater resources of the State of Tripura, 2024 has been assessed by using the 'Ground Water Estimation Methodology - 2015' (GEC-2015) through "India Groundwater Resource Estimation System" (IN- GRES), a GIS based web platform. This report on Dynamic Groundwater Resource Assessment of 2024 (GWRA-2024) is a collaborative effort of PWD (Water Resource), the State Nodal Department, Government of Tripura and the Central Ground Water Board, The State Unit Office, Agartala, Tripura. The annual assessment is providing a clear understanding of groundwater dynamics, its recharge, extraction and serves as the foundation for planning and implementation of strategies for sustainable management of groundwater resources across the State.

I congratulate the dedicated efforts of CGWB, SUO Agartala for their pivotal role in compiling this report and PWD (WR), the State Ground Water Nodal Department in conducting the assessment. I also appreciate the valuable contributions of the State Level Committee (SLC), Tripura for their guidance in timely completion of the assessment and compilation. I believe that, this comprehensive report will serve as an important document for planners, decision- makers and stakeholders in securing the groundwater resources for Viksit Bharat in the state of Tripura.

Agartala
February, 2025

Kiran Gitte
Secretary, PWD (WR) &
Chairman, State level Committee (GWRA)
Government of Tripura

टी. एस. अनीता श्याम
सदस्य (दक्षिण)
T. S. Anitha Shyam
Member (South)

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल बोर्ड
Government of India
Ministry of Jal Shakti
Dept. of Water Resources, RD & GR
Central Ground Water Board

Message

Groundwater plays an important role in the Nation's economic growth and forms a vital component of our ecological system. India's agricultural productivity, industrial output, and domestic water supply are heavily reliant on groundwater. However, rising water demands have led to excessive groundwater extraction in many parts of India, exceeding the annual replenishment leading to decline in groundwater level. A thorough assessment of this hidden resources is essential for developing strategies for management and regulatory measures. Since 2022, it has been decided to carry out the estimation of the Dynamic Groundwater Resources of the nation every year to provide the planners, decision makers and all stakeholders with reliable data/information for taking timely measures for sustainable management of groundwater resources.

The assessment of dynamic groundwater resources of **Tripura, 2024** is based on the Groundwater Estimation Methodology of 2015 (GEC-2015), which comprehensively factors in all relevant parameters contributing to groundwater recharge and extraction. The Dynamic Groundwater Resource Assessment of 2024 (GWRA-2024) of **Tripura** is a collaborative effort involving both the **State Nodal Department of Ground Water** and the Central Ground Water Board, North Eastern Region by utilizing the INDIA-Ground Water Resource Estimation System (IN-GRES) Software.

I extend my heartfelt appreciation to the dedicated officers of CGWB, NER for their significant role in compiling the state-level data. My gratitude also goes to the officers of CGWB and State Ground Water Nodal Departments of **Tripura** for their relentless efforts in conducting assessments according to the planned schedule.

The valuable contributions of the SLC members in refining the State Report of **Tripura** are also acknowledged. I hope this State level compilation will serve as an important document for planners, decisionmakers, and all concerned stakeholders in prioritizing actions necessary to ensure the sustainability of groundwater resources in the state.

Faridabad
January, 2025

(**T. S. Anitha Shyam**)
Member (South)

N. Varadaraj
Member (East)

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल बोर्ड
Government of India
Ministry of Jal Shakti
Dept. of Water Resources, RD & GR
Central Ground Water Board

Groundwater is considered the "backbone" of India's water security, fulfilling nearly 80% of the country's drinking water needs and providing around two-thirds of the water required for irrigation, making it a critical resource for both rural and urban populations. India's agricultural productivity, industrial output, and domestic water supply are heavily reliant on groundwater. Rapid rise in population increases demand for water. Rise in urban population increases load on management of waste and polluted water. India is the largest user of groundwater accounting for approximately 25% of the total global withdrawal. Indian cities cater to about 48% of their water supply from groundwater. With rise in population, groundwater use is expected to rise further.

A systematic assessment of this hidden resources is essential for developing strategies for management and regulatory measures. Since 2022, it has been decided to carry out the estimation of the Dynamic Groundwater Resources of the State of Tripura every year to provide the planners, decision makers and all stakeholders with reliable data/information for taking timely measures for sustainable management of groundwater resources.

The assessment of dynamic groundwater resources of Tripura is based on the Groundwater Estimation Methodology of 2015 (GEC-2015), which comprehensively factors in all relevant parameters contributing to groundwater recharge and extraction. The Dynamic Groundwater Resource Assessment of 2024 (GWRA-2024) of Tripura is a collaborative effort involving both the State Nodal Department of Ground Water, i.e. PWD (WR), Government of Tripura and the Central Ground Water Board, State Unit Office, Agartala by utilizing the INDIA-Ground Water Resource Estimation System (IN-GRES) Software.

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The valuable contributions of the SLC members in refining the State Report of Tripura are also acknowledged. I hope this State level compilation will serve as an important document for planners, decision makers, and all concerned stakeholders in prioritizing actions necessary to ensure the sustainability of groundwater resources in the state.

N. Varadaraj

Faridabad
February, 2025

(N Varadaraj)
Member (East)

तपन चक्रवर्ती
क्षेत्रीय निर्देशक
Tapan Chakraborty
Regional Director

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी बिकास और गंगा संगरक्षण बिभाग
केन्द्रीय भूमि जल बोर्ड
Government of India
Ministry of Jal Shakti
Dept. of Water Resources, RD & GR
Central Ground Water Board
North Eastern Region

PREFACE

The State of Tripura is characterized by hilly terrain with steep slopes. valley areas, which are found as repository of groundwater in state. The valleys covered with unconsolidated alluvial deposits and semi-consolidated Tertiary sedimentary formations are having fairy good scope, for groundwater development.

For rapidly expanding urban and agricultural water requirement of the state, groundwater utilization is of fundamental importance. For proper planning and management of groundwater, reliable assessment of groundwater resource in the state is prime necessity. Keeping this objective in view, the groundwater resource potential of Tripura has been reassessed based on 'Ground Water Resource Estimation Methodology - 2015 (GEC 2015).

Ground Water Resource Estimation of Tripura has been carried out jointly by Central Ground Water Board, State Unit Office Agartala and Public Works Department (Water Resource), Government of Tripura (State Nodal Department) in coordination with other members/departments of State Level Committee (SLC) on Ground Water Resource Assessment of Tripura.

Earlier Dynamic Groundwater Resource Assessment was done manually throughout the country. Later it was observed that some minor computational error might have occurred in calculating the resource, as the process of Dynamic Groundwater Resource Assessment is a complicated and lengthy. So, to overcome this human error. computation of dynamic ground water resources of whole of India along with Tripura was carried out through IN-GRES software which is a software/web-based application developed by CGWB in collaboration with Vassar Lab, IIT-Hyderabad.

The computation has been done based on the field data generated by Central Ground Water Board and statistical information compiled by the State Nodal Departments and Member, SLC. The report contains blocks-wise - total ground water recharge, current annual gross ground water extraction and existing gross ground water extraction for various uses. The stage of groundwater extraction in the State is in Safe Category. The report also throws light on the future ground water availability for various uses including irrigation and the domestic sectors.

The Ground Water Resources of Tripura, 2024 have been assessed block-wise for the recharge worthy area. Total Annual Ground Water Recharge of the State has been assessed as 1.45 bcm and Annual Extractable Ground Water Resources as 1.18 bcm. The Annual Ground Water Extraction is 0.11 bcm and Stage of Ground Water extraction is 9.48%. All the assessment units and districts have been categorized as '**Safe**' and there is no saline area in the state.

The report will be very helpful for the user agencies.

Guwahati
February, 2025

(Tapan Chakraborty)
Regional Director &
Member Secretary, SLC

Tripura is a picturesque state in the north-eastern region of the country. The state is acceded to the Indian Union in 1949 and is bounded on the north, west, south & southeast by the international boundary of Bangladesh. Shallow tube wells with small command area is most suitable in the state.

For a scientific planning and judicious development of dynamic ground water resource potential of the state, estimation of ground water resource has been done based on the latest methodology as recommended by Ground Water Resource Estimation Committee-2015 (GEC-2015) and duly approved by Govt. of India. The estimation of groundwater resource has been done on block wise basis.

The report on dynamic Ground water resource potential has been assessed based on the field data generated by Central Ground Water Board and statistical information collected from other State Departments. The annual ground water recharge, total extractable groundwater resource and total extraction on irrigation and domestic uses, etc., have been estimated for the state. The report also highlights on the net annual ground water availability for future use.

The total annual ground water recharge in the state of Tripura is 1.45 BCM. The Annual Extractable Ground Water Resources of the state is 1.18 BCM after deducting the natural discharge. Present Ground Water Extraction is 0.11 BCM out of which 0.025 BCM extraction is on account of irrigation and the annual domestic extraction is 0.08 BCM. The annual allocation for Domestic uses has been made as 0.087 BCM based upon the population data projected up to year 2025. The over-all stage of ground water development of the state is 9.48%.

The report with its technical data will help in understanding present ground water scenario in Tripura State and prove valuable to policy makers, technical experts, professionals and user agencies for management of ground water development in the state in planned manner. All the assessment units and districts have been categorized as 'Safe'.

OIC, SUO Agartala, CGWB

STATE COMPILATION ON DYNAMIC GROUND WATER RESOURCES OF TRIPURA, 2024

AT A GLANCE

1.	**Total Annual Ground Water Recharge**	**: 1.45 BCM**
2.	**Annual Extractable Ground Water Resources**	**: 1.18 BCM**
3.	**Annual Ground Water Extraction**	**: 0.11 BCM**
4.	**Stage of Ground Water Extraction**	**: 9.48%**

CATEGORIZATION OF ASSESSMENT UNITS

(Blocks / Mandals / Taluks)

Sl.No	Category	Number of Assessment Units		Recharge worthy Area		Annual Extractable Ground Water Resource	
		Number	%	in sq. km	%	(in bcm)	%
1	Safe	59	100	6197.84*	100	1.18	100
2	Semi Critical	-	-	-	-	-	-
3	Critical	-	-	-	-	-	--
4	Over-Exploited	-	-	-	-	-	-
5	Saline	-	-	-	-	-	-
	TOTAL	**59**		**6197.84**		**1.18**	

* Total area of the State is 10,491.69 sq km, of which only 6197.84 sq km area are recharge worthy, accounting to 59% of Total Area of the state. Rest 4293.85 sq km are Hilly with slope >20%.

EXECUTIVE SUMMARY

Tripura is the third smallest state in Indian Union covering an area of 10,491.69 sq.km. It is situated between North Latitudes 22°56' to 24°32' and East Longitudes 91°09' to 92°20'. Tropic of cancer passes through the southern part of the state. It is a land-locked state and bounded by Bangladesh on the west, south and north. It's North-eastern and eastern boundary is demarcated by Assam and Mizoram respectively. The length of its international border with Bangladesh is 856 Km (84%) while it shares 53 Km border with Assam and 109 km border with Mizoram.

Administratively Tripura is divided into eight districts viz., West Tripura, Khowai, Sepahijala, South Tripura, Gomati, Dhalai, North Tripura and Unakoti with their headquarters at Agartala, Khowai, Bishalgarh, Belonia, Udaipur, Ambassa, Dharamnagar and Kailashahar respectively. Agartala city is the state capital. The Eight districts are further subdivided into 23 sub divisions and 58 blocks. Tripura also has an autonomous tribal council, the Tripura Tribal Areas Autonomous District Council (TTAADC) with its headquarters at Khumlung. The TTAADC covers about two third of the area (7132.56 sq.km). The total number of Gram Panchayats is 1178, which includes 587 Autonomous District Council (ADC) villeges. The National Highway No 8 (earlier known as NH-44), known as Agartala-Assam road is the only road link with the rest of India. Silchar – Agartala meter gauge railway line passes through the state. Agartala the state capital is connected with other parts of the country by air.

The state is characterized by warm and humid sub-tropical climate with three distinct seasons such as summer, rainy and winter. Winter is followed by a brief spell of spring. The average annual rainfall is more than 2200 mm in most part of the state.

There are as many as 10 rivers which originate in the hill ranges and flow either in a northerly or westerly direction through the narrow valleys draining the state. The Khowai, Manu, Deo, Juri, Dhalai and Longai rivers are characterized by northerly flow the Gomti, Haora, Muhuri, Burigang rivers flow westward into Bangladesh territory. The Gomti is the biggest river and Manu is the longest river of the state. A significant feature of the rivers is that they are perennial in nature and their flows are directly related to rainfall.

The state exposes mainly sediments of the Upper Tertiary age comprising a poorly fossiliferous succession of alternating shales, mudstone, siltstone and sandstone in varying proportions. In addition, extensive sediments of Quaternary age occur as terraced valley fills comprising mainly unconsolidated sand, silt and clays. There are three hydrogeological units / water bearing formations viz., Tipam Group, Dupitila formation and Alluvial formation. The Alluvial formation occurs in 10 to 15 m veneer along the banks of main rivers. Groundwater occurs under unconfined condition.

The groundwater development in the area has not been very significant because of high clay and sandy clay content. Groundwater developed through dug wells and ordinary hand

pumps. Sandstone of Tipam formation constitutes principal aquifer. This formation is developed by heavy-duty deep tubewells, mini deep tubewells and MKII/III tubewells.

The groundwater regime in Tripura is monitored through 112 monitoring stations, with assessments conducted four times a year. During the pre-monsoon period in March 2024, the water level depth ranged from 0.75 to 10.30 meters below ground level (bgl), while in November 2023, post-monsoon levels were between 0.54 and 9.48 m bgl. Long-term analyses indicate that there has been no significant decline in groundwater levels in the state to date.

Ground Water Resource Assessment is carried out at periodical intervals jointly by the PWD (WR), the State Nodal Department, Government of Tripura and Central Ground Water Board under the guidance of the respective State Level Committee (SLC) on Ground Water Assessment at State Levels and under the overall supervision of the Central Level Expert Group (CLEG). Such joint exercises have been taken up earlier in 1980, 1995, 2004, 2009, 2011, 2013, 2017, 2020, 2022, and 2023. From the year 2022, the exercise is being carried out annually.

The assessment involves computation of dynamic ground water resources or Annual Extractable Ground Water Resource, Total Current Annual Ground Water Extraction (utilization) and the percentage of utilization with respect to annual extractable resources (stage of Ground Water Extraction). The assessment units (blocks and AMC, in case of Tripura) are categorized based on Stage of Ground Water Extraction, which are then validated with long-term water level trends. The assessment prior to that of year 2017 were carried out following Ground Water Estimation Committee (GEC) 97 Methodology, whereas from 2017 onwards assessment are based on norms and guidelines of the GEC - 2015 Methodology.

The total groundwater recharge in Tripura is estimated at 1.437 billion cubic meters (BCM) from monsoon and non-monsoon rainfall, along with other sources. After accounting for evaporation and transpiration, the net recharge is 1.32 BCM. The annual extractable groundwater resources, after deducting natural discharge, amount to 1.18 BCM. Groundwater extraction for various uses is estimated at 0.11 BCM, with a domestic allocation projected at 0.087 BCM by 2025. This leaves a net annual groundwater availability of 1.065 BCM for future use. The stage of development in Tripura is 9.48%, and all 59 blocks, including Agartala, are classified under the ‘SAFE’ category.

There is large scope for further ground water development in the state. Large number of deep and shallow tube wells can be constructed in the state with space norms of 500 - 700 m for deep tube wells and 125 - 150 m for shallow tube wells.

CONTRIBUTIONS:

Estimation of Ground Water Resources of Tripura is a collaborative effort of Central Ground Water Board and the PWD (WR), the State Nodal Department, Government of Tripura. The report prepared is based on the data provided by the State Nodal Officer, Er. M Majumder, EE, WR Investigation Division, Public Works Department (Water Resources), Govt. of Tripura and from various other Departments such as Public Works Department (Drinking Water and Sanitation); Agriculture Department; Directorate of Economics and Statistics; Department of Fisheries; Forest Department; Rural Development; Urban Development Department; Agartala Municipal Corporation, Government of Tripura and Indian Meteorological Department, Govt. of India, etc.

The computation of the resource estimation has been done through the INGRES software developed in collaboration with IIT Hyderabad.

The report is prepared by the officers from the State Unit Office, Agartala, CGWB, namely, Dr. Raja Ram Purohit (Scientist- D & OIC) and Smt. Ritu K. Oraon (Scientist-C). The office is also thankful for the coordination received from Dr. S. S. Singh, Sc-D, NER Guwahati, online support received from Sh. Biplab Ray, Sc-D & Dr. Dip Jyoti Khound, Sc-D, NER Guwahati and compilation support from Sh. Masarul Islam, Sc-B & Sh. Shuvam Dutta, STA, SUO Agartala.

The contribution of Sh. K.M. Debbarma, Officer Surveyor; Sh. A.C. Namasudra, Officer Surveyor; Sh. N.B Debbarma, Chief Draftsman for the help in data collection is also duly acknowledged.

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1 INTRODUCTION

1.1 LOCATION:

The state of Tripura is situated in the north-eastern part of India and it is the third smallest state of the country covering an area of 10,491.69 sq.km. The erstwhile princely state of Tripura merged with the Union of India after independence on the 15th October, 1949 as Group-C category state. Then it became a Union Territory on 1st July 1963. Finally, Tripura emerged as a full-fledged state on the 21st January 1972. It is situated between North Latitudes 22°56' to 24°32' and East Longitudes 91°09' to 92°20'. Tropic of cancer passes through the small hamlet named Garjee (near Udaipur city), South Tripura district. It is a land-locked state and bounded by Bangladesh on the west, south and north. Its North-eastern and eastern boundary is demarcated by Assam and Mizoram respectively. The length of its international border with Bangladesh is 856 Km (84%) while it shares 53 km border with Assam and 109 km border with Mizoram.

The state is endowed with considerable natural resources such as fertile soil, well-distributed rainfall, rich flora and fauna, natural gas and abundant water resources. Moreover, the state has vast human resources with present literacy rate of 87.22 % (Male – 91.53 % & Female – 82.73 %) which is significantly higher than the all India rate of literacy (74.04 %). Most significant is that a thumping 85.58 % of the rural population of the state is literate (Rural Male – 90.86 % & Rural Female – 80.06 %), which is much higher than the all India rural literacy rate (67.8%) and 5th highest in India after Kerala (94 %), Lakshadweep (91.80%), Mizoram (91.30 %), and Goa (88.70). In terms of area, it is the smallest state in the north-eastern region and third smallest state in the country after Goa and Sikkim. The Census 2011 data reveals that Tripura is the second most populated state in the north-east after Assam with density of 350 persons per sq. km.

1.2 ADMINISTRATIVE DIVISIONS:

Administratively Tripura is divided into eight districts viz., North Tripura, Unakoti, Dhalai, Khowai, West Tripura, Sepahijala, Gomati and South Tripura with their headquarters at Dharmnagar, Kailasahar, Ambassa, Khowai, Agartala, Bishramganj, Udaipur and Belonia

respectively. Agartala city is the state capital. The eight districts are further sub-divided into 23 sub- divisions and 58 blocks. Tripura has one Autonomous District Council, the Tripura Tribal Areas Autonomous District Council (TTAADC), which has its headquarter at Khumulwng, 23 kms away from Agartala city. The TTAADC covers about two third of the state's area (7132.56 sq. km.). The 3 tier Panchayat Raj System is prevalent in the state. There are 8 Zilla Parishads and 23 Panchayat Samitis. The total number of Gram Panchayats/ADC Village Councils is 1178, which includes 587 Autonomous District Council (ADC) and 591 elected Gram Panchayats functioning outside the Autonomous District Council areas. The details of administrative divisions have been given in Table 1.1, whereas the Administrative Map of Tripura has been presented in Figure 1.1.

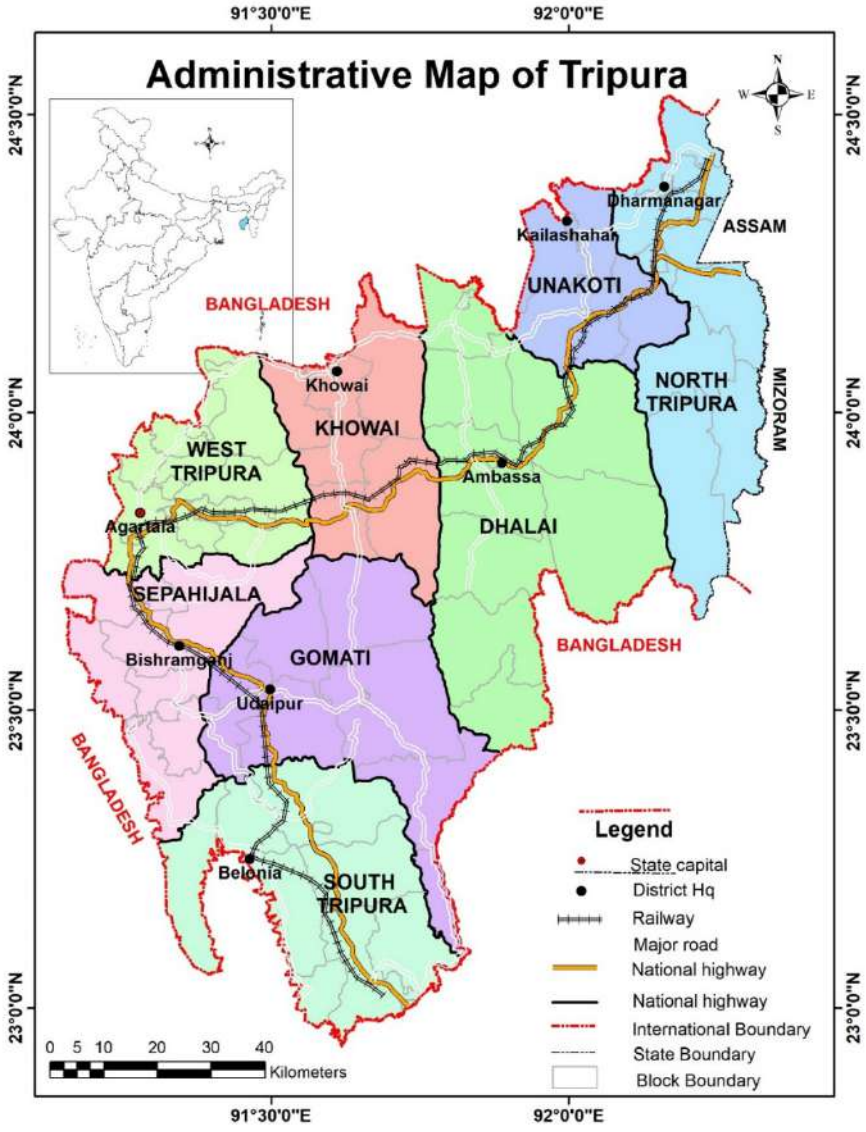

Figure 1-1: Administrative Map of Tripura

Table 1-1: Administrative Divisions of the State of Tripura

New District	Area (km^2)	Sub-Division	Block	GP	ADC	Revenue Village	Old District
1. North Tripura district (H.Q: Dharmanagar	1444.5	a) Dharmanagar b) Kanchanpur, c) Panisagar	1. Kadamtala, 2. Panisagar, 3. Damcherra 4. Jubaraj nagar, 5. Dasda, 6. Jampui Hills 7. Laljuri, 8. Kalacherra	70	60	89	North Tripura
2. Unakoti district (HQ: Kailashahar)	591.93	a) Kumarghat, b) Kailashahar	1. Gaurnagar, 2. Kumarghat 3. Pecharthal, 4. Chandipur	59	32	78	
3. Dhalai district (H.Q: Ambassa)	2405.3	a) Ambassa, b) Kamalpur c) Gandacherra d) Longtarai Valley	1. Salema, 2. Manu, 3. Ambassa 4. Chhamanu, 5. Dumburnagar 6. Raisabari, 7. Ganganagar 8. Durga-Chowmuhani	41	110	154	Dhalai
4. Khowai district (H.Q: Khowai)	1005.7	a) Khowai b) Teliamura	1. Khowai, 2. Tulashikhar, 3. Padmabil, 4. Teliamura, 5. Kalyanpur, 6. Mungiakami	54	69	79	West Tripura
5. West Tripura district (H.Q: Agartala)	942.55	a) Sadar b) Mohanpur c) Jirania	1. Dukli, 2. Mohanpur, 3.Lefunga, 4. Hezamara, 5. Jirania, 6. Mandai 7. Old Agartala, 8. Belbari, 9. Bamutia	87	85	98	
6. Sepahijala district (HQ: Bishramganj)	1044.8	a) Bishalgarh b) Sonamura c) Jampuijala	1. Jampuijala, 2. Bishalgarh, 3. Boxnagar, 4. Melaghar, 5. Kathalia, 6. Charilam 7. Nalchar	111	58	119	
7. Gomati district (H.Q: Udaipur)	1522.8	a) Udaipur, b) Amarpur c) Karbook	1. Matabari, 2. Tepaniya, 3. Kakraban, 4. Killa, 5. Amarpur, 6. Ompi, 7. Karbook, 8. Silachari	70	103	132	South Tripura
8. South Tripura district (H.Q: Bilonia)	1534.2	a) Santirbazar b) Belonia c) Sabroom	1. Bogafa, 2. Jolaibari, 3. Hrishyamukh, 4. Rajnagar, 5. Bharatchandra Nagar 6. Satchand, 7. Poyangbari, 8. Rupaichari	99	70	138	
Total Districts = 8	**10492**	**Sub-Divisions = 23**	**Blocks = 58**	**591**	**587**	**887**	

1.3 DEMOGRAPHY:

The state had a total population of 36,73,917 persons (Male – 18,74,376 & Female – 17,99,541) as per Census 2011; out of which 27,12,464 is rural population, which constitutes 74 % of the total population and 9,61,453 persons are under urban population, which is 26 % of the total population (Table 1.2).

West Tripura district is the most populous district which constitutes about 24.99% (9,18,200 persons) of the total population of the state with population density of 973 persons/sq. km (Table 1.2). Unakoti district has the minimum population of 2,76,506, with

population density of 157 persons/sq. km. The density of population for the whole state is 350 persons/sq. km, whereas in 2001 the density was 305 persons/sq. km. The percentage of decadal variation for the period 1991-2001 was 15.68 %, which indicate a sharp decline from that (34.30 %) of period 1981-91 (Table 1.2). Percentage of decadal variation for the last decade i.e. 2001-11 is found to be 14.84 %. Current population details of the state has been presented in Table 1.2 (2011 census).

There are 19 Scheduled Tribe communities with a total population of 11,66,813 which comprises 31.76 % of the state's total population. 17.82% of the total population of the state of Tripura comes under Scheduled Caste category, which is amounting to be 6,54,918 persons.

Table 1-2: District-wise Population (Census 2011)

District/ Sub-Division	Total Population			Rural		Urban		Percentage of decadal growth		Density per sq. km.	
	Person	Male	Female	Male	Female	Male	Female	1991-01	2001-11	2001	2011
West Tripura	918200	466152	452048	535911	511434	342019	335255	18.48	12.88	862	973
Khowai	327564	167401	160163						11.51	292	326
Sepahijala	483687	247829	235858						12.48	412	463
Dhalai	378230	194544	183686	173599	163914	20743	19732	10.96	22.776	128	157
North Tripura	417441	212650	204791	291577	281477	60894	59333	26.49	13.65	249	288
Unakoti	276506	140210	136296						19.66	392	469
Gomati	441538	225428	216110	384418	367721	62706	60299	6.78	13.348	253	287
South Tripura	430751	220162	210589						14.726	251	283
TRIPURA	**3673917**	**1874376**	**1799541**	**1385505**	**1324546**	**486362**	**474619**	**15.68**	**14.84**	**305**	**350**

Table 1-3: Decadal population Variation

Year	Total Population	Percentage of Decadal variation
1874-75	74,523	-
1881	95,637	23.83
1891	1,37,575	43.85
1901	1,73,325	25.98
1911	2,29,613	32.48
1921	3,04,437	32.59
1931	3,82,450	25.63
1941	5,13,010	34.14
1951	6,45,707	24.56
1961	11,42,005	78.71
1971	15,56,342	36.28
1981	20,53,058	31.92
1991	27,57,205	34.30
2001	31,99,203	16.03
2011	36,73917	14.75
2019-20	40,12,000	Estimated as per Tripura at a Glance, 2021-22

The above Table 1.3 shows the variation of population of Tripura 1874-75 to 2001 census. The above Figures indicate the total population within a century has increased more than 20 times. The decadal growth rates show fluctuations.

During the decade 1951-61, there was large scale migration of people from Bangladesh to Tripura and hence very high growth rate evidenced during that decade. There are 19 tribal communities comprising 31 percent of the state population. Tripuri, REANG, Jamatia, Chakma, Hlam, Mog Munda/Kaur, Kuki and Garo are most dominant tribal communities in the state.

1.4 CLIMATE

The climate of the state istropical, highly humid and characterized by moderate temperature with three prominent seasons - summer, monsoon and winter, where summer spans from March to May followed by southwest monsoon lasting till September. Winter season starts in November and lasts till the end of February and is marked with pleasant days & cold nights followed by a brief spell of spring.

The climate warms up generally from the middle of March and the height of summer is reached during the period from April to May. During this period maximum temperature is generally recorded above 35^0C and the minimum temperature from 21.3^0C to 22.4^0C. Generally, the maximum summer temperature ranges from 35^0–40^0C. Monsoon usually breaks in last week of May or in the first week of June and retreats by the end of September or October. Winter sets in from November and becomes severe in January when average minimum temperature at night is recorded as 8^0C.

Humidity generally remains high throughout the year. Generally, it is high in July and low in March. Relative humidity in a year generally varies from 70% to 85%. In summer, relative humidity varies from 60 to 75% in the morning and from 50 to 60% in the evening. In rainy season, relative humidity remains over 85% in the morning and from 70 to 80% in the evening. Relative humidity recorded at Agartala during a long period in the recent past is 89% to 63% in the morning and 80% to 50% in the evening.

Monthly evaporation varies from 1.6 to 6.9 mm/day (ICAR complex, Lembucherra, West Tripura district). Wind speed varies from 1.0 to 3.8km/hr in winter season and 3.7 to 18.3km/hr in summer and rainy season.

1.5 RAINFALL

Tripura, located in the northeastern region of India, experiences a tropical monsoon climate, which results in significant rainfall throughout the year. The state witnesses an annual average rainfall of about 2000 to 2500 mm, with the heaviest rainfall occurring during the monsoon season from June to September. This rainfall is vital for sustaining the state's agricultural economy, as the state heavily relies on crops like rice, tea, rubber, and various fruits and vegetables.

The monsoon rains help replenish water sources like rivers, lakes, and reservoirs, which are crucial for irrigation during the dry months. The state receives a good amount of rainfall due to its geographical location, which is characterized by hills, forests, and proximity to the Bay of Bengal. The coastal and hilly areas experience more rainfall compared to the plains. This variation in rainfall also supports diverse ecosystems and helps maintain the region's biodiversity.

1.5.1 District-Wise Normal Rainfall of Tripura

Rainfall in Tripura varies significantly across its eight districts due to the diverse topography of the state. Some districts receive heavier rainfall due to their proximity to the Khasi Hills and the Bangladesh border, while others experience more moderate rainfall.

- **West Tripura**: This district, which includes the state capital Agartala, receives moderate rainfall, averaging around 2000-2500 mm annually. Agartala itself experiences rainfall primarily during the monsoon months but has a relatively dry period in the winter months.
- **South Tripura**: This district is known for receiving higher rainfall compared to other parts of the state. The terrain in South Tripura is hilly, and its location closer to Bangladesh increases its rainfall, making it one of the wettest areas in the state. It receives around 2500-3000 mm of rainfall annually, which supports the area's agricultural activities.
- **Dhalai**: Located in the central part of Tripura, Dhalai also experiences substantial rainfall, averaging around 2500-2800 mm annually. This district's hilly terrain contributes to the

higher rainfall levels. The abundant rainfall supports both subsistence and commercial farming.

- **North Tripura**: This district generally receives moderate rainfall, with annual averages ranging between 2000-2500 mm. The region's agricultural activities, including the cultivation of rice and vegetables, benefit from the seasonal rains.
- **Unakoti**: Unakoti, a district known for its cultural heritage and natural beauty, receives rainfall ranging between 2200-2700 mm annually. The district's rainfall supports its forests and agricultural land, contributing to the local economy.
- **Khowai, Sepahijala, and Gomati**: These districts receive average to above-average rainfall, ranging from 2000-2600 mm annually. Khowai and Gomati, with their rolling hills, get more rainfall, while Sepahijala also sees moderate levels of rainfall, benefiting from the monsoon winds.

Table 1-4: Rainfall data variation all assessment unit

District	Block	Actual Monsoon Rainfall 2023	Normal Monsoon Rainfall 2023	Actual Non Monsoon Rainfall 2023	Normal Non Monsoon Rainfall 2023	Average Rainfall (mm)
Dhalai	Ambasa	1456.0	2033.0	486.2	659.1	2692.1
Dhalai	Chawmanu	1281	1841.8	455.6	501.0	2342.8
Dhalai	Dumburnagar	1281	1815.9	455.6	437.6	2253.5
Dhalai	Durgachowmuhani	1456.0	2033.0	486.2	659.1	2692.1
Dhalai	Ganganagar	1281	1815.9	455.6	437.6	2253.5
Dhalai	Manu	1281	1841.8	455.6	501.0	2342.8
Dhalai	Raishyabari	1281	1815.9	455.6	437.6	2253.5
Dhalai	Salema	1456.0	2033.0	486.2	659.1	2692.1
Gomati	Amarpur	1835	1786.9	442.6	451.3	2238.1
Gomati	Kakraban	1835	1701.6	442.6	439.7	2141.3
Gomati	Karbuk	1835	1757.8	442.6	443.5	2201.3
Gomati	Killa	1199.5	1693.2	381.8	442.5	2135.7
Gomati	Matabari	1199.5	1693.2	381.8	442.5	2135.7
Gomati	Ompi	1835	1786.9	442.6	451.3	2238.1
Gomati	Silachari	1835	1757.8	442.6	443.5	2201.3
Gomati	Tepania	1199.5	1693.2	381.8	442.5	2135.7
Khowai	Kalyanpur	1400.6	1610.1	518.2	521.1	2131.2
Khowai	Khowai	1400.6	1756.4	518.2	558.4	2314.9
Khowai	Mungiakami	1400.6	1610.1	518.2	521.1	2131.2
Khowai	Padmabil	1400.6	1756.4	518.2	558.4	2314.9
Khowai	Teliamura	1400.6	1610.1	518.2	521.1	2131.2
Khowai	Tulashikar	1400.6	1756.4	518.2	558.4	2314.9

North T	Damcherra	1202.7	1892.0	594.2	588.1	2480.2
North T	Dasda	1202.7	1892.0	594.2	588.1	2480.2
North T	Jampui hill	1202.7	1892.0	594.2	588.1	2480.2
North T	Jubarajnagar	1547.9	1945.2	594.2	635.7	2581.0
North T	Kadamtala	1547.9	1945.2	594.2	635.7	2581.0
North T	Kalacherra	1547.9	1945.2	594.2	635.7	2581.0
North T	Laljuri	1202.7	1892.0	594.2	588.1	2480.2
North T	Panisagar	1547.9	1945.2	594.2	635.7	2581.0
Sepahijala	Bishalgarh	879	1552.6	272.8	472.6	2025.3
Sepahijala	Boxanagar	1377.2	1676.3	478.5	439.1	2115.4
Sepahijala	Charilam	879	1552.6	272.8	446.5	1999.1
Sepahijala	Jampaijala	879	1552.6	272.8	446.5	1999.1
Sepahijala	Kathalia	1377.2	1676.3	478.5	439.1	2115.4
Sepahijala	Mohanbhog	1377.2	1676.3	478.5	439.1	2115.4
Sepahijala	Nalchar	1377.2	1676.3	478.5	439.1	2115.4
South T	Bagafa	1407.2	1867.3	469.5	472.0	2339.3
South T	Bharat Chandra Nagar	1407.2	1867.3	469.5	472.0	2339.3
South T	Hrishyamukh	1093	1806.3	395.3	442.6	2248.9
South T	Jolaibari	1407.2	1867.3	469.5	472.0	2339.3
South T	Poangbari	1791.2	2263.3	353.5	529.3	2792.7
South T	Rajnagar	1093	1806.3	395.3	442.6	2248.9
South T	Rupaichari	1791.2	2263.3	353.5	529.3	2792.7
South T	Satchand	1791.2	2263.3	353.5	529.3	2792.7
Unakoti	Chandipur	1381.5	1853.1	535.2	523.5	2376.6
Unakoti	Gournagar	1381.5	1853.1	535.2	523.5	2376.6
Unakoti	Kumarghat	1381.5	1853.1	535.2	523.5	2376.6
Unakoti	Pecharthal	1381.5	1853.1	535.2	523.5	2376.6
West T	Agartala MC	1323	1602.4	463.2	463.0	2065.4
West T	Bamutia	1323	1602.4	463.2	463.0	2065.4
West T	Belbari	1323	1534.9	463.2	418.9	1953.7
West T	Dukli	1323	1602.4	463.2	463.0	2065.4
West T	Hezamara	1323	1602.4	463.2	463.0	2065.4
West T	Jirania	1323	1534.9	463.2	418.9	1953.7
West T	Lefunga	1323	1602.4	463.2	463.0	2065.4
West T	Mandai	1323	1534.9	463.2	418.9	1953.7
West T	Mohanpur	1323	1602.4	463.2	463.0	2065.4
West T	Old Agartala	1323	1534.9	463.2	418.9	1953.7

Overall, the variation in rainfall across the districts of Tripura not only supports the diverse agricultural practices but also helps maintain the region's rich natural resources, including its forests, rivers, and wildlife. The different rainfall patterns in the state have contributed to the development of various regional crops and helped shape the culture and economy of each district. The overall rainfall is crucial for maintaining the ecological balance of the state and sustaining its agricultural output, which is a major part of Tripura's economy.

Table 1-5: Month wise rainfall during 2015 to 2020 in the State

Rainfall (in mm)							
Name of Month	**Normal**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
January	9.6	0.4	1.8	0.0	3.3	0.0	27.6
February	21.7	12.2	49.8	16.7	8.9	45.4	1.4
March	65.4	14.7	98.2	185.2	35.7	39.7	3.8
April	179.1	318.0	184.2	392.5	190.6	177.2	190.7
May	339.6	333.6	431.0	225.9	601.2	294.8	336.1
June	452.0	282.2	247.8	617.6	519.9	306.7	456.2
July	367.5	514.7	330.9	442.8	258.3	610.8	355.2
August	316.7	338.8	329.5	516.2	222.3	218.4	193.7
September	257.8	296.9	246.4	358.4	135.1	202.6	304.5
October	165.6	105.3	119.6	334.4	80.1	164.1	266.2
November	33.2	3.9	162.3	2.2	14.8	47.2	24.6
December	5.6	10.0	0.6	88.5	17.6	4.8	0.0
Annual Rainfall	**2213.4**	**2229.7**	**2202.2**	**3180.4**	**2087.8**	**2111.7**	**2160.0**

Table 1-6: Rainfall during Ground Water Assessment Year 2023-24 for the State and District wise

Sl. No	DISTRICT	Rainfall (mm)			Recharge Worthy Area (ha)	Ground Water Recharge (ham)		
		Monsoon	Non-Monsoon	Total		Monsoon	Non-Monsoon	Total
1	Dhalai	1903.72	532.59	2436.31	99581	18643.1	4068.87	22711.97
2	Gomati	1733.8	444.59	2178.39	109828	20274.69	3597.03	23871.72
3	Khowai	1683.25	539.29	2222.54	49560	9752.77	2484.94	12237.71
4	North Tripura	1918.63	539.79	2458.42	54382	10614.49	3107.27	13721.76
5	Sepahijala	1623.31	445.99	2069.3	87170	15229.43	3662	18891.43
6	South Tripura	2000.57	486.12	2486.69	98103	21620.62	4112.04	25732.66
7	Unakoti	18503.07	523.5	19026.57	42878	8544.69	1903.43	10448.12
8	West Tripura	1575.39	445.36	2020.75	78282	14005.09	3670.77	17675.86

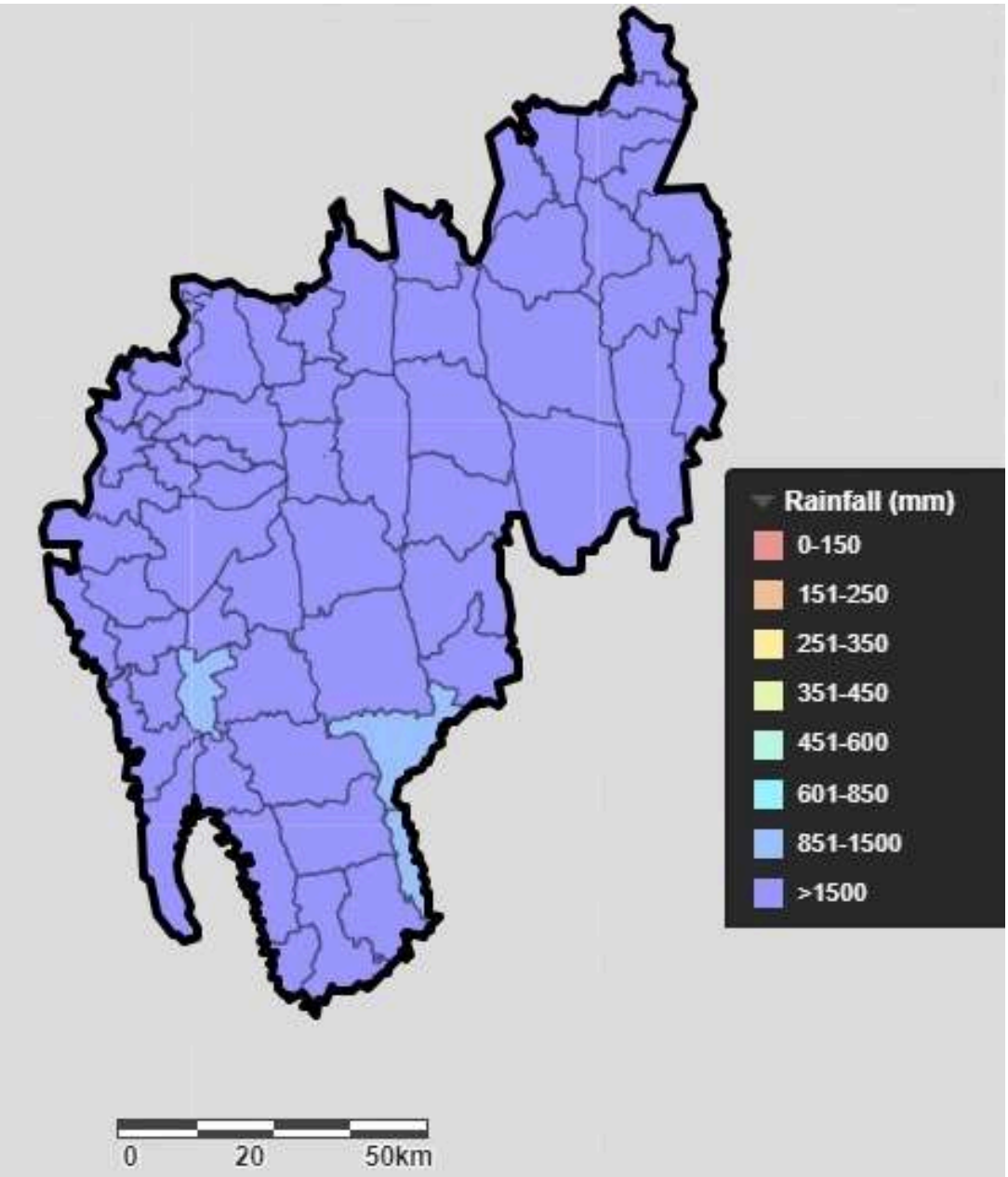

Figure 1-2 :Annual Normal Rainfall Map of Tripura

2 HYDROGEOLOGICAL SETUP OF THE STATE OF TRIPURA

Geologically the state of Tripura is occupied by sedimentary formations of Recent to Tertiary age. Hydrogeologically the state is divided into 4 units i.e Alluvial formation, Dupitila formation, Tipam formation and Surma formation (Bokabil and Bhuban). Fourth hydrogeological unit i.e. Surma formation comprising shale/sandstone is mostly hard, compact and non-porous, thus not considered to be an important unit in terms of ground water potential.

2.1 WATER BEARING FORMATIONS

(i)Alluvial formation: It occurs along the banks of main rivers and in valleys and its thickness is only upto 15m. Ground water occurs under unconfined condition. The ground water development in this formation has not been very significant because of high clay and sandy clay content. Ground water is developed through dug wells and shallow tube wells fitted with hand pumps. These alluvial formations are underlained by Dupitila and Tipam formations.

(ii) Dupitila formation: It occurs nearly in horizontal disposition and its thickness varies from 10 to 30 m forming the near surface aquifers within 30 m bgl. The formation consists of mainly clay and silt with some intercalations of gritty and ferruginous sandstones. It is exposed in the central portion of all the major valleys and also on northern part of Manu valley. In general, it has low permeability and low storage capacity due to high clay content. Ground water in this formation occurs under unconfined condition, which is developed through dug wells and hand pumps.

(iii) Tipam formation: Tipam formation constitutes the principal and productive aquifer horizons. Due to higher porosity and permeability; transmissivity and storage co-efficients of the formation is much higher than that of Dupitila formation or Surma formation. The recharge area of the formation is in the surrounding anticlinal hills. This formation consists of sub-rounded, fine to medium grained, friable sandstone with intercalated clay. Ground water occurs under unconfined, semi-confined to confined conditions. This formation is developed by deep tube wells and mini deep tube wells fitted with electric motors, shallow tube wells, Mark - II/III and hand pumps.

2.2 OCCURRENCE AND MOVEMENT OF GROUNDWATER

Ground water in Tripura occurs under unconfined to confined conditions. At shallow depths, in shallow aquifers ground water occurs mainly under unconfined condition. In some small isolated zones ground water at shallow depths occurs under semi-confined to confined conditions and sometimes shows artesian condition due to presence of top clay. Water bearing formation occur both in shallow Quartanary alluvial formation and Tertiary coarse clastics occurring in deeper horizons.

In Alluvial, Dupitila and Tipam formation (at shallow depths) groundwater occurs under unconfined condition. However, in Tipam formation groundwater occurs under semi-confined to confined condition in most of the cases.

The movement of groundwater in unconfined aquifer is towards north in Longai, Juri, Manu-Deo, Dhalai and Khowai basins and almost towards west in Haora, Burigang, Gomati and Muhari basins.

2.3 HYDROGEOLOGICAL CONDITIONS

The semi-consolidated Tertiary Formations constitute the main hydrogeological units in the state. Other small depositions of alluvial formations of Recent age also constitute the local hydrogeological units along major river courses. The hydrogeological units of Tertiary Formations consist of friable sandstones, claystones and shales which can be subdivided into two groups namely Dupitila Group and Tipam Group. Formations belonging to Dupitila Group are mainly clay and silt with some thin intercalations of gritty and ferruginous sandstones, whose thickness is limited to 10 - 30 m and prominent in the western parts of the state. Storage Capacity and permeability of the formations of Dupitila Group are very low due to the presence of thick clay layers. Formations of Tipam Group are mainly soft, massive and friable sandstones and alternating layers of shales, which are exposed throughout the state along the outer flanks of the anticlinal hills with moderate dips and are occupying the synclinal valleys as well. Thickness of Tipam Group is about 1400 m. Due to their poor consolidation and moderately medium grained texture, the Tipam sandstones form the principal and only productive aquifer system. General hydrogeological setup of Tripura is presented in Figure 2.1.

CGWB has carried out Intensive hydrogeological surveys and ground water exploration through drilling and construction of 65 EW, 19 OW, 2 SH and 12 Pz under NAQUIM studies

programme and under Ground Water Exploration Program. Besides CGWB, Drinking Water and Sanitation Department (DWS); Govt. of Tripura, PWD (Water Resource), Govt. of Tripura and other state agencies have drilled a number of deep tube wells in the state. Based on the lithological logs of these tube wells, valley-wise hydrogeological sections have been drawn to study the lateral and vertical distribution of the aquifer system in Tripura.

Hydrogeological surveys, aided by exploratory drilling and deposit well programmes carried out by Central Ground Water Board, N.E. Region since 1972 have revealed that there are 3 to 4 major aquifers encountered within 250m depth in the synclinal valleys of the State, and the thickness of the aquifers varies from valley to valley and it decreases considerably in the northern valleys of the State, namely, Kamalpur, Kailasahar & Dharmanagar valleys. The Tipam formation comprising of medium to fine grained, semi-consolidated & friable sandstones, form the aquifer system of the State. The ground water worthiness of the aquifer varies from valley to valley, while in western part of the State the aquifers are of good potential in comparison to northeastern parts towards Dharmanagar, where it is moderately potential. On the basis of drilling, the aquifer zones down to the explored depth of 250m, can be divided into two groups, viz., (1) a shallow aquifer zone within 40m depth from surface & (2) a deeper aquifer zone below 40m depth. The study of sub-surface geology through lithological logs has revealed that the aquifers are discontinuous in nature even within the same valley.

In Tripura, ground water occurs under unconfined condition in Dupitila formation, Recent formation & in Tipam formation. Besides it also occurs under confined to semi-confined conditions in Tipam formation at considerable depth. Recharge areas for the deeper aquifer lies in the adjacent anticlinal hills. Wherever a good thickness of impermeable clay beds underlie & overlie the saturated granular zones, autoflow artesian conditions have been found in the valleys, which are the discharge area. In fact, the geology as well as geomorphology of the State is favourable for such artesian conditions within synclinal valleys. The artesian flowing conditions occur in patches both at shallow depth and at deeper depth. The auto discharge of the flowing wells in the State ranges from 100 to 6000 lph, the maximum auto discharge from deep tube well to the extent of 54000 lph has been found in Khowai valley near Khowai town, where the piezometric head rose up to 7m above ground level. The depth to water level in dug wells varies from 0.75 to 10.30 m bgl during pre-monsoon period March 2023 and 0.54 to 9.48 m bgl during post-monsoon period November 2023.

Hydrogeological sections in Agartala-Udaipur-Sabroom valley show the presence of clay intercalations and two to four granular zones. The first granular zone occurs in the depth range of 7 to 60 m bgl, second granular zone occurs within 70 to 130 m, while the third granular zone occurs in depth range of 170 to 250 m. In the central part around Baikhora and Satchand the sandstone is quite thick and forms almost a single aquifer system with layers of clay occurs locally creating a confined condition.

The perusal of the hydrogeological section in Khowai-Teliamura-Amarpur valley shows the predominance of clay over sandy layers. Up to 300 m depth, four to five granular zones are occurring. The thickness of these granular zones varies from 5 – 20 m.

The sub-surface configuration in Kamalpur-Ambassa-Gondacherra valley reveals the high variation in the facies laterally as well as vertically (F). It is also evident that clay is dominating in the middle portion of the valley as compared to the southern parts of the valley. Generally, down to 300 m bgl depth four granular zones are occurring viz. (i) 5 - 30 mbgl, (ii) 50 - 65 mbgl (iii) 80 - 120 mbgl and (iv) 130 - 240 mbgl. The deeper aquifer from 80 m below ground level are confined and exhibit artesian condition around Abhanga and Ambassa, while the Shallow aquifer are found under unconfined to semi-confined conditions.

Sub-surface set-up in Kailasahar-Chawmanu and Dharmanagar-Machmara valley shows the wide litho-facies variation both laterally and vertically. Aquifer at shallow depth is not persistent. However, in deeper zones it is persistent, but at different levels, it is discontinuous due to presence of three inferred faults. These faults, one at south of Trilokpara, second at Gaurnagar and the third one at south of South Irani, have resulted in wide and abrupt lateral variation of litho-facies. Both the shallow and deep aquifers around Kailashahar show artesian condition.

Analysis of aquifer performance test data of the exploratory/deposit wells has shown that transmissivity ranges from 4.5 to 1577 m^2/day and permeability from 0.1 to 28.4 m/day. Storage Co-efficient ranges from 2.25 x 10^{-5} to 2.20 x 10^{-3} showing confined nature of the aquifers.

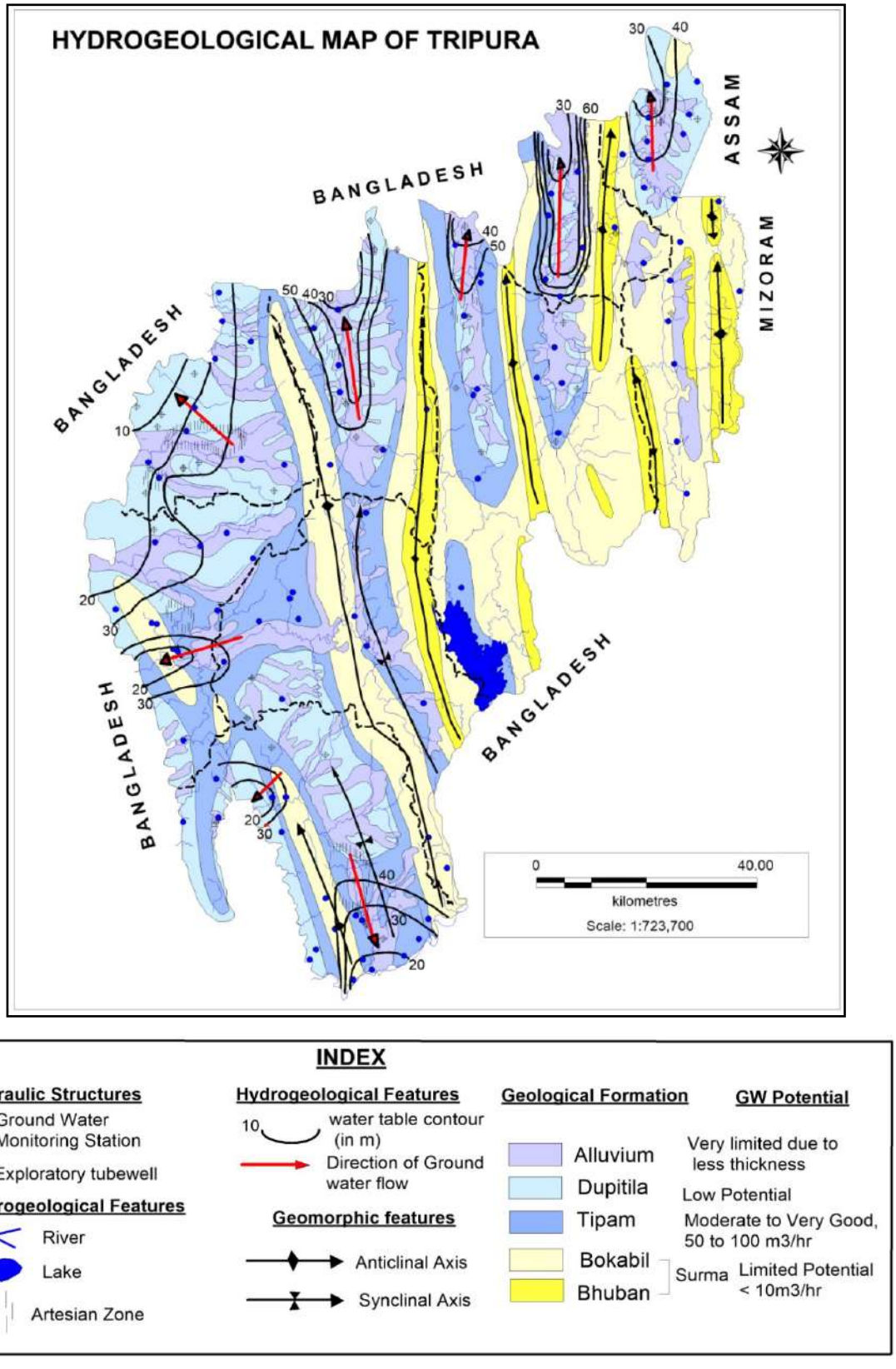

Figure 2-1: Hydrogeological Map of Tripura

Table 2-1: Aquifer Disposition and Groundwater Potential of Tripura

Age		Group	Formation	Lithology	Aquifer Disposition	Ground Water Potential
Quaternary	Un-consolidated	Recent	Recent Alluvium	Clay, Silt and Sand	Limited thickness along river valleys	Yield Prospects very limited due to superficial thickness
Upper Tertiary	Semi Consolidated	Dupitila	Dupitila	Coarse to gritty Sandstone with dominated Clay layers	Forms Unconfined aquifer in dug well zones near surface. Maximum thickness : 30 m	Limited yield prospect due to poor permeability
		Tipam	Champaknagar/ Manu Bazar	Fine to coarse Sandstone with intercalations of Shale layers	Forms major aquifer system for shallow and deep tube wells up to 300 m depth at favourable locations.	Moderate yield prospect, yields varies from 20 to 150 m^3/hr for drawdown upto 30 m
		Surma	Bokabil/ Bhuban	Thinly bedded Sandstone, Siltstone and shale	Occurs on anticlinal hill ranges	Not potential for ground water development, due to argillaceous nature of formations

2.3.1 Hydro-meteorological Condition

The climate of the state is characterized by moderate temperature and high humid atmosphere. Winter sets in November and lasts till the end of February. Summer season starts from March and lasts up to May and is followed by Southwest monsoon lasting till September. Generally, the maximum summer temperature ranges from 35^0C to 40^0C and average minimum temperature in winter nights is recorded at 6^0C.

The state receives rainfall from Southwest Monsoon. The average annual rainfall over the state is 2128 mm. The intensity of rainfall increases from SW to NE in the state. In West Tripura district the normal monsoon rainfall is 1339 mm and normal annual rainfall is 1925mm. In South Tripura district normal monsoon rainfall is 1806 mm and normal annual rainfall is 2419 mm. In

North Tripura district normal monsoon rainfall is 1590 mm and normal annual rainfall is 2407 mm. In Dhalai district normal monsoon rainfall is 1493 mm and normal annual rainfall is 2212 mm. In Khowai district normal monsoon rainfall is 1412 mm and normal annual rainfall is 2115 mm. In Unakoti district normal monsoon rainfall is 1514 mm and normal annual rainfall is 2308 mm. In Gomati district normal monsoon rainfall is 1306 mm and normal annual rainfall is 1760 mm. In Sepahijala district normal monsoon rainfall is 1401 mm and normal annual rainfall is 2000 mm.

2.3.2 Ground Water Level Conditions

Ground water regime of Tripura is being monitored through a network of 106 permanent observation stations (GWMS) four times in a year. The depth to water level during pre-monsoon period (March' 23) generally lies between 0.75 to 10.30 m bgl and during post-monsoon period (November' 23) depth to water level lies between 0.54 to 9.48 m bgl. The analysis of long-term water level trend (both pre-monsoon and post-monsoon period) of ground water monitoring stations indicates that there is no significant falling trend of water level in the state so far.

2.3.3 Depth to Water level during March, 2023 (Pre-Monsoon)

In March 2023, water level monitoring was conducted at 94 stations across Tripura, revealing significant variations in the depth to water level in different areas of the state. Water level in 14.9% (14) of the monitored stations of the state was recorded within 0-2 mbgl and Water level in the range of 2-5 mbgl was found in 45.7% (43). The majority of stations recorded water levels within the range of 0-5 meters below ground level (mbgl), which is considered a normal depth for water availability. Specifically, 45.7% (43) of the stations reported water levels in this range, indicating that groundwater was generally accessible in most regions.

A smaller proportion of stations recorded water levels in the deeper ranges. About 29.8% (28) of stations had water levels between 5-10 mbgl, showing a moderate drop in groundwater levels in these areas. Additionally, 8.5% (8) of the monitored stations showed water levels in the range of 10-20 mbgl, suggesting a more significant decrease in groundwater depth. One station located in the West Tripura district recorded a water level beyond 20 mbgl, indicating a severe drop in groundwater levels, which might require attention for water conservation efforts.

In dugwells, the water levels varied even more. The lowest recorded water level was 0.86 mbgl in South Tripura, indicating that groundwater was relatively close to the surface in that area. On the other hand, the highest recorded water level was 10.58 mbgl in Gomati district,

2.3.4 Depth to water level during November 2023 (Post Monsoon)

During the month of November 2023, water level in major part of the state (82.8%, 87 stations) was observed within 5 mbgl. Water level in the range of 0-2 mbgl was found in 26.6% (28) of the monitored stations, in the range of 2-5 mbgl in 56.2% (59) stations and in the range of 5-10 mbgl in 14.3% (15) stations. Two stations located in Khowai and South Tripura recorded water level in the range of 10-20 mbgl. Water level above 20 mbgl was found in only one station of West Tripura district. In dugwells, the minimum water level of 0.34 mbgl and the maximum water level of 9.70 mbgl had been recorded in Gomati and South Tripura district respectively.

Some of the Graph from Shallow aquifers are presented below:

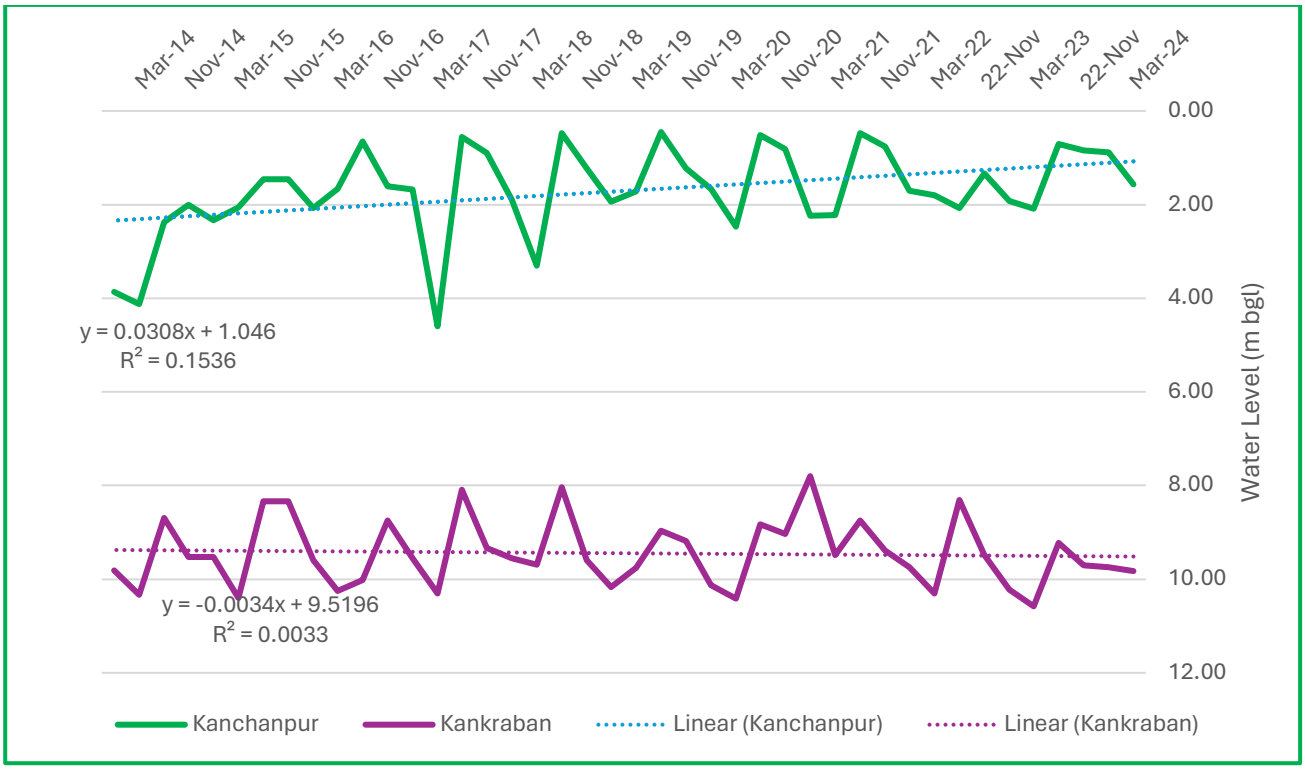

Figure 2-2: Water Level Hydrograph of Shallow Aquifer (A)

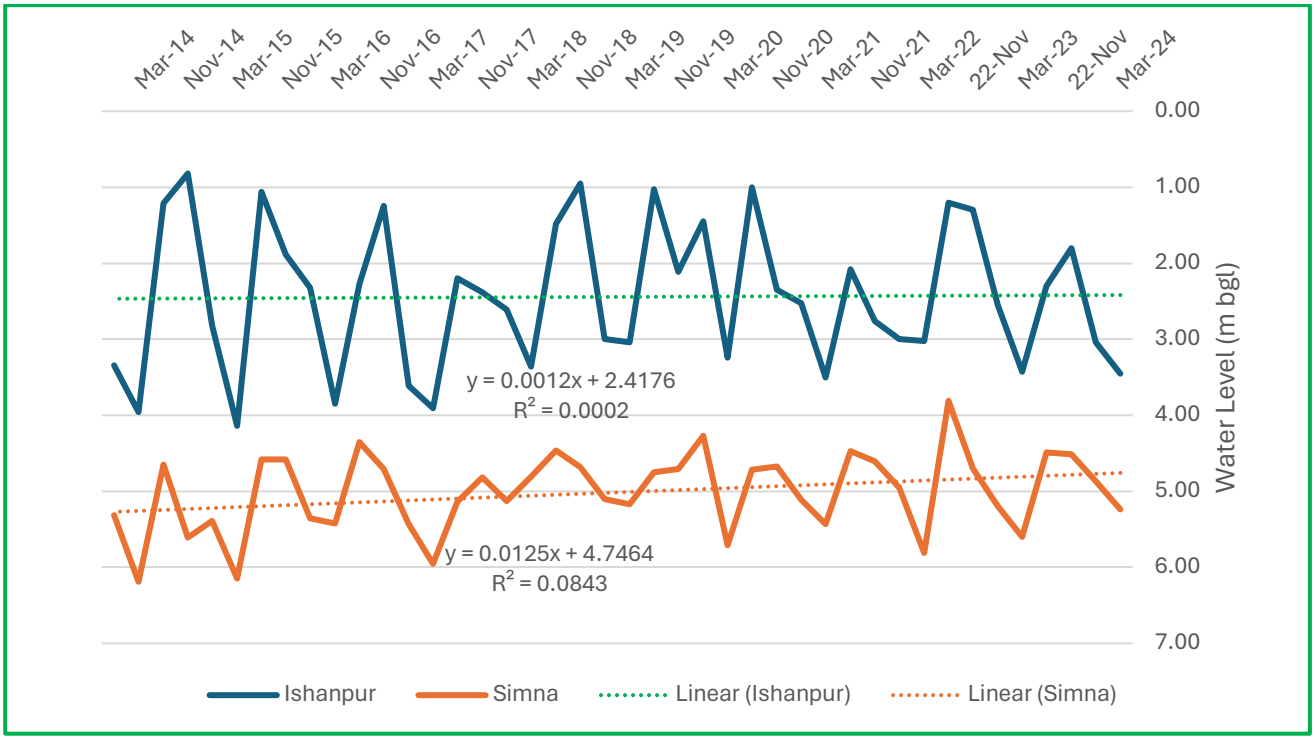

Figure 2-3: Water Level Hydrograph of Shallow Aquifer (B)

Similarly, the Rainfall Vs Water levels of the Deeper Aquifer is presented below:

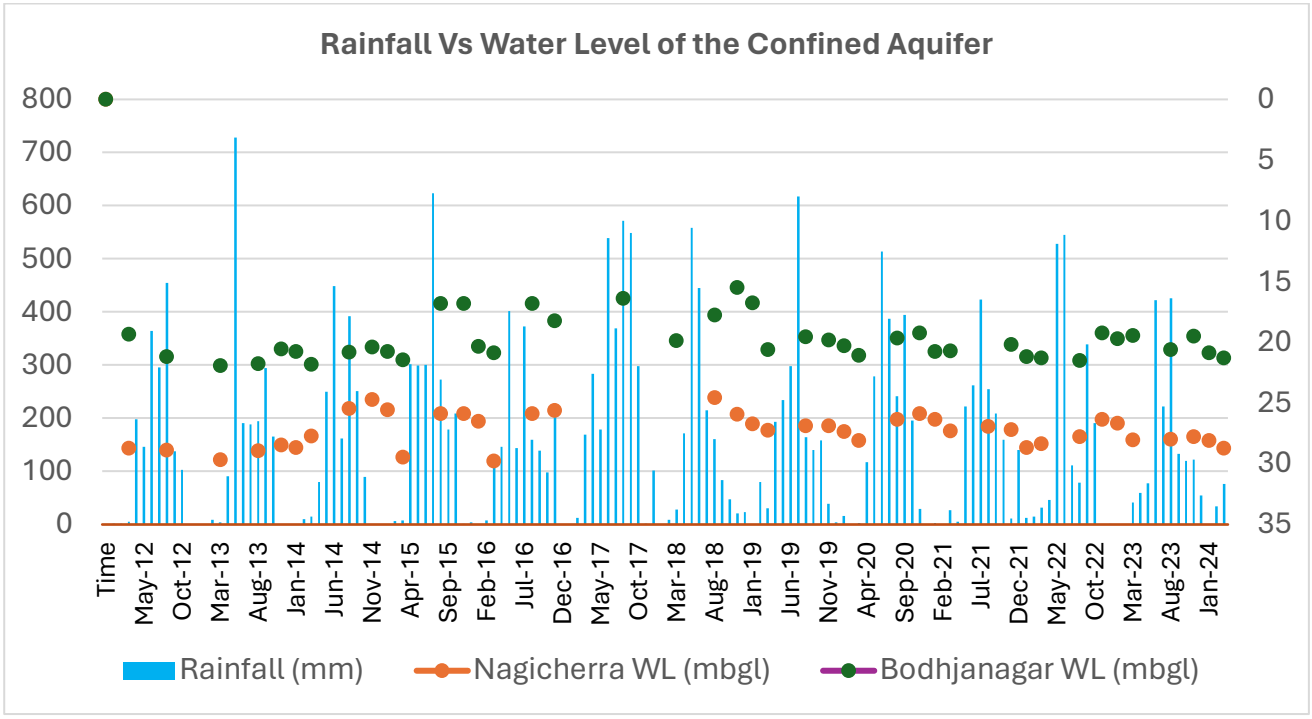

Figure 2-4: Water Level Hydrograph of Deeper Confined Aquifer

2.3.5 Ground Water Quality

Results of chemical quality of ground water show that ground water in all parts of the State is good for domestic, irrigational & industrial uses. Iron content in ground water, however, is high, which warrants proper treatment before use. The water is encrusting in nature throughout the state. Hence, it is recommended that well screens should be cleaned periodically. Range of chemical contents of Ground Water in Tripura is given in the table below:

Table 2-2: Range of chemical contents of Ground Water in Tripura

Sl. no	Chemical constituents	Phreatic Aquifer		
			Min	Max
1	pH		4.15	9.02
2	EC (µS/cm) at 25°C		50.57	841.10
3	Turbidity (NTU)	mg/l	BDL	0.4
4	TDS		24.83	440.2
5	CO_3		BDL	51
6	HCO_3		12.21	311.35
7	TA (as $CaCO_3$)		12.21	362.35
8	Cl-		7.09	141.8
9	SO_4		BDL	134.01
10	NO_3		BDL	10.73
11	F-		BDL	1.4
12	Ca		2	40.03
13	Mg		2.41	35.19
14	TH (as $CaCO_3$)		25	200
15	Na		2.77	118.55
16	K		0.69	34.69
17	Fe		BDL	6.54

Ground water in the state is acidic to alkaline with pH values ranging from 4.15 to 9.02. The electrical conductivity values for ground water in phreatic aquifer in Tripura range from 50.57 to 841.10 µs/cm at 25ºC indicating the quality of ground water to be of low salinity and

the water is potable. Total hardness (Ca+Mg) expressed as $CaCO_3$ in ppm is small indicating that the water is soft in quality. The other chemical constituents of ground water namely HCO_3, Cl, Ca, Mg, Fe etc. all are within permissible limit according to Bureau of Indian Standard (IS: 10500-2012**).** The chemical analysis of ground water samples from phreatic aquifer reveals that the ground water of Tripura is generally suitable for drinking purposes. Almost all the chemical constituents are within the permissible limits of drinking water standards except for Iron, which is high in isolated locations. Higher concentration of iron above permissible limit in ground water in phreatic aquifer in Tripura is observed in most of the places.

3 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.

3.1 JOURNEY OF METHODOLOGY FOR RESOURCE ESTIMATION IN INDIA

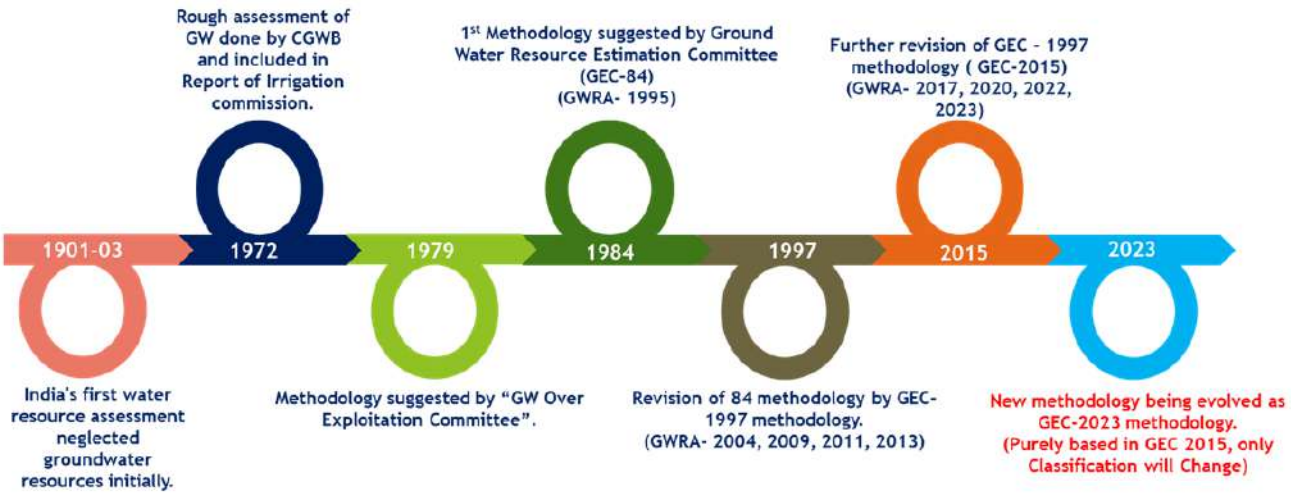

Figure 3-1: Ground Water Resource Estimation in India

3.2 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.

3.2.1 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 –

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

Equation (1) can be further elaborated as –

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

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.

3.2.1.1 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.

3.2.1.1.1 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

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

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:

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

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

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

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,

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

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

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

$$\boldsymbol{R = ar} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(8)}$$

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:

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

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,

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

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:

$$a = \frac{NS_4 - S_1S_2}{NS_3 - S_1^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

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

Where,

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

3.2.1.1.2 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 –

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

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.

3.2.1.1.3 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

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

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.

3.2.1.2 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.

Table 3-1: Methods of Estimation of Recharge from different sources

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
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

3.2.1.3 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.

3.2.1.4 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.

3.2.1.5 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.

3.2.1.6 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.

3.2.1.7 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).

3.2.1.8 Estimation of Ground Water Extraction

Ground water draft or extraction is assessed as follows.

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

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

3.2.1.8.1 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.

3.2.1.8.2 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.

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

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.

3.2.1.8.3 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.

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

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.

3.2.1.9 Stage of Ground Water Extraction

The stage of ground water extraction is defined by,

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

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.

3.2.1.10 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

3.2.1.11 Categorisation of Assessment Unit

As emphasised in the National Water Policy, 2012, a convergence of Quantity and Quality of ground water resources is required while assessing the ground water status in an assessment unit. Therefore, it is recommended to separate estimation of resources where water quality is beyond permissible limits for the parameter salinity.

3.2.1.11.1 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

3.2.1.11.2 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. Such quality hazards are to be based on available ground water monitoring data of State Ground Water Departments and/or Central Ground Water Board. 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.

3.2.1.12 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.

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

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)

3.2.1.13 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.

3.2.1.14 Additional Potential Resources under Specific Conditions

3.2.1.14.1 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.

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

Where,

Q = Spring Discharge

No of days = No of days spring yields.

3.2.1.14.2 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:

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

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

3.2.1.14.3 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

3.2.1.15 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.

3.3 NORMS

3.3.1 Norms for Recharge due to Irrigation

Table 3-2: 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

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

3.3.2 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.

3.3.3 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.

3.3.4 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.

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

$$\textbf{Normalised Unit Draft} = \frac{\sum_{i=1}^{n} \textbf{Unit Draft}_i}{\textbf{Number of Years}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (31)$$

3.4 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

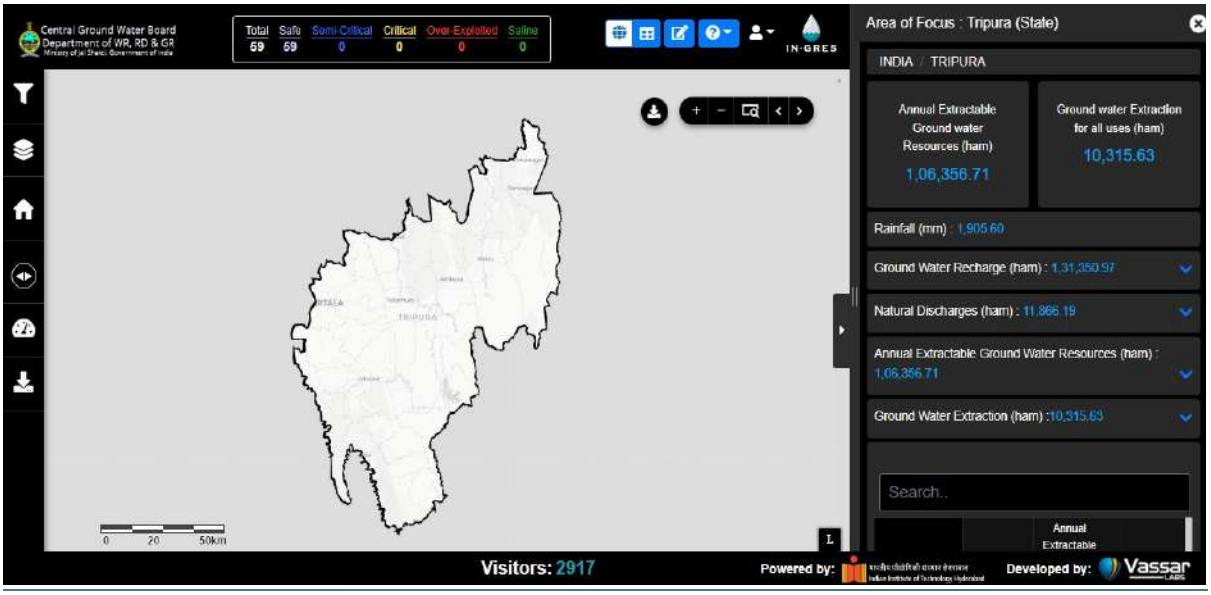

Figure 3-2: INGRES Website

3.4.1 Automation of Estimation of Dynamic Ground Water Resources using GEC-2015

The computation of the resource estimation of Tripura for the year 2023-24 is done through IN-GRES software (India Ground Water Resource Estimation System). IN-GRES is the common portal to input, estimate, analyze, and access static and dynamic groundwater resources. India GEC system will take Data Input through Excel as well as through Forms, compute various Ground water components (recharge, draft, flux, etc.), classify assessment unit into appropriate categories and develop visibility dashboards for each of the components. System allows user to view the data in both MIS as well as GIS view. User can also download the reports in formats like CGWB, etc.

India GEC system is divided into 3 modules – Input, Computation and Output.

i. Input module – Input Module refers to the Data Entry module at an Assessment Unit level. Data Input is done via 2 methods i.e.

a. Excel based input – In this, the user needs to download District level data sheet template where he/she can fill the data at an Assessment Unit level. User now needs to upload their fully filled excel sheet into the system.

b. Form based input – In this, the user is shown a form and he/she can fill/edit the data in data sheet in an online mode. Once user is done with editing online, he/she can submit the data file.

ii. Computation module – Computation Module refers to the ground water calculations for an assessment unit. These computations are based on GEC 2015 methodology and are used to calculate Annual Extractable Ground Water Resource, Total Current Annual Ground Water Extraction (utilization) and the percentage of ground water utilization with respect to recharge (stage of Ground Water Extraction) for an assessment unit. Based on these percentages an assessment unit is categorized into SAFE, SEMI-CRITICAL, CRITICAL AND OVEREXPLOITED categories.

iii. Output module Once categorized the data is shown in two views:

a. MIS Dashboard – MIS dashboard shows the results of the assessment for the entire India, and also State wise in tabular form. The MIS dashboard shows all type of recharges,

extractions, inflows and outflows computed for both monsoon and non-monsoon periods of the year and then reflect the overall stage of extraction at the selected Geo-Zoom Level.

b. GIS Dashboard – GIS dashboard shows the data in Web Geo-Server format, implemented in interactive GIS platform allowing user to all GEC related information in the map itself. GIS view represents the data on India map and color codes each block/Assessment unit based on the categorization

3.5 PROCEDURE FOLLOWED IN THE PRESENT ASSESSMENT INCLUDING ASSUMPTIONS

3.5.1 Data source for each of the data element and how the data was used in the computation (constraint in the data base, if any)

In the present report, block has been taken as the smallest administrative unit for resources computation.

The following sub-units have been considered for computation of various figures as per GEC-2015 methodology.

The total geographical area of the blocks and block-wise population of 2011 were taken from 2011 Census report. The population data of 2011 is projected for population of 2023 and 2025. Ground water draft for drinking and domestic purposes was calculated as per population. All the data were provided by the nodal department PWD (WR). The monthly rainfall data was used for recharge from rainfall. Block-wise number of ground water abstraction structures for irrigation, drinking and domestic purposes was used for calculating draft as per structures. Deep tube wells and artesian wells were considered to calculate the area under groundwater irrigation. But only shallow tube wells were considered for calculating draft for irrigation from phreatic aquifer. Draft for Industrial extraction has been calculated as per unit draft provided by the firm for issuance of NOC approvals to Central Groundwater Authority. Water level data of CGWB has been utilized for calculating recharge by WLFM and long term water level trend used for categorization of blocks.

Constraints in database- block-wise area irrigated by different structures were not available. Data regarding ground water structures is not complete because there are thousands of private shallow tube wells which have not come under present ground water structure / spot sources survey.

3.5.2 Changes, if any, applied in the original methodology proposed by GEC along with justification

Return flow from ground water has not been considered for monsoon season, as there is enough rainfall during monsoon and ground water irrigation is not practiced. There is no major or medium irrigation scheme in Tripura. Entire area has been considered as non-command area. Water spread area, days of water availability (monsoon & non-monsoon) and seepage from ponds & tanks given in the methodology have been used to determine the seepage from ponds & tanks for monsoon & non-monsoon separately. Since the aquifer remains fully saturated during the periods of intensive rainfall, additional recharge from ponds & tanks during this period is negligible. Recharge from ponds and tanks during non-monsoon period are considered for 212 days. Computation factor for seepage from ponds & tanks is taken as 0.00144 m/day as per GEC-2015 methodology.

Categorization was done based on stage of groundwater extraction and validation. Validation was done.

3.5.3 Various norms used in the computation

The unit of computation proposed in the methodology is “watershed”. However, it also recommends blocks/ tehsil as the unit for the first few years since there can be non-availability of data. In the present report block- the smallest administrative unit is taken as the unit of computation. This is mainly due to lack of data especially on number of ground water structures, draft, population and other vital figures on watershed basis.

The rainfall infiltration factor recommended by GEC 2015 for sandstone is 0.12. For calculating recharge from return flow from irrigation, an average water requirement of 1m & 0.1m for paddy & non-paddy has been taken from Agriculture department, Govt. of Tripura. Computation factor for return flow from ground water irrigation is taken as 0.25 – 0.45 and from surface water irrigation is taken as 0.30 – 0.50 as per GEC’2015 methodology.

Ground water drafts for various uses in the different subunits have been estimated and according to the recommended methodology. Ground water draft for domestic use has been estimated based on the number of different types of ground water abstraction structures and their unit draft per year and also as per population of 2011. The unit draft of dug well is 0.2 ham and unit draft of shallow tubewell (fitted with hand pumps) is 0.12 ham during monsoon and 0.48 ham during non-monsoon period.

Block-wise ground water draft for irrigation was estimated based on the number of structures of shallow tubewell and the unit draft of shallow tubewell fitted with pump. Ground water in the state is mostly used for domestic & irrigational purposes. Groundwater for Industrial extraction has been calculated as per unit draft provided by the firm for issuance of NOC approvals to Central Groundwater Authority.

The major potential aquifer in the state is Tipam sandstone and the specific yield value for Tipam sandstone is taken as 0.05 (from GEC'2015 Methodology).

3.5.4 Any documented field studies

The summarized results of the soil infiltration test carried out by the State Unit Office, Agartala, CGWB has been given as below. However, no other field study has carried out to measure unit draft of different structures and the data have been collected from the state government resources.

Table 3-3: Soil Infiltration Test results carried out by SUO Agartala

S.No	District	Block	Village	Lat	Long	Duration of Test (min)	Soil type	Infiltration rate (cm/hr)
1	West Tripura	Agartala MC	SUO Agartala	23.83658	91.30223	141	Clayey Loam	0.02
2	West Tripura	Mohanpur	Brahma Kund	24.08438	91.3923	125	Sandy clay	3.26
3	Sipahijala	Bishalgarh	Kamla Sagar	23.74152	91.16467	160	Sandy clay	7.12
4	West Tripura	Teliamura	Pashim Hawaibari	23.81006	91.59218	170	Clayey Loam	0.42
5	Shipahijala	Jampuijala	Tufaniamura	23.6987	91.40701	150	Sandy clay	8.04
6	West Tripura	Dukli	Kathaltali	23.7804	91.28609	205	Sandy clay	23.12
7	West Tripura	Bamutia	Berimura	24.06491	91.59514	150	Clayey Loam	0.8
8	Khowai	Khowai NP	Godarghat	24.06491	91.59514	150	Clayey Loam	0.6
9	West Tripura	Jirania	Jirania NIT	23.83586	91.42189	170	Sandy clay	6.6
10	Gomti	Matabari	Bodhupara Gorjee Cherra,	23.42601	91.5129	190	Sandy clay	17.2
11	South Tripura	Satchand Block	Betaga Saduram Para	23.0122	91.66438	190	Sandy clay	7.13

12	South Tripura	Sabroom	Kathalchari	23.01801	91.7441	205	Sandy clay	11.2
13	Sepahijala	Kanthalia RD Block	Baghair Char, Kanthalia Bazar	23.3813	91.3085	190	Sandy clay	18.02
14	Dhalai	Ambassa	Hridaypara, Ambassa	23.9317	91.8566	150	Sandy clay	2.04
15	Dhalai	Durga Chowmuhani	Ghospara	24.1429	91.7893	170	Sandy clay	5.08
16	Khowai	Kalyanpur	Totabari Hr. Sec School	23.9091	91.6201	140	Sandy clay	3.04

4 COMPUTATION OF GROUND WATER RESOURCES IN TRIPURA

Ground water resources of Tripura state have been computed according to the GEC-2015 methodology and the norms described in the report in the previous pages. The block-wise details have been provided in the following Annexures.

4.1 SALIENT FEATURES OF THE DYNAMIC GROUND WATER RESOURCES ASSESSMENTS.

The smallest administrative unit 'block' is taken as the unit of computation. Total number of assessment units in Tripura is 59. The resource computations presented in this report is for the ground water year 2023 – 2024 (1st April, 2023 to 31st March, 2024). Population data of 2011 collected from Census report 2011 and projected population of 2023 and 2025 were worked out. Rainfall data collected for 1993 - 2024. Ground water abstraction structure for irrigation and for drinking and domestic was provided by PWD (WR), and PWD (DWS) Govt. of Tripura. Apart from the same, the other related Data have been provided by from various other State Government Departments such as Public Works Department (Drinking Water and Sanitation); Agriculture Department; Directorate of Economics and Statistics; Department of Fisheries; Forest Department; Rural Development; Urban Development Department; Agartala Municipal Corporation, Government of Tripura and Indian Meteorological Department, Govt. of India, etc.

Although the total area of Tripura State is 10,491.69 sq km, most of the area are hilly and inaccessible. About 4293.85 sq. km. area (41% of the total area) has a slope higher than 20% and has not been considered for the Resource Estimation. The Remaining 6197.84 sq km area (accounting 59% of the State).

Hilly Areas (Slope > 20%)	Recharge is Not Feasible Tripura: 429385 ha or 4293.85 sq.km (41% of the total assessment area)
Ground Water Recharge Worthy Areas	Slope < 20% Tripura: 619784 ha or 6197.84 SQ.KM (59% of the total assessment area)
Command Areas	Command of any Major (=>10000 Ha) or Medium Irrigation (=>2000 Ha) Project: Tripura: No command area (no Assessment Units has a command area >2000 ha) as per GEC:2015
Non-Command Areas	619784 ha or 6197.84 sq.km

Poor Ground Water Quality Areas	Area affected by Arsenic/Fluoride or Salinity Tripura: No

4.1.1 Assessment Sub-Unit-Wise Method adopted for Computing Rainfall Recharge During Monsoon Season (WLF/RIF).

Recharge from Rainfall has been computed separately for monsoon and non-monsoon periods for the entire state. The recharge from rainfall during monsoon season has been computed using both water level fluctuation method (WLFM) and rainfall infiltration method (RIFM). The results from the above two methods (WLFM & RIFM) have been compared using Percent Deviation (PD). After the computation of the percent deviation (PD) it is found that in out of 59 assessment units, 55 units were considered by RIF method and 4 units by WLF method.

4.2 GROUND WATER RESOURCES OF THE STATE

4.2.1 Annual Ground Water Recharge

The total annual groundwater recharge from Rainfall across Tripura amounts to 122,512.35 Ham. This recharge is derived from various sources, including 102,634.28 Ham from rainfall during the monsoon season and 19,878.07 Ham from non-monsoon rainfall. Additionally, recharge from other sources contributes 16,050.6 Ham during the monsoon and 6,728.34 Ham in non-monsoon periods. The net groundwater availability for future use is approximately 106,510.9 Ham, indicating a sustainable management status with a stage of groundwater extraction at about 9.48%, categorized as safe for all districts in the state. This data underscores the importance of effective groundwater management practices to ensure long-term sustainability in Tripura's water resources.

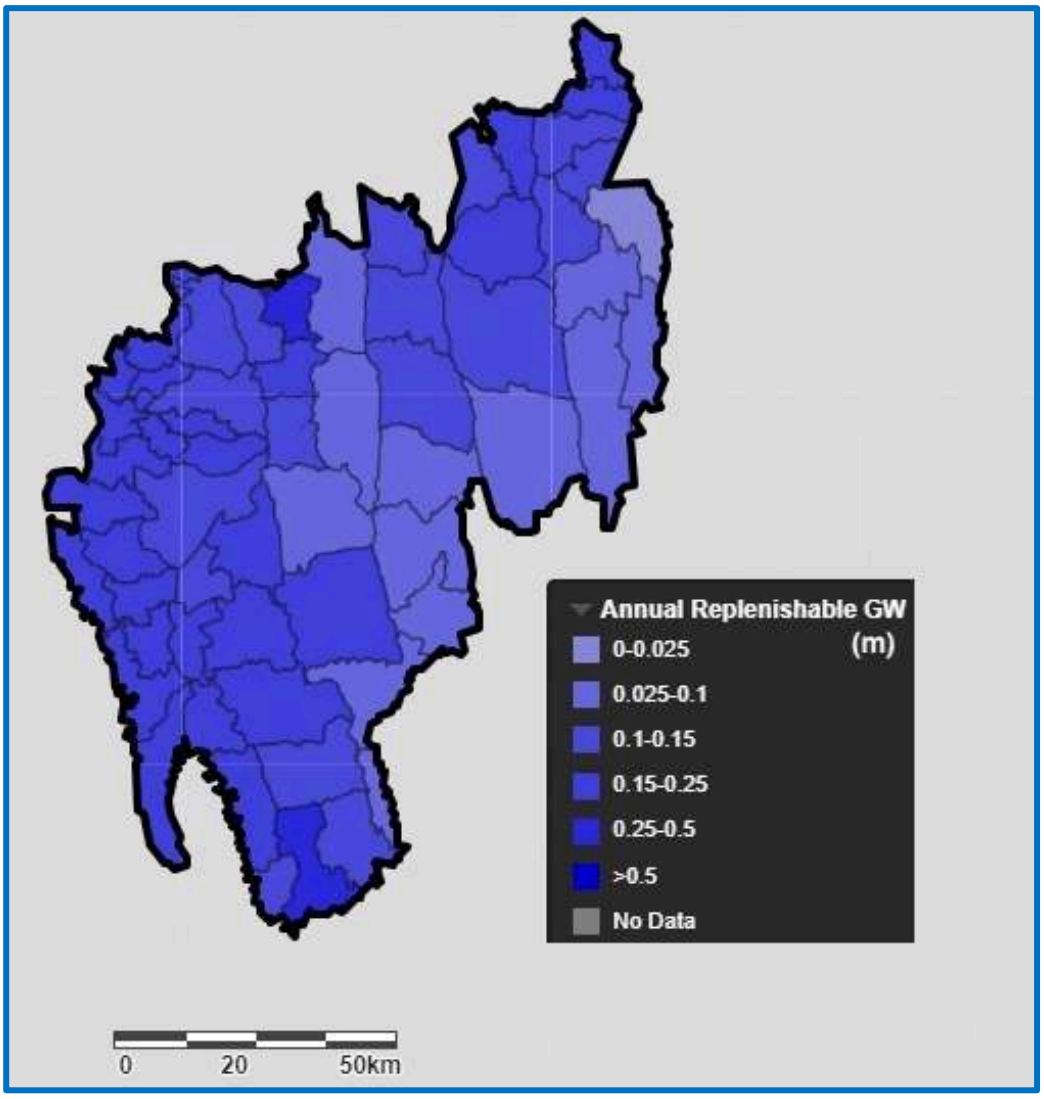

Figure 4-1: Annual Ground Water Recharge Map of Tripura

4.2.2 Annual Extractable Ground Water Resources

The annual extractable groundwater resources in Tripura are estimated to be 118,013.93 Ham. This figure represents the total volume of groundwater that can be sustainably extracted without depleting the aquifers over time. The data indicates that the groundwater extraction for irrigation, industrial, and domestic uses amounts to 2,505.35 Ham, 261.37 Ham, and 8,419.22 Ham, respectively, totaling 11,185.92 Ham in extractions across the state. With a net groundwater availability for future use of approximately 8,736.3 Ham, Tripura maintains a stage of groundwater extraction at about 9.48%, which categorizes it as a safe zone for groundwater management.

4.2.3 Allocation for Domestic use as on 2025 (in Ham)

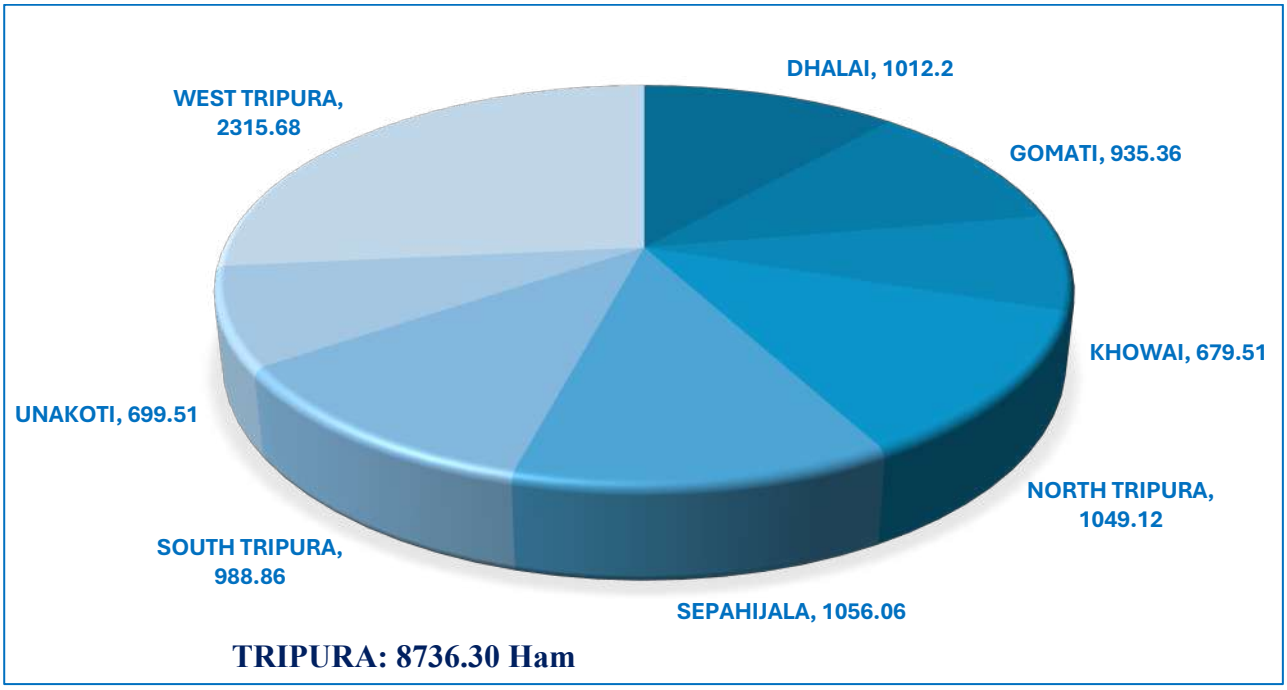

Figure 4-2: Allocation for Domestic use as on 2025 (in Ham)

4.2.4 Net Ground Water Availability for Future use (in Ham)

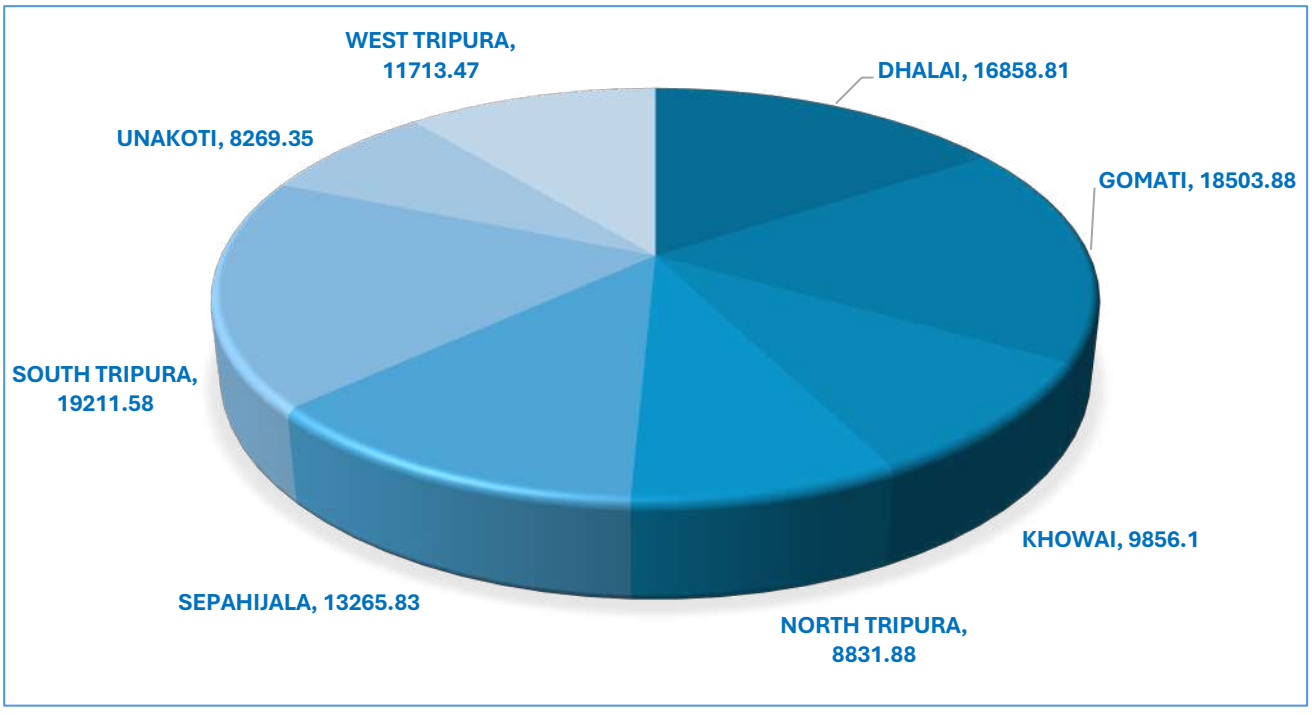

Figure 4-3: Net Ground Water Availability for Future use (in Ham)

4.2.5 Annual Total Ground Water Extraction

The annual total groundwater extraction in Tripura is assessed against the backdrop of its extractable groundwater resources. The state has an annual extractable groundwater resource of 1.18 billion cubic meters (BCM). Currently, the gross groundwater extraction is approximately 0.103 BCM, which includes 0.08 BCM for domestic use, 0.03 BCM for irrigation, and a minimal 0.0003 BCM for industrial purposes. This indicates that the overall stage of groundwater development in Tripura is relatively low, at about 9.48%, suggesting that the state is utilizing only a small fraction of its available groundwater resources for various needs.

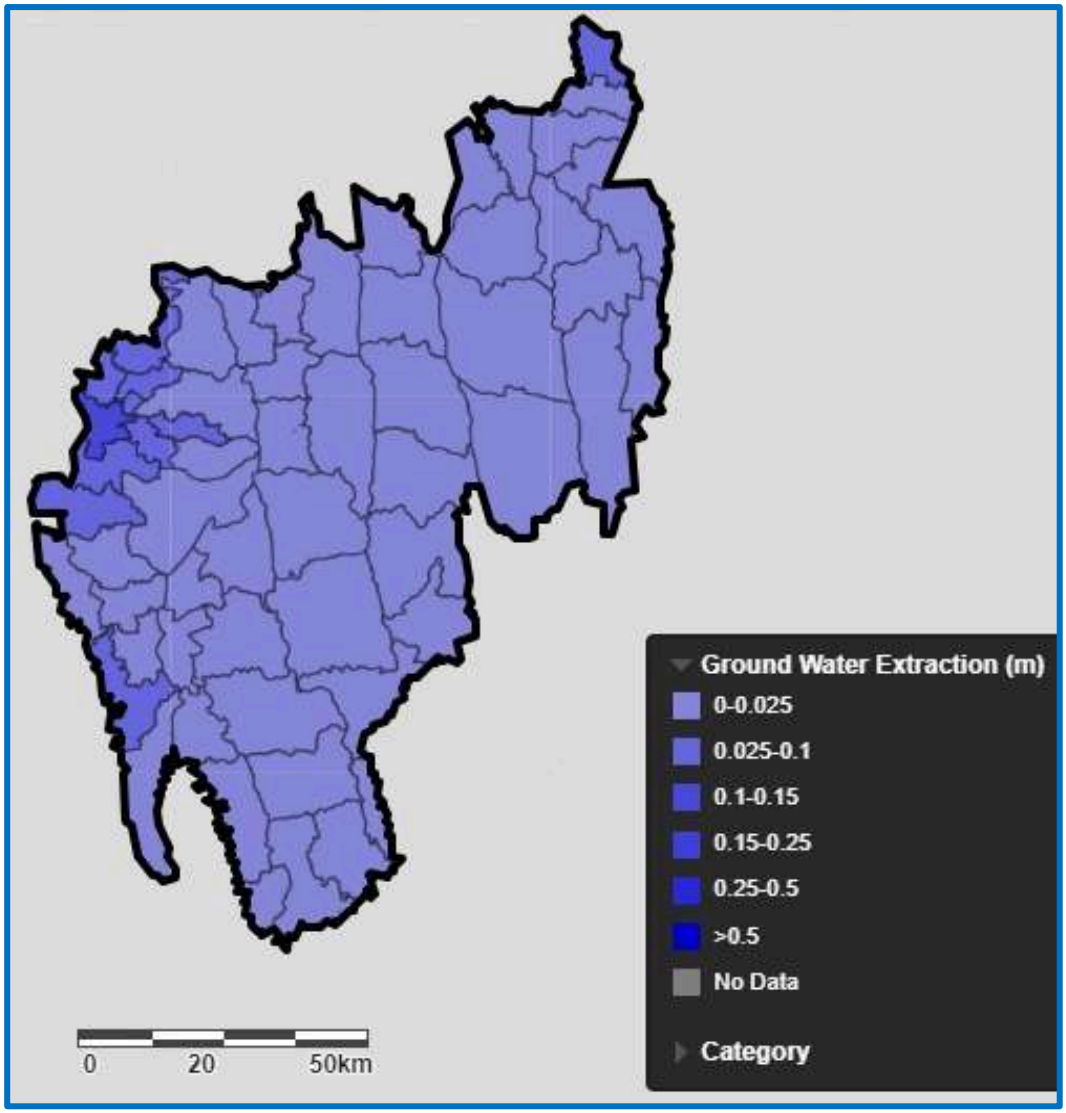

Figure 4-4: Ground Water Extraction Map of Tripura

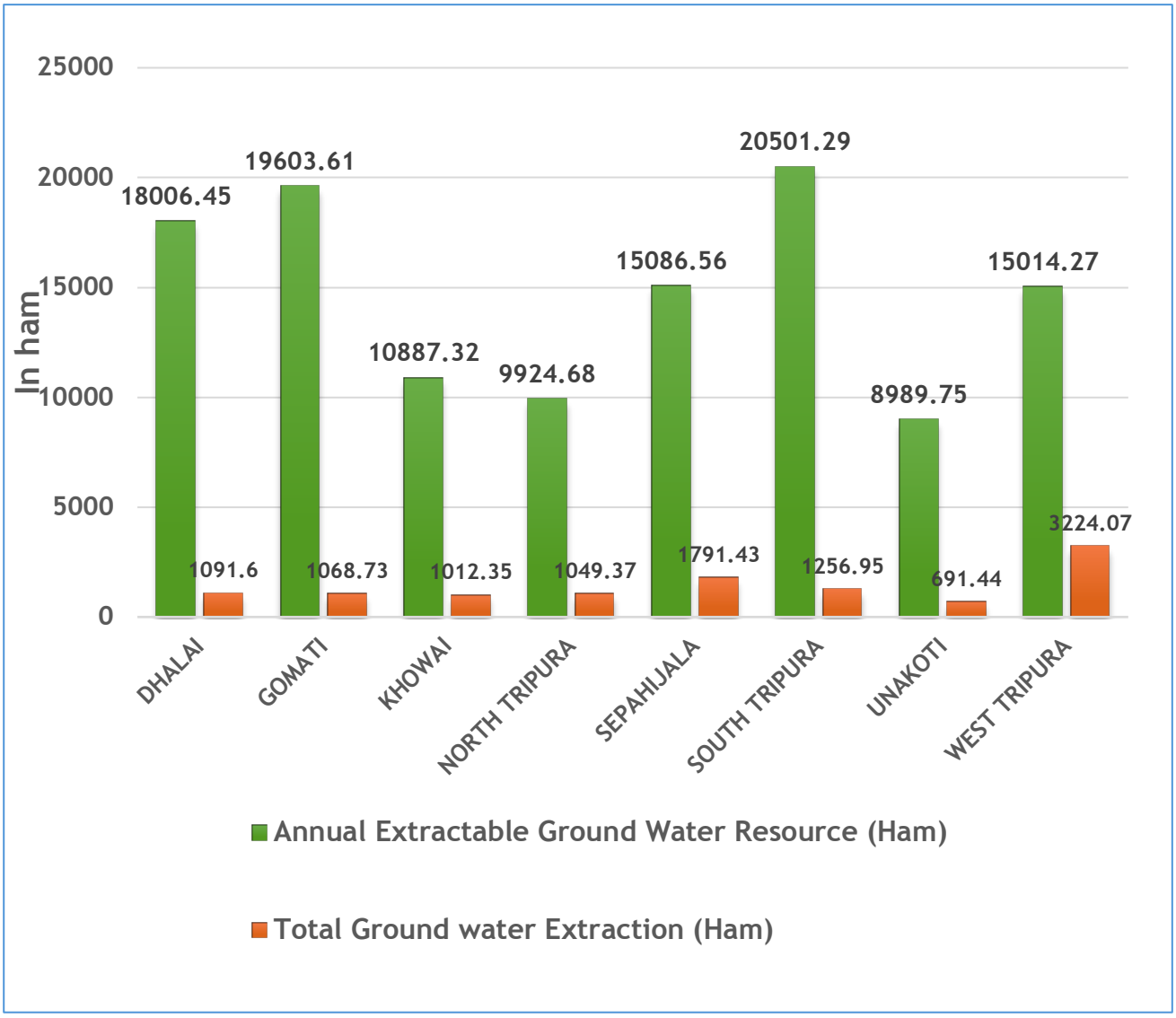

Figure 4-5: Annual Extractable GW Resource vs. Annual Extraction (both in Ham)

4.2.6 Stage of Ground Water Extraction

Total ground water recharge is estimated from monsoon rainfall and non-monsoon rainfall and all other sources, it is 1.45 BCM. Annual extractable groundwater resources are estimated after deducting natural discharge of 0.27 BCM, it is 1.18 BCM. Ground water extraction for various uses has been estimated for all the assessment units of Tripura. Gross annual ground water extraction for all uses in Tripura is 0.11 BCM and allocation for domestic up to year 2025 is 0.087 BCM. Net annual groundwater availability for future use are 1.065 BCM. The stage of development of Tripura is 9.48 % and all the 59 blocks / assessment units (including 1 non-block, Agartala) in Tripura state falls under **SAFE** category

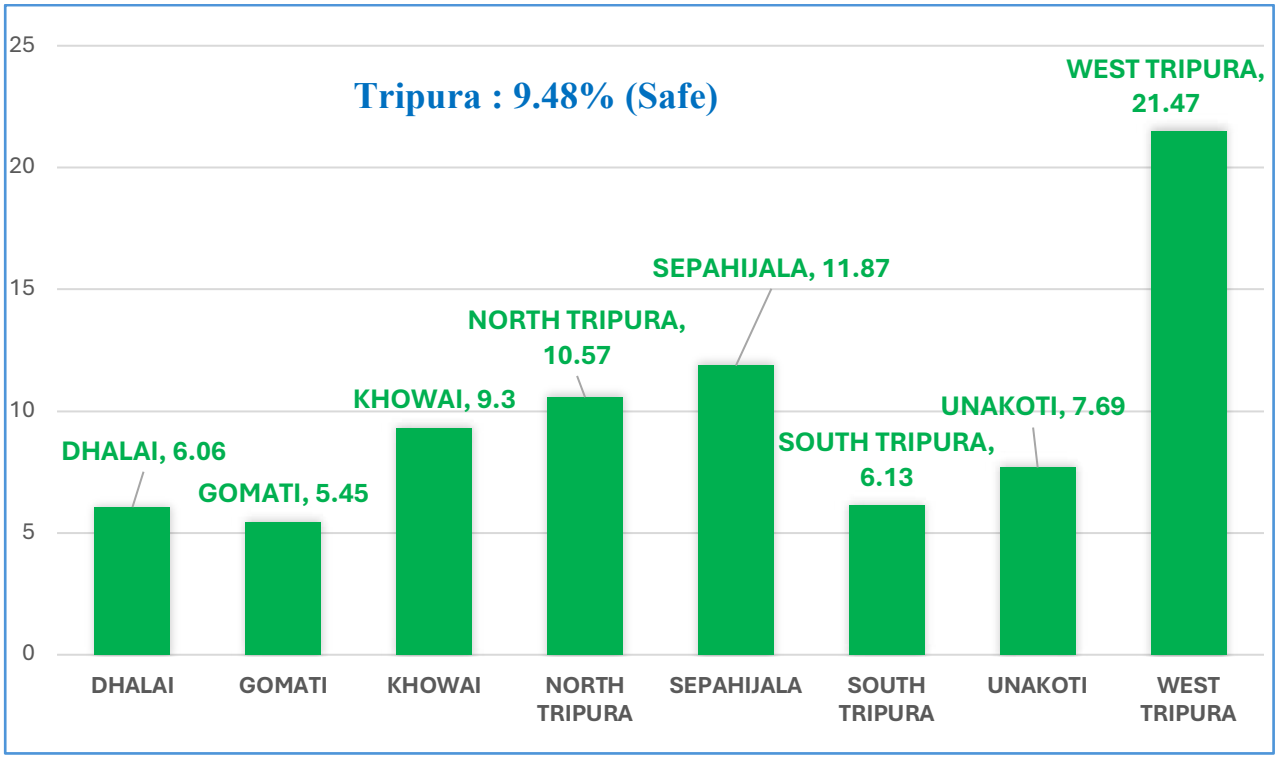

Figure 4-6: Stage of Ground Water Extraction

4.2.7 Spatial Variation of the Ground Water Recharge and Development/Extraction Scenario In Tripura

Annual Extractable ground water resources in the state are of the order of 1.18 BCM. Maximum annual extractable ground water resource of 0.2 BCM is found in South Tripura district while the minimum of 0.08 BCM is in Unakoti district.

Ground water extraction is done mainly through dug wells and shallow tubewells from unconfined aquifer in the state. The stage of ground water extraction in Tripura is 9.48%. Agartala MC is having the highest stage of ground water extraction of 57.04% while the minimum is 2.48 %, in Karbook block.

4.2.8 Categorization of Assessment Units

The stage of development of Tripura is 9.48 % and all the 59 blocks / assessment units (including 1 non-block, Agartala) in Tripura state falls under SAFE category.

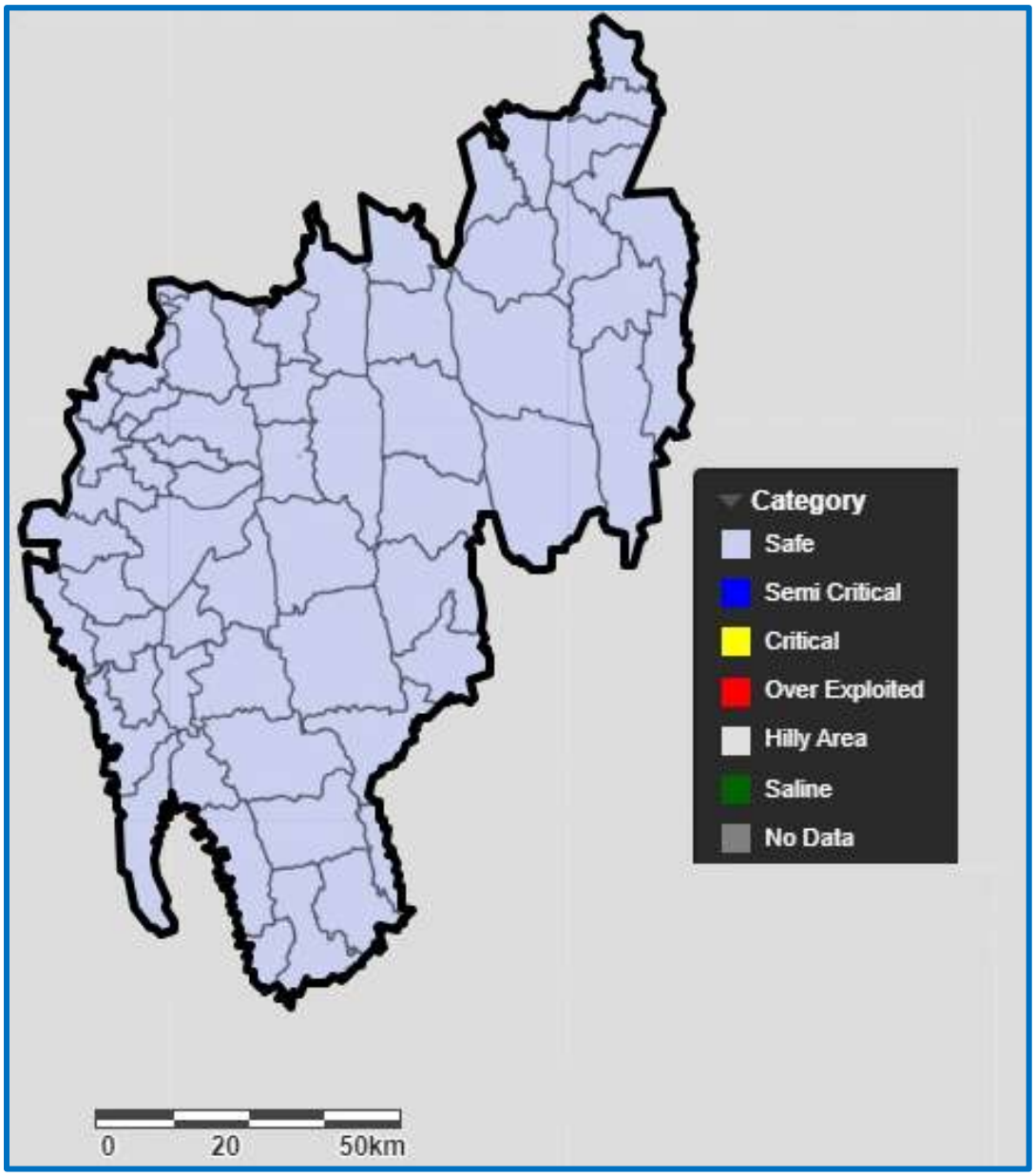

Figure 4-7: Map showing Block wise Dynamic Groundwater Resource of Tripura (as on March, 2024)

4.3 COMPARISON WITH EARLIER GROUND WATER RESOURCES ESTIMATE

A comparison is made between the previous estimate as on March 2017, 2020, 2022, 2023 and present estimate based on GEC'15 as on 2024, and presented in tabular statement given below.

Table 4-1: A: Dynamic Ground Water Resources of Tripura

	RECHARGE COMPONENTS (in BCM)	2017	2020	2022	2023	2024
1	Monsoon Rainfall Recharge	0.8	0.85	0.811	0.81	1.02
2	Monsoon Recharge from Other Sources	0.06	0.34	0.06	0.16	0.16
3	Non-Monsoon Rainfall Recharge	0.4	0.06	0.217	0.3	0.19
4	Non-Monsoon Recharge from Other Sources	0.26	0.22	0.224	0.06	0.07
5	Annual G. W. Recharge {(1+2+3+4))}	1.52	1.47	1.182	1.36	1.44
6	Total Natural discharge	0.29	0.14	0.119	0.13	0.14
7	Resultant Flows (Evaporation-transpiration Loss)	0.18	0.09	0.087	0.13	0.12
8	Annual extractable Ground Water Resource [(5- (6+7)]	1.24	1.24	1.063	1.09	1.18

Table 4-2: B: Dynamic Ground Water Resources of Tripura

	EXTRACTION COMPONENT IN BCM	2017	2020	2022	2023	2024
1	Annual extractable Ground Water Resource (BCM)	1.239	1.244	1.06	1.09	1.18
2	Current annual gross G.W. Extraction for domestic use (in BCM)	0.078	0.078	0.0813	0.08	0.08
3	Current annual gross G.W. Extraction for irrigation (in BCM)	0.02	0.0197	0.0211	0.025	0.03
4	Current annual gross G.W. Extraction for industrial use (in BCM)	0	0.0001	0.00006	0.0003	0.0003
5	Current annual gross G.W. Extraction for All uses (in BCM) (2+3+4)	0.098	0.098	0.103	0.11	0.11
6	Stage of GW Extraction (in %) [(5/1)*100]	7.80%	8%	9.70%	9.92%	9.48%
7	Annual G.W. Allocation for Domestic water supply as on 2025 (in BCM)	1.067	0.086	0.086	0.087	0.087
8	Net Annual G.W. availability for future use (in BCM) (1-(3+4+7))	1.112	1.138	0.955	0.981	1.065

4.4 GRAPHICAL REPRESENTATION OF THE COMPARISON AGARTALA MUNICIPAL CORPORTATION, WEST TRIPURA AND TRIPURA STATE

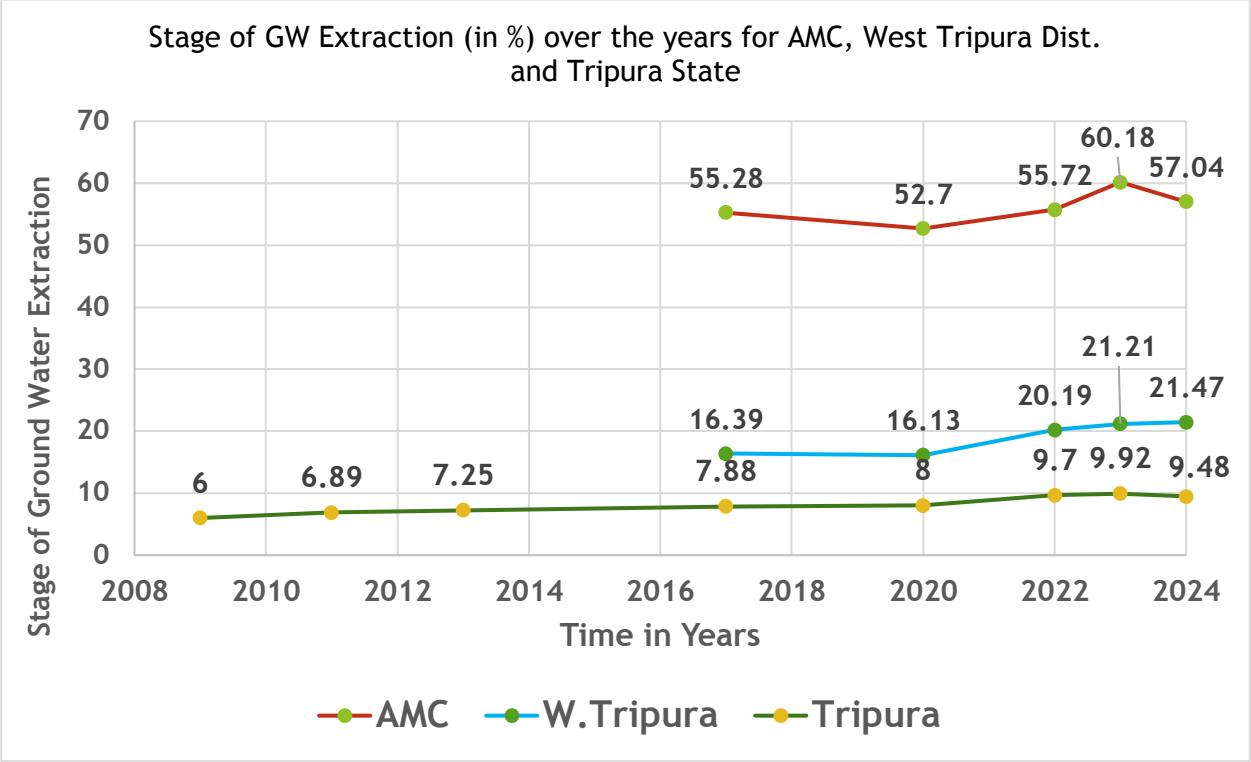

Figure 4-8: Stage of GW Extraction (in %) over the years for AMC, West Tripura Dist. and Tripura State

4.5 GROUND WATER RECHARGE IN POOR GROUND WATER QUALITY ZONE.

As there is no poor quality zone in Tripura so annual ground water recharge for the poor ground water quality area is not assessed.

4.6 ADDITIONAL ANNUAL POTENTIAL RECHARGE.

Additional potential recharge is computed for shallow water table areas. Area under shallow water table is calculated from water level maps prepared by CGWB. Additional annual potential recharge in the state is 0.23 BCM.

4.7 CONCEPT OF WATER GRID FOR TRIPURA.

Tripura is blessed with numerous valleys endowed with Artesian wells and free flowing water, whereas, the hilly tracts of Tripura (the hill ranges) are devoid of water. The hill ranges act as recharging zone there by recharging the aquifers in the valley portion. The majority of water flows through the International boundary to the neighboring country of Bangladesh. The Artesian wells in the valley regions continuously provide water, which are utilized for Paddy cultivation.

To minimize the disparity of water availability in the hilly region the concept of Water Grid is being introduced in this report.

The surplus available water in the valley region can be tapped through a battery of Pumping wells (through Solar Pumps to minimize the operational cost) from the free flowing, Artesian region and through multi stage Pumping (again, through Solar Pumps to minimize the operational cost) can be made available to the Highest point in the Hill regions. From there, through gravity, the water can be distributed to the area of scarcity. A pictorial depiction is at figure 4.9.

The valleys may also be interconnected through pipelines to form a Grid and water can be channelized where ever required.

For a Pilot study and see its practicability, the surplus water in the Khowai valley may be tapped to supply water in the hilly region of Mungiakami and Tulasikhar block of Tripura. On successful implementation, the same can be replicated in the other hills and valleys.

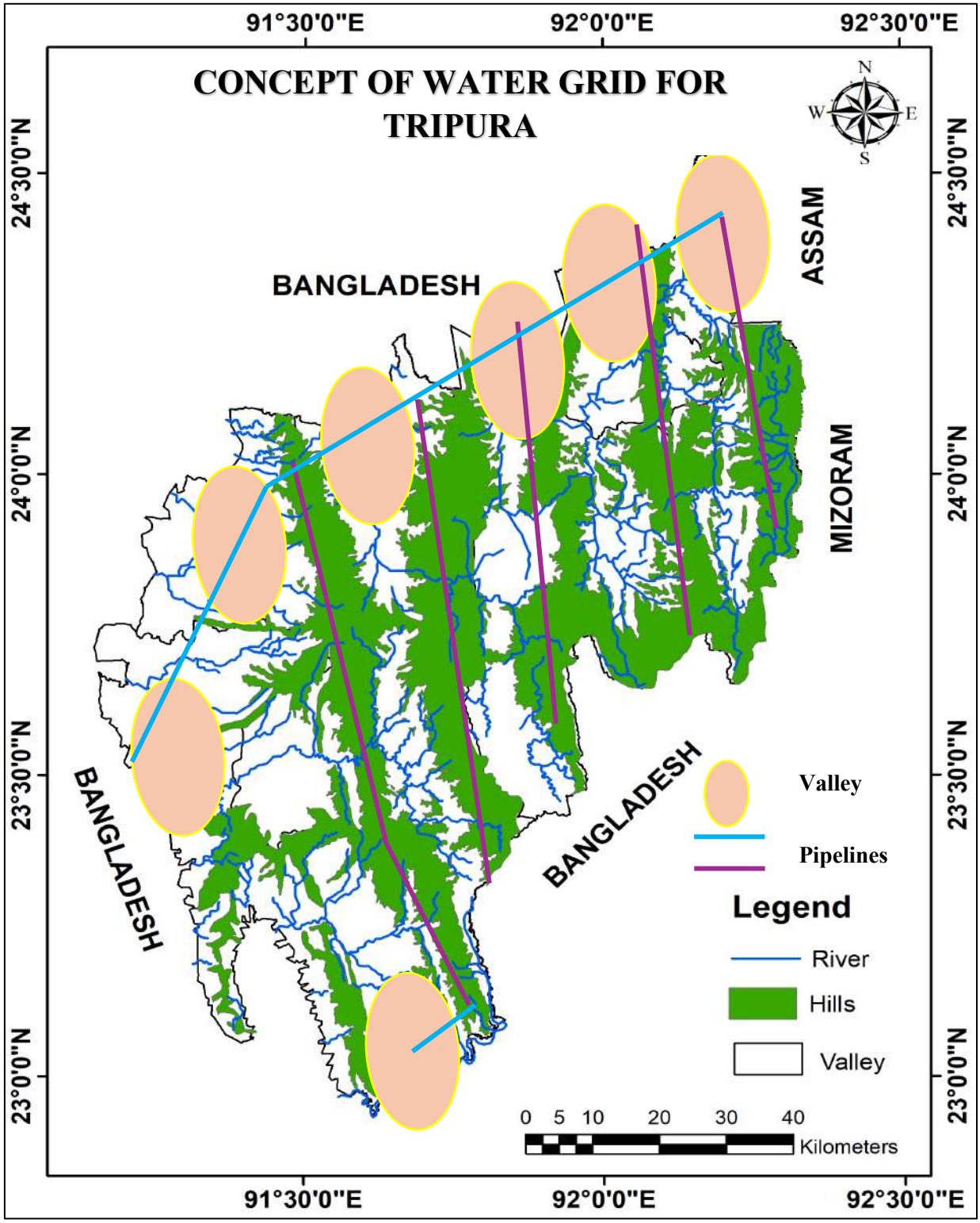

Figure 4-9:The concept of Water Grid for Tripura

5 ANNEXURES

5.1 ANNEXURE-I: GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF EXTRACTION (AS IN 2024)

DYNAMIC GROUND WATER RESOURCES OF TRIPURA, 2024															
TRIPURA (in bcm)															
S.No	NAME OF STATE/UT	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	TRIPURA	1.026	0.161	0.199	0.067	1.453	0.141	1.18	0.03	0.003	0.08	0.11	0.09	1.07	9.48
	Total (BCM)	**1.026**	**0.161**	**0.199**	**0.067**	**1.453**	**0.141**	**1.18**	**0.03**	**0.003**	**0.08**	**0.11**	**0.09**	**1.07**	**9.48**

5.2 ANNEXURE-II: DISTRICT WISE GROUND WATER RESOURCES AVAILABILITY, UTILIZATION AND STAGE OF EXTRACTION (AS IN 2024)

Sl No.	Districts	Total Area of Assessment Unit (Ha)	Recharge Worthy Area(Ha)	Ground Water Recharge (ham)			Total Natural Discharge (ham)	Annual Extractable Ground water Resource (ham)	Ground Water Extraction for all uses (ham)				Net Annual Ground Water Availability for Future Use (ham)	Stage of Ground Water Extraction (%)
				Rainfall Recharge	Recharge from other sources	Total			Domestic	Industrial	Irrigation	Total		
1	**Dhalai**	231489	99581	21205.3	1506.67	22711.97	2271.17	18006.45	956.15	0.15	135.3	1091.6	16858.81	6.06
2	**Gomati**	161705	109828	19946.23	3925.49	23871.72	2387.17	19603.61	904.37	0.17	164.19	1068.73	18503.88	5.45
3	**Khowai**	101245	49560	9851.14	2386.57	12237.71	1059.55	10887.32	660.64	24	327.71	1012.35	9856.1	9.3
4	**North Tripura**	135792	54382	12433.78	1287.98	13721.76	1372.17	9924.68	1005.7	11.27	32.4	1049.37	8831.88	10.57
5	**Sepahijala**	104392	87170	14748.93	4142.5	18891.43	1889.14	15086.56	1026.74	3.49	761.2	1791.43	13265.83	11.87
6	**South Tripura**	151201	98103	21448.82	4283.84	25732.66	2573.27	20501.29	956.11	5.54	295.3	1256.95	19211.58	6.13
7	**Unakoti**	65703	42878	8895.96	1552.22	10448.18	929.91	8989.75	670.56	4.83	16.05	691.44	8269.35	7.69
8	**West Tripura**	97642	78282	13982.19	3693.67	17675.86	1666.9	15014.27	2238.95	211.93	773.19	3224.07	11713.47	21.47
	Total (ham)	**1049169**	**619784**	**122512.4**	**22778.94**	**145291.3**	**14149.28**	**118013.9**	**8419.22**	**261.38**	**2505.34**	**11185.94**	**106510.9**	**9.48**
	BCM	**1.04**	**0.62**	**1.23**	**0.23**	**1.45**	**0.14**	**1.18**	**0.08**	**0**	**0.03**	**0.11**	**1.07**	

5.3 ANNEXURE III: ANNUAL EXTRACTABLE GROUND WATER RESOURCE OF ASSESSMENT UNITS UNDER DIFFERENT CATEGORY FOR THE STATE/UT

District	Assessment Unit Name	Recharge from Rainfall-Monsoon Season	Recharge from Other Sources-Monsoon Season	Recharge from Rainfall-Non Monsoon Season	Recharge from Other Sources - Non Monsoon Season	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use (Ham)	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (Over-Exploited/Critical/Semi-Critical/Safe/Saline)
Dhalai	Ambasa	2248.43	129.09	621.29	65.76	2923.03	306.45	2616.58	18.6	0.15	97.75	116.5	103.48	2494.35	4.45%	Safe
Dhalai	Chawmanu	3121.76	55.95	518	81.4	3306.93	377.71	2929.22	1.5	0	84.96	86.45	89.94	2837.79	2.95%	Safe
Dhalai	Dumburnagar	1879.21	73.83	313.49	64.89	2025.64	233.14	1792.5	3.15	0	93.63	96.78	99.12	1690.23	5.40%	Safe
Dhalai	Durga Chowmohani	1249.17	209.54	276.14	150.29	1505.4	188.51	1316.89	51.81	0	126.12	177.93	133.52	1131.56	13.51%	Safe
Dhalai	Ganganagar	692.93	0	115.59	28.36	726.85	83.68	643.17	0	0	81.97	81.97	86.78	556.39	12.74%	Safe
Dhalai	Manu	5079.35	277.88	842.82	57.95	5373.17	625.8	4747.37	23.06	0	212.59	235.65	225.05	4499.26	4.96%	Safe
Dhalai	Raishyabari	1207.51	6.72	201.44	27.46	1414.02	144.31	1269.71	2.73	0	56.39	59.12	59.7	1207.28	4.66%	Safe
Dhalai	Salema	2223.71	188.02	614.46	89.53	3002.58	311.57	2691.01	34.45	0	202.73	237.18	214.61	2441.95	8.81%	Safe
Dhalai	**Dist. Total**	**17702.07**	**941.03**	**3503.23**	**565.64**	**20277.62**	**2271.17**	**18006.45**	**135.3**	**0.15**	**956.15**	**1091.58**	**1012.2**	**16858.81**	**6.06%**	**Safe**
Gomati	Amarpur	4020.04	859.11	731.26	88.42	5141.3	569.88	4571.42	26.73	0	132.67	159.4	137.21	4407.48	3.49%	Safe
Gomati	Kakraban	1316.95	675.03	199.68	79.36	2253.03	227.1	2025.93	21.78	0	176.57	198.36	182.63	1821.51	9.79%	Safe
Gomati	Karbook	2271.1	332.46	412.41	37	3012.63	305.3	2707.33	4.05	0	63.21	67.26	65.38	2637.9	2.48%	Safe
Gomati	Killa	2314.94	306.36	447.72	117.98	2764.38	318.7	2445.68	70.32	0	95.94	166.27	99.23	2276.12	6.80%	Safe
Gomati	Matabari	3170.85	662.18	490.6	99.86	3717.39	442.35	3275.04	10.8	0.06	239.38	250.24	247.58	3016.6	7.64%	Safe
Gomati	Ompi	2320.7	307.98	422.14	64.56	3081.42	311.54	2769.88	8.1	0	90.6	98.7	93.71	2668.07	3.56%	Safe
Gomati	Silachhari	660.59	22.21	119.96	41.3	827.4	84.41	742.99	1.62	0	43.14	44.76	44.62	696.75	6.02%	Safe
Gomati	Tepania	877.57	156.62	169.72	75.06	1193.24	127.9	1065.34	20.79	0.11	62.85	83.74	65	979.45	7.86%	Safe
Gomati	**Dist. Total**	**16952.74**	**3321.95**	**2993.49**	**603.54**	**21990.79**	**2387.18**	**19603.61**	**164.19**	**0.17**	**904.37**	**1068.73**	**935.36**	**18503.88**	**5.45%**	**Safe**
Khowai	Kalyanpur	1215.85	461.14	268.09	183.63	2128.71	212.87	1915.84	121.8	0	106.85	228.65	109.9	1684.14	11.93%	Safe
Khowai	Khowai	1827.2	638.14	391.74	164.62	2810.23	302.17	2508.06	57.6	0	149.1	206.7	153.35	2297.11	8.24%	Safe
Khowai	Mungiakami	1499.72	94.51	413.35	49.26	2052.84	205.68	1847.16	14.06	0	66.91	80.97	68.81	1764.29	4.38%	Safe
Khowai	Padmabil	1043.37	87.14	256.15	40.28	1417.2	71.35	1345.85	10.2	0	81.51	91.71	83.84	1251.81	6.81%	Safe
Khowai	Teliamura	1030.78	408.66	227.28	79.54	1709.85	174.62	1535.23	112.65	24	156.6	293.25	161.07	1237.51	19.10%	Safe
Khowai	Tulasikhar	1345.66	100.6	331.95	79.05	1828.04	92.86	1735.18	11.4	0	99.69	111.09	102.54	1621.24	6.40%	Safe
Khowai	**Dist. Total**	**7962.58**	**1790.19**	**1888.56**	**596.38**	**11946.87**	**1059.55**	**10887.32**	**327.71**	**24**	**660.64**	**1012.37**	**679.51**	**9856.1**	**9.30%**	**Safe**

North Tripura	Damchhera	223.44	23.08	58.67	77.78	358.15	38.29	319.86	3	0.07	66.08	69.15	68.94	247.85	21.62%	Safe
North Tripura	Dasda	2059.87	47.95	432.74	140.31	1880.23	268.08	1612.15	1.8	0	132.21	134.01	137.92	1472.43	8.31%	Safe
North Tripura	Jampui Hill	882.46	0	185.39	0	1001.48	106.79	894.69	0	0	28.81	28.82	30.06	864.62	3.22%	Safe
North Tripura	Jubarajnagar	1422.95	169.01	403.59	105.44	1812.17	210.1	1602.07	0	7.64	162.73	170.37	169.76	1424.67	10.63%	Safe
North Tripura	Kadamtala	1930.52	95.79	438.04	73.67	1983.25	253.8	1729.45	21.6	3.45	223.03	248.08	232.66	1471.74	14.34%	Safe
North Tripura	Kalacherra	1553.69	21.71	352.53	22.45	1538.52	195.04	1343.48	2.4	0.1	172.52	175.03	179.97	1161	13.03%	Safe
North Tripura	Laljuri	1132.09	9.8	297.28	165.13	1409.59	160.43	1249.16	0	0	112.56	112.56	117.42	1131.74	9.01%	Safe
North Tripura	Panisagar	826.19	215.94	234.33	119.92	1313.46	139.64	1173.82	3.6	0	107.74	111.34	112.39	1057.83	9.49%	Safe
North Tripura	**Dist. Total**	**10031.21**	**583.28**	**2402.57**	**704.7**	**11296.85**	**1372.17**	**9924.68**	**32.4**	**11.27**	**1005.7**	**1049.36**	**1049.12**	**8831.88**	**10.57%**	**Safe**
Sepahijala	Bishalgarh	1783.53	781.25	449.8	363.72	3085	337.83	2747.17	241.2	0.16	182.59	423.95	187.8	2318.01	15.43%	Safe
Sepahijala	Boxanagar	1554.13	175.11	301.79	71.98	1707.65	210.3	1497.35	77.94	0.24	118.61	196.79	122	1297.17	13.14%	Safe
Sepahijala	Charilam	1493.01	263.27	343.38	162.99	1984	226.27	1757.73	66.6	2.63	198.77	267.99	204.45	1484.06	15.25%	Safe
Sepahijala	Jampuijala	3328.41	346.99	765.5	31.36	3849.26	447.23	3402.03	47.14	0.29	104.79	152.21	107.78	3246.83	4.47%	Safe
Sepahijala	Kanthalia	1663.53	436.31	323.03	257.88	2583.15	268.07	2315.08	311.86	0	143.34	455.2	147.43	1855.79	19.66%	Safe
Sepahijala	Mohanbhog	1076.27	533.33	167.2	86.84	1852.54	186.36	1666.18	1.2	0	109.35	110.55	112.47	1552.51	6.63%	Safe
Sepahijala	Nalchar	1297.75	496.54	201.6	134.93	1914.1	213.08	1701.02	15.26	0.18	169.29	184.72	174.13	1511.46	10.86%	Safe
Sepahijala	**Dist. Total**	**12196.63**	**3032.8**	**2552.3**	**1109.7**	**16975.7**	**1889.14**	**15086.56**	**761.2**	**3.49**	**1026.74**	**1791.41**	**1056.06**	**13265.83**	**11.87%**	**Safe**
South Tripura	Bagafa	3726.12	471.29	543.03	283.12	4177.08	502.36	3674.72	34.8	0	173.65	208.45	179.6	3460.32	5.67%	Safe
South Tripura	Bharat Ch Nagar	1671.36	303.82	243.58	171.76	1886.71	239.05	1647.66	24.62	1.54	77.26	103.43	79.91	1541.58	6.28%	Safe
South Tripura	Hrishyamukh	2279.13	435.7	313.73	280.03	2780.52	330.86	2449.66	56.74	1.46	123.67	181.87	127.91	2263.55	7.42%	Safe
South Tripura	Jolaibari	2481.47	670.68	361.64	186.99	3505.1	370.08	3135.02	29.38	0	120.56	149.93	124.69	2980.96	4.78%	Safe
South Tripura	Poangbari	812.36	0.27	127.98	42.86	878.68	98.34	780.34	3	0	62.49	65.49	64.63	712.71	8.39%	Safe
South Tripura	Rajnagar	2456.68	100.48	422.71	206.95	3006.55	318.69	2687.86	124.98	1.5	143.67	270.15	148.59	2412.79	10.05%	Safe
South Tripura	Rupaichari	1990.43	217.18	250.85	80.88	2415.27	253.93	2161.34	9.55	0	112.44	121.99	116.29	2035.5	5.64%	Safe
South Tripura	Satchand	3254.97	748.68	512.78	83.15	4424.65	459.96	3964.69	12.23	1.04	142.37	155.65	147.24	3804.17	3.93%	Safe
South Tripura	**Dist. Total**	**18672.52**	**2948.1**	**2776.3**	**1335.74**	**23074.56**	**2573.27**	**20501.29**	**295.3**	**5.54**	**956.11**	**1256.96**	**988.86**	**19211.58**	**6.13%**	**Safe**
Unakoti	Chandipur	1711.59	270.47	282.16	33.85	2065.74	114.9	1950.84	0.9	0	155.56	156.46	162.28	1787.66	8.02%	Safe

Unakoti	Gournagar	1698.9	184	300.62	161.35	2204.48	234.49	1969.99	15.15	0.32	161.91	177.38	168.9	1785.62	9.00%	Safe
Unakoti	Kumarghat	2717.31	524.88	601.02	84.9	3787.66	392.81	3394.85	0	4.51	247.62	252.13	258.31	3132.03	7.43%	Safe
Unakoti	Pencharthal	1297.4	140.14	286.96	152.63	1861.78	187.71	1674.07	0	0	105.46	105.47	110.02	1564.04	6.30%	Safe
Unakoti	**Dist. Total**	**7425.2**	**1119.49**	**1470.76**	**432.73**	**9919.66**	**929.91**	**8989.75**	**16.05**	**4.83**	**670.56**	**691.44**	**699.51**	**8269.35**	**7.69%**	**Safe**
West Tripura	AMC	1499.71	22.96	235.46	255.62	2013.75	100.68	1913.07	35.64	1.1	1054.47	1091.21	1090.6	785.73	57.04%	Safe
West Tripura	Bamutia	733.13	109.83	168.39	46.43	955.08	105.78	849.3	52.8	0	110.33	163.13	114.11	682.39	19.21%	Safe
West Tripura	Belbari	1110.88	355.51	185.33	30.07	1505.96	168.18	1337.78	13.8	7.87	180.21	201.89	186.38	1129.72	15.09%	Safe
West Tripura	Dukli	1999.58	434.03	306.19	136.01	2807.22	287.58	2519.64	255.73	2.3	221.58	479.61	229.18	2032.43	19.03%	Safe
West Tripura	Hezamara	1456.07	184.78	334.45	46.62	1986.72	202.2	1784.52	17.79	0	83.55	101.34	86.41	1680.32	5.68%	Safe
West Tripura	Jirania	601.43	244.23	125.42	266.26	1147.85	123.74	1024.11	103.2	137.9	87.65	328.75	90.65	692.36	32.10%	Safe
West Tripura	Lefunga	472.49	86.66	108.53	122.18	771.33	78.98	692.35	15.9	2.24	110.33	128.47	114.11	560.1	18.56%	Safe
West Tripura	Mandwi	1520.35	322.55	317.06	90.3	2085.24	225.03	1860.21	0	0	104.75	104.75	108.35	1751.86	5.63%	Safe
West Tripura	Mohanpur	1458.75	335.57	335.07	234.77	2191.29	236.41	1954.88	190.13	5.6	163.09	358.81	168.68	1590.48	18.35%	Safe
West Tripura	Old Agartala	838.94	217.64	174.96	151.65	1216.73	138.32	1078.41	88.2	54.93	122.99	266.11	127.21	808.08	24.68%	Safe
West Tripura	**Dist. Total**	**11691.33**	**2313.76**	**2290.86**	**1379.91**	**16681.17**	**1666.9**	**15014.27**	**773.19**	**211.93**	**2238.95**	**3224.07**	**2315.68**	**11713.47**	**21.47%**	**Safe**
Tripura	**Grand Total**	**102634.28**	**16050.6**	**19878.07**	**6728.34**	**132163.22**	**14149.29**	**118013.93**	**2505.35**	**261.37**	**8419.22**	**11185.92**	**8736.3**	**106510.9**	**9.48%**	**Safe**

5.4 ANNEXURE-III(A) CATEGORIZATION OF BLOCKS/ MANDALS/ TALUKS IN INDIA (AS IN 2024) FOR THE STATE/UT

CATEGORIZATION OF BLOCKS/ MANDALS/ TALUKAS IN Tripura (2023-2024)												
S.No	District	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
			Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	DHALAI	8	8	100	-	-	-	-	-	-	-	-
2	GOMATI	8	8	100	-	-	-	-	-	-	-	-
3	KHOWAI	6	6	100	-	-	-	-	-	-	-	-
4	NORTH TRIPURA	8	8	100	-	-	-	-	-	-	-	-
5	SEPAHIJALA	7	7	100	-	-	-	-	-	-	-	-
6	SOUTH TRIPURA	8	8	100	-	-	-	-	-	-	-	-
7	UNAKOTI	4	4	100	-	-	-	-	-	-	-	-
8	WEST TRIPURA	10	10	100	-	-	-	-	-	-	-	-
	Total States	59	59	100	-	-	-	-	-	-	-	-
	Grand Total	59	59	100	-	-	-	-	-	-	-	-

5.5 ANNEXURE III (B): DISTRICT WISE CATEGORIZATION OF BLOCKS/ MANDALS/ TALUKS FOR THE STATE/UT (AS IN 2024)

CATEGORIZATION OF DISTRICS IN TRIPURA (2023-2024)																				
S.No	States / Union Territories	Total 2023-2024	Total 2023 - 2024	Diff	Safe			Semi-Critical			Critical			Over-Exploited			Saline		
					2022 - 2023	2023 - 2024	Diff	2022 - 2023	2023 - 2024	Diff	2022 - 2023	2023 - 2024	Diff	2022 - 2023	2023 - 2024	Diff	2022 - 2023	2023 - 2024	Diff
1	DHALAI	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
2	GOMATI	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
3	KHOWAI	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
4	NORTH TRIPURA	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
5	SEPAHIJALA	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
6	SOUTH TRIPURA	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
7	UNAKOTI	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
8	WEST TRIPURA	1	1	0	1	1	0	-	-	-	-	-	-	-	-	-	-	-	-
	TRIPURA	8	8	0	8	8	0	-	-	-	-	-	-	-	-	-	-	-	-

5.6 ANNEXURE- III (E): RECHARGE WORTHY AREA OF ASSESSMENT UNIT UNDER DIFFERENT CATEGORY FOR THE STATE (AS IN 2024)

Sl. No	District	Assessment Unit Name	Total Area of Assessment Unit (Ha)	Safe		Semi-Critical		Critical		Over-Exploited		Saline	
				Recharge Worthy Area of Assessed Units (ha)	%	Recharge Worthy Area of Assessed Units (in ha)	%	Recharge Worthy Area of Assessed Units (in ha)	%	Recharge Worthy Area of Assessed Units (in ha)	%	Recharge Worthy Area of Assessed Units (in ha)	%
1	Dhalai	Ambasa	30556	13279	100	-	-	-	-	-	-	-	-
2	Dhalai	Chawmanu	45829	16183	100	-	-	-	-	-	-	-	-
3	Dhalai	Dumburnagar	28157	12307	100	-	-	-	-	-	-	-	-
4	Dhalai	Durga Chowmohani	14587	5902	100	-	-	-	-	-	-	-	-
5	Dhalai	Ganganagar	25624	4538	100	-	-	-	-	-	-	-	-
6	Dhalai	Manu	46331	26331	100	-	-	-	-	-	-	-	-
7	Dhalai	Raishyabari	16958	7908	100	-	-	-	-	-	-	-	-
8	Dhalai	Salema	23447	13133	100	-	-	-	-	-	-	-	-
	Dhalai	**Dist. Total**	**231489**	**99581**	100	-	-	-	-	-	-	-	-
9	Gomati	Amarpur	41046	26791	100	-	-	-	-	-	-	-	-
10	Gomati	Kakraban	10378	7378	100	-	-	-	-	-	-	-	-
11	Gomati	Karbook	21468	15385	100	-	-	-	-	-	-	-	-
12	Gomati	Killa	19372	16297	100	-	-	-	-	-	-	-	-
13	Gomati	Matabari	22880	17858	100	-	-	-	-	-	-	-	-
14	Gomati	Ompi	30511	15466	100	-	-	-	-	-	-	-	-
15	Gomati	Silachhari	7394	4475	100	-	-	-	-	-	-	-	-
16	Gomati	Tepania	8656	6178	100	-	-	-	-	-	-	-	-
	Gomati	**Dist. Total**	**161705**	**109828**	100	-	-	-	-	-	-	-	-
17	Khowai	Kalyanpur	10153	7253	100	-	-	-	-	-	-	-	-
18	Khowai	Khowai	10173	9985	100	-	-	-	-	-	-	-	-
19	Khowai	Mungiakami	29292	11183	100	-	-	-	-	-	-	-	-
20	Khowai	Padmabil	11904	6529	100	-	-	-	-	-	-	-	-
21	Khowai	Teliamura	13262	6149	100	-	-	-	-	-	-	-	-
22	Khowai	Tulasikhar	26461	8461	100	-	-	-	-	-	-	-	-

	Khowai	**Dist. Total**	**101245**	**49560**	100	-	-	-	-	-	-	-	-
23	North Tripura	Damchhera	18510	1410	100	-	-	-	-	-	-	-	-
24	North Tripura	Dasda	37545	10399	100	-	-	-	-	-	-	-	-
25	North Tripura	Jampui Hill	18889	4455	100	-	-	-	-	-	-	-	-
26	North Tripura	Jubarajnagar	14386	8751	100	-	-	-	-	-	-	-	-
27	North Tripura	Kadamtala	9578	9498	100	-	-	-	-	-	-	-	-
28	North Tripura	Kalacherra	7768	7644	100	-	-	-	-	-	-	-	-
29	North Tripura	Laljuri	19950	7144	100	-	-	-	-	-	-	-	-
30	North Tripura	Panisagar	9166	5081	100	-	-	-	-	-	-	-	-
	North Tripura	**Dist. Total**	**135792**	**54382**	100	-	-	-	-	-	-	-	-
31	Sepahijala	Bishalgarh	14998	13732	100	-	-	-	-	-	-	-	-
32	Sepahijala	Boxanagar	11806	11052	100	-	-	-	-	-	-	-	-
33	Sepahijala	Charilam	12675	11473	100	-	-	-	-	-	-	-	-
34	Sepahijala	Jampuijala	30652	25577	100	-	-	-	-	-	-	-	-
35	Sepahijala	Kanthalia	15580	11830	100	-	-	-	-	-	-	-	-
36	Sepahijala	Mohanbhog	8716	6123	100	-	-	-	-	-	-	-	-
37	Sepahijala	Nalchar	9965	7383	100	-	-	-	-	-	-	-	-
	Sepahijala	**Dist. Total**	**104392**	**87170**	100	-	-	-	-	-	-	-	-
38	South Tripura	Bagafa	30219	19010	100	-	-	-	-	-	-	-	-
39	South Tripura	Bharat Ch Nagar	12209	8527	100	-	-	-	-	-	-	-	-
40	South Tripura	Hrishyamukh	18260	12010	100	-	-	-	-	-	-	-	-
41	South Tripura	Jolaibari	23601	12660	100	-	-	-	-	-	-	-	-
42	South Tripura	Poangbari	7415	4265	100	-	-	-	-	-	-	-	-
43	South Tripura	Rajnagar	20822	16182	100	-	-	-	-	-	-	-	-
44	South Tripura	Rupaichari	18485	8360	100	-	-	-	-	-	-	-	-
45	South Tripura	Satchand	20190	17089	100	-	-	-	-	-	-	-	-
	South Tripura	**Dist. Total**	**151201**	**98103**	100	-	-	-	-	-	-	-	-
46	Unakoti	Chandipur	12845	8226	100	-	-	-	-	-	-	-	-
47	Unakoti	Gournagar	12195	8764	100	-	-	-	-	-	-	-	-
48	Unakoti	Kumarghat	24697	17522	100	-	-	-	-	-	-	-	-
49	Unakoti	Pencharthal	15966	8366	100	-	-	-	-	-	-	-	-
	Unakoti	**Dist. Total**	**65703**	**42878**	100	-	-	-	-	-	-	-	-
50	**West Tripura**	**AMC**	**7650**	**7650**	100	-	-	-	-	-	-	-	-
51	West Tripura	Bamutia	5471	5471	100	-	-	-	-	-	-	-	-
52	West Tripura	Belbari	9655	6911	100	-	-	-	-	-	-	-	-
53	West Tripura	Dukli	10445	9948	100	-	-	-	-	-	-	-	-
54	West Tripura	Hezamara	18366	10866	100	-	-	-	-	-	-	-	-

55	West Tripura	Jirania	5630	4677	100	-	-	-	-	-	-	-	-
56	West Tripura	Lefunga	4942	3526	100	-	-	-	-	-	-	-	-
57	West Tripura	Mandwi	18073	11823	100	-	-	-	-	-	-	-	-
58	West Tripura	Mohanpur	10886	10886	100	-	-	-	-	-	-	-	-
59	West Tripura	Old Agartala	6524	6524	100	-	-	-	-	-	-	-	-
	West Tripura	**Dist. Total**	**97642**	**78282**	100	-	-	-	-	-	-	-	-
	Tripura	**Grand Total**	**1049169**	**619784**	100	-	-	-	-	-	-	-	-

5.7 ANNEXURE III (F): DISTRICT WISE RECHARGE WORTHY AREA OF ASSESSMENT UNIT UNDER DIFFERENT CATEGORY FOR THE STATE/UT

DYNAMIC GROUND WATER RESOURCES OF TRIPURA, 2024												
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	DHALAI	995.81	995.81	100.0	-	-	-	-	-	-	-	-
2	NORTH TRIPURA	543.82	543.82	100.0	-	-	-	-	-	-	-	-
3	KHOWAI	495.6	495.6	100.0	-	-	-	-	-	-	-	-
4	GOMATI	1098.28	1098.28	100.0	-	-	-	-	-	-	-	-
5	WEST TRIPURA	782.82	782.82	100.0	-	-	-	-	-	-	-	-
6	UNAKOTI	428.78	428.78	100.0	-	-	-	-	-	-	-	-
7	SOUTH TRIPURA	981.03	981.03	100.0	-	-	-	-	-	-	-	-
8	SEPAHIJALA	871.7	871.7	100.0	-	-	-	-	-	-	-	-
	Total	6197.84	6197.0	100.0	-	-	-	-	-	-	-	-

5.8 Annexure IV (A): Categorization of Over Exploited, Critical and Semi Critical blocks/ mandals/ taluks (as in 2024)

CATEGORISATION OF ASSESSMENT UNIT, 2024							
TRIPURA							
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
ABSTRACT							
Total No. of Assessed Units		Number of Semi-critical Assessment Units		Number of Critical Assessment Units		Number of Over Exploited Assessment Units	
59		0		0		0	

5.9 ANNEXURE IV (B): QUALITY PROBLEMS IN ASSESSMENT UNITS (AS IN 2024)

QUALITY PROBLEMS IN ASSESSMENT UNITS, 2024							
TRIPURA							
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
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	
0		0		0		0	

5.10 Annexure IV (C): List of Saline Assessment units

CATEGORISATION OF ASSESSMENT UNIT, 2024							
TRIPURA							
S.NO	Name of District	S.NO	Name of Saline Assessment Units	S.NO			
ABSTRACT							
Total No. of Assessed Units		Number of Saline Assessment Units					
59		0		0		0	

5.11 ANNEXURE V: GENERAL DESCRIPTION OF THE GROUND WATER ASSESSMENT UNIT OF TRIPURA STATE (2023-24)

Type of Ground Water Assessment Unit (Watershed/ Block/ Taluka/ Mandal): **Block**

Sl.No	Ground Water Assessment Unit (Block)	Type of rock formation	Areal extent (in hectares)					
			Total Geographical area	Hilly area	Ground water recharge worthy area			Water logged and shallow water Table
					Command area	Non command area	Poor ground water quality area	
1	AMBASA	Semi consolidated Tertiary Sandstone	30556	17277	0	13279	0	9586.331
2	CHAWMANU	-Do-	45829	29646	0	16183	0	0
3	DUMBURNAGAR	-Do-	28157	15850	0	12307	0	8137.222
4	DURGA CHOWMOHANI	-Do-	14587	8685	0	5902	0	5902
5	GANGANAGAR	-Do-	25624	21086	0	4538	0	0
6	MANU	-Do-	46331	20000	0	26331	0	17159.45
7	RAISHYABARI	-Do-	16958	9050	0	7908	0	6254.94
8	SALEMA	-Do-	23447	10314	0	13133	0	6735.903
	DHALAI		**231489**	**131908**		**99581**		**53775.85**
9	AMARPUR	-Do-	41046	14255	0	26791	0	18024.29
10	KAKRABAN	-Do-	10378	3000	0	7378	0	2792.872
11	KARBOOK	-Do-	21468	6083	0	15385	0	8287.26
12	KILLA	-Do-	19372	3075	0	16297	0	5921.817
13	MATABARI	-Do-	22880	5022	0	17858	0	14735.13
14	OMPI	-Do-	30511	15045	0	15466	0	6471.781
15	SILACHHARI	-Do-	7394	2919	0	4475	0	3300
16	TEPANIA	-Do-	8656	2478	0	6178	0	6178
	GOMATI		**161705**	**51877**		**109828**		**65711.15**
17	KALYANPUR	-Do-	10153	2900	0	7253	0	5125.439
18	KHOWAI	-Do-	10173	188	0	9985	0	7289.606
19	MUNGIAKAMI	-Do-	29292	18109	0	11183	0	0
20	PADMABIL	-Do-	11904	5375	0	6529	0	2981.489
21	TELIAMURA	-Do-	13262	7113	0	6149	0	4628.879
22	TULASIKHAR	-Do-	26461	18000	0	8461	0	268.5418
	KHOWAI		**101245**	**51685**		**49560**		**20293.95**
23	DAMCHHERA	-Do-	18510	17100	0	1410	0	1115.437
24	DASDA	-Do-	37545	27146	0	10399	0	5408.466
25	JAMPUI HILL	-Do-	18889	14434	0	4455	0	0
26	JUBARAJNAGAR	-Do-	14386	5635	0	8751	0	8424.596
27	KADAMTALA	-Do-	9578	80	0	9498	0	8271.708
28	KALACHERRA	-Do-	7768	124	0	7644	0	7124.681
29	LALJURI	-Do-	19950	12806	0	7144	0	4813.428
30	PANISAGAR	-Do-	9166	4085	0	5081	0	3387.038
	NORTH TRIPURA		**135792**	**81410**		**54382**		**38545.35**
31	BISHALGARH	-Do-	14998	1266	0	13732	0	10971.12
32	BOXANAGAR	-Do-	11806	754	0	11052	0	10850.18

33	CHARILAM	-Do-	12675	1202	0	11473	0	10077.11
34	JAMPUIJALA	-Do-	30652	5075	0	25577	0	20125.61
35	KANTHALIA	-Do-	15580	3750	0	11830	0	9537.071
36	MOHANBHOG	-Do-	8716	2593	0	6123	0	2618.701
37	NALCHAR	-Do-	9965	2582	0	7383	0	6190.67
	SEPAHIJALA		**104392**	**17222**		**87170**		**70370.46**
38	BAGAFA	-Do-	30219	11209	0	19010	0	11139.06
39	BHARAT CH NAGAR	-Do-	12209	3682	0	8527	0	8225.191
40	HRISHYAMUKH	-Do-	18260	6250	0	12010	0	11217.27
41	JOLAIBARI	-Do-	23601	10941	0	12660	0	11977.18
42	POANGBARI	-Do-	7415	3150	0	4265	0	3336.056
43	RAJNAGAR	-Do-	20822	4640	0	16182	0	9657.491
44	RUPAICHARI	-Do-	18485	10125	0	8360	0	7908.815
45	SATCHAND	-Do-	20190	3101	0	17089	0	14555.09
	SEPAHIJALA		**151201**	**53098**		**98103**		**78016.15**
46	CHANDIPUR	-Do-	12845	4619	0	8226	0	4511.076
47	GOURNAGAR	-Do-	12195	3431	0	8764	0	7668.934
48	KUMARGHAT	-Do-	24697	7175	0	17522	0	15536.98
49	PENCHARTHAL	-Do-	15966	7600	0	8366	0	5502.253
	UNAKOTI		**65703**	**22825**		**42878**		**33219.24**
50	AMC	-Do-	7650	0	0	7650	0	7644.634
51	BAMUTIA	-Do-	5471	0	0	5471	0	5393.427
52	BELBARI	-Do-	9655	2744	0	6911	0	6123.342
53	DUKLI	-Do-	10445	497	0	9948	0	9600.939
54	HEZAMARA	-Do-	18366	7500	0	10866	0	2241.795
55	JIRANIA	-Do-	5630	953	0	4677	0	3866.003
56	LEFUNGA	-Do-	4942	1416	0	3526	0	2182.982
57	MANDWI	-Do-	18073	6250	0	11823	0	10095.69
58	MOHANPUR	-Do-	10886	0	0	10886	0	6209.971
59	OLD AGARTALA	-Do-	6524	0	0	6524	0	6391.899
	WEST TRIPURA		**97642**	**19360**		**78282**		**59750.69**
TOTAL	**TRIPURA**		**1049169**	**429385**	**0**	**619784**	**0**	**359932.2**

5.12 ANNEXURE V(A): DATA VARIABLES USED IN DYNAMIC GROUND WATER RESOURCES OF THE TRIPURA STATE (2023-24)

Sl. No.	District	Assessment Unit	Command/ Non-command/ Poor GW Quality	Normal Annual Rainfall (mm)	Average Pre-monsoon Water level (mgbl)	Average Post-monsoon Water Level (mgbl)	Average Fluctuation (m)
1	DHALAI	AMBASA	Non command	2692.1	4.372	2.31	2.25
2	DHALAI	CHAWMANU	- Do -	2342.8	4.895	2.19	1.61
3	DHALAI	DUMBURNAGAR	- Do -	2253.5	4.895	1.71	1.86
4	DHALAI	DURGACHOWMOHANI	- Do -	2692.1	2.95	2.48	1.49
5	DHALAI	GANGANAGAR	- Do -	2253.5	4.895	1.9	1.44
6	DHALAI	MANU	- Do -	2342.8	4.895	2.19	1.61
7	DHALAI	RAISHYABARI	- Do -	2253.5	4.895	1.71	1.86
8	DHALAI	SALEMA	- Do -	2692.1	4.372	2.31	2.25
9	GOMATI	AMARPUR	- Do -	2238.1	5.455	4.16	1.295
10	GOMATI	KAKRABAN	- Do -	2141.3	10.58	9.7	0.88
11	GOMATI	KARBOOK	- Do -	2201.3	5.84	3.74	2.1
12	GOMATI	KILLA	- Do -	2135.7	2.41	1.51	0.9
13	GOMATI	MATABARI	- Do -	2135.7	4.21	2.65	1.56
14	GOMATI	OMPI	- Do -	2238.1	7.89	5.63	2.26
15	GOMATI	SILACHHARI	- Do -	2201.3	5.08	2.95	2.13
16	GOMATI	TEPANIA	- Do -	2135.7	7.89	5.63	2.26
17	KHOWAI	KALYANPUR	- Do -	2131.2	2.42	1.46	0.96
18	KHOWAI	KHOWAI	- Do -	2314.9	2.42	1.46	0.96
19	KHOWAI	MUNGIAKAMI	- Do -	2131.2	3.3	2.23	1.07
20	KHOWAI	PADMABIL	- Do -	2314.9	3.3	2.23	1.07
21	KHOWAI	TELIAMURA	- Do -	2131.2	3.3	2.23	1.07
22	KHOWAI	TULASIKHAR	- Do -	2314.9	3.3	2.23	1.07
23	NORTH TRIPURA	DAMCHHERA	- Do -	2480.2	3.56	2.43	1.13
24	NORTH TRIPURA	DASDA	- Do -	2480.2	1.9125	1.8375	0.075
25	NORTH TRIPURA	JAMPUI HILL	- Do -	2480.2	1.66	4.84	-3.18
26	NORTH TRIPURA	JUBARAJNAGAR	- Do -	2581.0	5.265	2.195	3.07
27	NORTH TRIPURA	KADAMTALA	- Do -	2581.0	2.458	1.92	0.538
28	NORTH TRIPURA	KALACHERRA	- Do -	2581.0	5.265	2.195	3.07
29	NORTH TRIPURA	LALJURI	- Do -	2480.2	5.66	4.77	0.89
30	NORTH TRIPURA	PANISAGAR	- Do -	2581.0	4.55	3.526667	1.023333
31	SEPAHIJALA	BISHALGARH	- Do -	2025.3	4.905	3.87	1.035
32	SEPAHIJALA	BOXANAGAR	- Do -	2115.4	4.905	3.87	1.035
33	SEPAHIJALA	CHARILAM	- Do -	1999.1	4.905	3.87	1.035
34	SEPAHIJALA	JAMPUIJALA	- Do -	1999.1	4.905	3.87	1.035
35	SEPAHIJALA	KANTHALIA	- Do -	2115.4	3.453	1.89	1.563333
36	SEPAHIJALA	MOHANBHOG	- Do -	2115.4	3.45	1.89	1.563333
37	SEPAHIJALA	NALCHAR	- Do -	2115.4	3.45	1.89	1.56
38	SOUTH TRIPURA	BAGAFA	- Do -	2339.3	6.285	5.51	0.775
39	SOUTH TRIPURA	BHARAT CH NAGAR	- Do -	2339.3	6.285	5.51	0.775
40	SOUTH TRIPURA	HRISHYAMUKH	- Do -	2248.9	6.285	5.51	0.775
41	SOUTH TRIPURA	JOLAIBARI	- Do -	2339.3	6.285	5.51	0.775
42	SOUTH TRIPURA	POANGBARI	- Do -	2792.7	5.05	3.68	1.37
43	SOUTH TRIPURA	RAJNAGAR	- Do -	2248.9	6.13	4.22	1.91
44	SOUTH TRIPURA	RUPAICHARI	- Do -	2792.7	6.285	5.51	0.775
45	SOUTH TRIPURA	SATCHAND	- Do -	2792.7	4.07	3.06	1.01

46	UNAKOTI	CHANDIPUR	- Do -	2376.6	5.54	2.01	3.53
47	UNAKOTI	GOURNAGAR	- Do -	2376.6	4.12	2.63	1.49
48	UNAKOTI	KUMARGHAT	- Do -	2376.6	4.855	4.364	0.491
49	UNAKOTI	PENCHARTHAL	- Do -	2376.6	6.46	3.945	2.515
50	WEST TRIPURA	AMC	- Do -	2065.4	7.02	4.46	2.56
51	WEST TRIPURA	BAMUTIA	- Do -	2065.4	7.03	6.41	0.62
52	WEST TRIPURA	BELBARI	- Do -	1953.7	7.03	6.41	0.62
53	WEST TRIPURA	DUKLI	- Do -	2065.4	5.92	4.41	1.501
54	WEST TRIPURA	HEZAMARA	- Do -	2065.4	7.03	6.41	0.62
55	WEST TRIPURA	JIRANIA	- Do -	1953.7	2.25	0.94	1.31
56	WEST TRIPURA	LEFUNGA	- Do -	2065.4	3.19	2.62	0.57
57	WEST TRIPURA	MANDWI	- Do -	1953.7	2.25	0.94	1.31
58	WEST TRIPURA	MOHANPUR	- Do -	2065.4	3.63	2.73	0.9
59	WEST TRIPURA	OLD AGARTALA	- Do -	1953.7	7.02	4.46	2.56

5.13 Annexure V: COMPARISON of categorization of assessment units (2023 to 2024)

S.No	Name of District	Name of Assessment Unit	Stage of Ground Water Extraction (%) 2023	Categorization in 2023	Stage of Ground Water Extraction (%) 2024	Categorization in 2024
1	Dhalai	Ambasa	4.3	Safe	4.45	Safe
2	Dhalai	Chawmanu	4.07	Safe	2.95	Safe
3	Dhalai	Dumburnagar	6.3	Safe	5.40	Safe
4	Dhalai	Durga Chowmohani	15.76	Safe	13.51	Safe
5	Dhalai	Ganganagar	11.73	Safe	12.74	Safe
6	Dhalai	Manu	6.86	Safe	4.96	Safe
7	Dhalai	Raishyabari	4.89	Safe	4.66	Safe
8	Dhalai	Salema	8.52	Safe	8.81	Safe
9	Dhalai	Dist. Total	6.99	Safe	6.06	Safe
10	Gomati	Amarpur	3.14	Safe	3.49	Safe
11	Gomati	Kakraban	13.65	Safe	9.79	Safe
12	Gomati	Karbook	3.98	Safe	2.48	Safe
13	Gomati	Killa	6.76	Safe	6.80	Safe
14	Gomati	Matabari	7.78	Safe	7.64	Safe
15	Gomati	Ompi	3.73	Safe	3.56	Safe
16	Gomati	Silachhari	10.03	Safe	6.02	Safe
17	Gomati	Tepania	7.79	Safe	7.86	Safe
18	Gomati	Dist. Total	5.92	Safe	5.45	Safe
19	Khowai	Kalyanpur	12.54	Safe	11.93	Safe
20	Khowai	Khowai	8.33	Safe	8.24	Safe
21	Khowai	Mungiakami	4.59	Safe	4.38	Safe
22	Khowai	Padmabil	7.54	Safe	6.81	Safe
23	Khowai	Teliamura	20.83	Safe	19.10	Safe
24	Khowai	Tulasikhar	7.06	Safe	6.40	Safe
25	Khowai	Dist. Total	9.75	Safe	9.30	Safe
26	North Tripura	Damchhera	21.97	Safe	21.62	Safe
27	North Tripura	Dasda	11.27	Safe	8.31	Safe
28	North Tripura	Jampui Hill	4.02	Safe	3.22	Safe
29	North Tripura	Jubarajnagar	10.35	Safe	10.63	Safe
30	North Tripura	Kadamtala	18.1	Safe	14.34	Safe
31	North Tripura	Kalacherra	16.76	Safe	13.03	Safe
32	North Tripura	Laljuri	9.24	Safe	9.01	Safe
33	North Tripura	Panisagar	9.54	Safe	9.49	Safe
34	North Tripura	Dist. Total	12.11	Safe	10.57	Safe
35	Sepahijala	Bishalgarh	15.82	Safe	15.43	Safe
36	Sepahijala	Boxanagar	13.02	Safe	13.14	Safe
37	Sepahijala	Charilam	15.38	Safe	15.25	Safe
38	Sepahijala	Jampuijala	4.55	Safe	4.47	Safe
39	Sepahijala	Kanthalia	17.17	Safe	19.66	Safe
40	Sepahijala	Mohanbhog	6.66	Safe	6.63	Safe
41	Sepahijala	Nalchar	10.93	Safe	10.86	Safe
42	Sepahijala	Dist. Total	11.73	Safe	11.87	Safe
43	South Tripura	Bagafa	5.86	Safe	5.67	Safe
44	South Tripura	Bharat Ch Nagar	6.45	Safe	6.28	Safe
45	South Tripura	Hrishyamukh	7.43	Safe	7.42	Safe
46	South Tripura	Jolaibari	5.61	Safe	4.78	Safe
47	South Tripura	Poangbari	8.36	Safe	8.39	Safe
48	South Tripura	Rajnagar	9.96	Safe	10.05	Safe

49	South Tripura	Rupaichari	6.73	Safe	5.64	Safe
50	South Tripura	Satchand	3.34	Safe	3.93	Safe
51	South Tripura	Dist. Total	6.21	Safe	6.13	Safe
52	Unakoti	Chandipur	10.64	Safe	8.02	Safe
53	Unakoti	Gournagar	10.46	Safe	9.00	Safe
54	Unakoti	Kumarghat	7.2	Safe	7.43	Safe
55	Unakoti	Pencharthal	6.19	Safe	6.30	Safe
56	Unakoti	Dist. Total	8.26	Safe	7.69	Safe
57	West Tripura	AMC	60.18	Safe	57.04	Safe
58	West Tripura	Bamutia	18.91	Safe	19.21	Safe
59	West Tripura	Belbari	15.69	Safe	15.09	Safe
59	West Tripura	Dukli	22.85	Safe	19.03	Safe
59	West Tripura	Hezamara	5.58	Safe	5.68	Safe
59	West Tripura	Jirania	20.06	Safe	32.10	Safe
59	West Tripura	Lefunga	18.27	Safe	18.56	Safe
59	West Tripura	Mandwi	5.95	Safe	5.63	Safe
59	West Tripura	Mohanpur	18.08	Safe	18.35	Safe
59	West Tripura	Old Agartala	20.78	Safe	24.68	Safe
59	West Tripura	Dist. Total	21.21	Safe	21.47	Safe
	Tripura	Grand Total	9.92	Safe	9.48	Safe

5.14 ANNEXURE VI: ASSESSMENT UNIT WISE REPORT (ATTRIBUTE TABLE)

District	Assessment Unit Name	Recharge from Rainfall-Monsoon Season	Recharge from Other Sources-Monsoon Season	Recharge from Rainfall-Non Monsoon Season	Recharge from Other Sources-Non Monsoon Season	Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use (Ham)	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (Over-Exploited/Critical/Semi-Critical/Safe/Saline)
Dhalai	Ambasa	2248.43	129.09	621.29	65.76	2923.03	306.45	2616.58	18.6	0.15	97.75	116.5	103.48	2494.35	4.45%	Safe
Dhalai	Chawmanu	3121.76	55.95	518	81.4	3306.93	377.71	2929.22	1.5	0	84.96	86.45	89.94	2837.79	2.95%	Safe
Dhalai	Dumburnagar	1879.21	73.83	313.49	64.89	2025.64	233.14	1792.5	3.15	0	93.63	96.78	99.12	1690.23	5.40%	Safe
Dhalai	Durga Chowmohani	1249.17	209.54	276.14	150.29	1505.4	188.51	1316.89	51.81	0	126.12	177.93	133.52	1131.56	13.51%	Safe
Dhalai	Ganganagar	692.93	0	115.59	28.36	726.85	83.68	643.17	0	0	81.97	81.97	86.78	556.39	12.74%	Safe
Dhalai	Manu	5079.35	277.88	842.82	57.95	5373.17	625.8	4747.37	23.06	0	212.59	235.65	225.05	4499.26	4.96%	Safe
Dhalai	Raishyabari	1207.51	6.72	201.44	27.46	1414.02	144.31	1269.71	2.73	0	56.39	59.12	59.7	1207.28	4.66%	Safe
Dhalai	Salema	2223.71	188.02	614.46	89.53	3002.58	311.57	2691.01	34.45	0	202.73	237.18	214.61	2441.95	8.81%	Safe
Dhalai	**Dist. Total**	**17702.07**	**941.03**	**3503.23**	**565.64**	**20277.62**	**2271.17**	**18006.45**	**135.3**	**0.15**	**956.15**	**1091.58**	**1012.2**	**16858.81**	**6.06%**	**Safe**
Gomati	Amarpur	4020.04	859.11	731.26	88.42	5141.3	569.88	4571.42	26.73	0	132.67	159.4	137.21	4407.48	3.49%	Safe
Gomati	Kakraban	1316.95	675.03	199.68	79.36	2253.03	227.1	2025.93	21.78	0	176.57	198.36	182.63	1821.51	9.79%	Safe
Gomati	Karbook	2271.1	332.46	412.41	37	3012.63	305.3	2707.33	4.05	0	63.21	67.26	65.38	2637.9	2.48%	Safe
Gomati	Killa	2314.94	306.36	447.72	117.98	2764.38	318.7	2445.68	70.32	0	95.94	166.27	99.23	2276.12	6.80%	Safe
Gomati	Matabari	3170.85	662.18	490.6	99.86	3717.39	442.35	3275.04	10.8	0.06	239.38	250.24	247.58	3016.6	7.64%	Safe
Gomati	Ompi	2320.7	307.98	422.14	64.56	3081.42	311.54	2769.88	8.1	0	90.6	98.7	93.71	2668.07	3.56%	Safe
Gomati	Silachhari	660.59	22.21	119.96	41.3	827.4	84.41	742.99	1.62	0	43.14	44.76	44.62	696.75	6.02%	Safe
Gomati	Tepania	877.57	156.62	169.72	75.06	1193.24	127.9	1065.34	20.79	0.11	62.85	83.74	65	979.45	7.86%	Safe
Gomati	**Dist. Total**	**16952.74**	**3321.95**	**2993.49**	**603.54**	**21990.79**	**2387.18**	**19603.61**	**164.19**	**0.17**	**904.37**	**1068.73**	**935.36**	**18503.88**	**5.45%**	**Safe**
Khowai	Kalyanpur	1215.85	461.14	268.09	183.63	2128.71	212.87	1915.84	121.8	0	106.85	228.65	109.9	1684.14	11.93%	Safe
Khowai	Khowai	1827.2	638.14	391.74	164.62	2810.23	302.17	2508.06	57.6	0	149.1	206.7	153.35	2297.11	8.24%	Safe
Khowai	Mungiakami	1499.72	94.51	413.35	49.26	2052.84	205.68	1847.16	14.06	0	66.91	80.97	68.81	1764.29	4.38%	Safe
Khowai	Padmabil	1043.37	87.14	256.15	40.28	1417.2	71.35	1345.85	10.2	0	81.51	91.71	83.84	1251.81	6.81%	Safe
Khowai	Teliamura	1030.78	408.66	227.28	79.54	1709.85	174.62	1535.23	112.65	24	156.6	293.25	161.07	1237.51	19.10%	Safe
Khowai	Tulasikhar	1345.66	100.6	331.95	79.05	1828.04	92.86	1735.18	11.4	0	99.69	111.09	102.54	1621.24	6.40%	Safe
Khowai	**Dist. Total**	**7962.58**	**1790.19**	**1888.56**	**596.38**	**11946.87**	**1059.55**	**10887.32**	**327.71**	**24**	**660.64**	**1012.37**	**679.51**	**9856.1**	**9.30%**	**Safe**

North Tripura	Damchhera	223.44	23.08	58.67	77.78	358.15	38.29	319.86	3	0.07	66.08	69.15	68.94	247.85	21.62%	Safe
North Tripura	Dasda	2059.87	47.95	432.74	140.31	1880.23	268.08	1612.15	1.8	0	132.21	134.01	137.92	1472.43	8.31%	Safe
North Tripura	Jampui Hill	882.46	0	185.39	0	1001.48	106.79	894.69	0	0	28.81	28.82	30.06	864.62	3.22%	Safe
North Tripura	Jubarajnagar	1422.95	169.01	403.59	105.44	1812.17	210.1	1602.07	0	7.64	162.73	170.37	169.76	1424.67	10.63%	Safe
North Tripura	Kadamtala	1930.52	95.79	438.04	73.67	1983.25	253.8	1729.45	21.6	3.45	223.03	248.08	232.66	1471.74	14.34%	Safe
North Tripura	Kalacherra	1553.69	21.71	352.53	22.45	1538.52	195.04	1343.48	2.4	0.1	172.52	175.03	179.97	1161	13.03%	Safe
North Tripura	Laljuri	1132.09	9.8	297.28	165.13	1409.59	160.43	1249.16	0	0	112.56	112.56	117.42	1131.74	9.01%	Safe
North Tripura	Panisagar	826.19	215.94	234.33	119.92	1313.46	139.64	1173.82	3.6	0	107.74	111.34	112.39	1057.83	9.49%	Safe
North Tripura	**Dist. Total**	**10031.21**	**583.28**	**2402.57**	**704.7**	**11296.85**	**1372.17**	**9924.68**	**32.4**	**11.27**	**1005.7**	**1049.36**	**1049.12**	**8831.88**	**10.57%**	**Safe**
Sepahijala	Bishalgarh	1783.53	781.25	449.8	363.72	3085	337.83	2747.17	241.2	0.16	182.59	423.95	187.8	2318.01	15.43%	Safe
Sepahijala	Boxanagar	1554.13	175.11	301.79	71.98	1707.65	210.3	1497.35	77.94	0.24	118.61	196.79	122	1297.17	13.14%	Safe
Sepahijala	Charilam	1493.01	263.27	343.38	162.99	1984	226.27	1757.73	66.6	2.63	198.77	267.99	204.45	1484.06	15.25%	Safe
Sepahijala	Jampuijala	3328.41	346.99	765.5	31.36	3849.26	447.23	3402.03	47.14	0.29	104.79	152.21	107.78	3246.83	4.47%	Safe
Sepahijala	Kanthalia	1663.53	436.31	323.03	257.88	2583.15	268.07	2315.08	311.86	0	143.34	455.2	147.43	1855.79	19.66%	Safe
Sepahijala	Mohanbhog	1076.27	533.33	167.2	86.84	1852.54	186.36	1666.18	1.2	0	109.35	110.55	112.47	1552.51	6.63%	Safe
Sepahijala	Nalchar	1297.75	496.54	201.6	134.93	1914.1	213.08	1701.02	15.26	0.18	169.29	184.72	174.13	1511.46	10.86%	Safe
Sepahijala	**Dist. Total**	**12196.63**	**3032.8**	**2552.3**	**1109.7**	**16975.7**	**1889.14**	**15086.56**	**761.2**	**3.49**	**1026.74**	**1791.41**	**1056.06**	**13265.83**	**11.87%**	**Safe**
South Tripura	Bagafa	3726.12	471.29	543.03	283.12	4177.08	502.36	3674.72	34.8	0	173.65	208.45	179.6	3460.32	5.67%	Safe
South Tripura	Bharat Ch Nagar	1671.36	303.82	243.58	171.76	1886.71	239.05	1647.66	24.62	1.54	77.26	103.43	79.91	1541.58	6.28%	Safe
South Tripura	Hrishyamukh	2279.13	435.7	313.73	280.03	2780.52	330.86	2449.66	56.74	1.46	123.67	181.87	127.91	2263.55	7.42%	Safe
South Tripura	Jolaibari	2481.47	670.68	361.64	186.99	3505.1	370.08	3135.02	29.38	0	120.56	149.93	124.69	2980.96	4.78%	Safe
South Tripura	Poangbari	812.36	0.27	127.98	42.86	878.68	98.34	780.34	3	0	62.49	65.49	64.63	712.71	8.39%	Safe
South Tripura	Rajnagar	2456.68	100.48	422.71	206.95	3006.55	318.69	2687.86	124.98	1.5	143.67	270.15	148.59	2412.79	10.05%	Safe
South Tripura	Rupaichari	1990.43	217.18	250.85	80.88	2415.27	253.93	2161.34	9.55	0	112.44	121.99	116.29	2035.5	5.64%	Safe
South Tripura	Satchand	3254.97	748.68	512.78	83.15	4424.65	459.96	3964.69	12.23	1.04	142.37	155.65	147.24	3804.17	3.93%	Safe
South Tripura	**Dist. Total**	**18672.52**	**2948.1**	**2776.3**	**1335.74**	**23074.56**	**2573.27**	**20501.29**	**295.3**	**5.54**	**956.11**	**1256.96**	**988.86**	**19211.58**	**6.13%**	**Safe**
Unakoti	Chandipur	1711.59	270.47	282.16	33.85	2065.74	114.9	1950.84	0.9	0	155.56	156.46	162.28	1787.66	8.02%	Safe

Unakoti	Gournagar	1698.9	184	300.62	161.35	2204.48	234.49	1969.99	15.15	0.32	161.91	177.38	168.9	1785.62	9.00%	Safe
Unakoti	Kumarghat	2717.31	524.88	601.02	84.9	3787.66	392.81	3394.85	0	4.51	247.62	252.13	258.31	3132.03	7.43%	Safe
Unakoti	Pencharthal	1297.4	140.14	286.96	152.63	1861.78	187.71	1674.07	0	0	105.46	105.47	110.02	1564.04	6.30%	Safe
Unakoti	**Dist. Total**	**7425.2**	**1119.49**	**1470.76**	**432.73**	**9919.66**	**929.91**	**8989.75**	**16.05**	**4.83**	**670.56**	**691.44**	**699.51**	**8269.35**	**7.69%**	**Safe**
West Tripura	AMC	1499.71	22.96	235.46	255.62	2013.75	100.68	1913.07	35.64	1.1	1054.47	1091.21	1090.6	785.73	57.04%	Safe
West Tripura	Bamutia	733.13	109.83	168.39	46.43	955.08	105.78	849.3	52.8	0	110.33	163.13	114.11	682.39	19.21%	Safe
West Tripura	Belbari	1110.88	355.51	185.33	30.07	1505.96	168.18	1337.78	13.8	7.87	180.21	201.89	186.38	1129.72	15.09%	Safe
West Tripura	Dukli	1999.58	434.03	306.19	136.01	2807.22	287.58	2519.64	255.73	2.3	221.58	479.61	229.18	2032.43	19.03%	Safe
West Tripura	Hezamara	1456.07	184.78	334.45	46.62	1986.72	202.2	1784.52	17.79	0	83.55	101.34	86.41	1680.32	5.68%	Safe
West Tripura	Jirania	601.43	244.23	125.42	266.26	1147.85	123.74	1024.11	103.2	137.9	87.65	328.75	90.65	692.36	32.10%	Safe
West Tripura	Lefunga	472.49	86.66	108.53	122.18	771.33	78.98	692.35	15.9	2.24	110.33	128.47	114.11	560.1	18.56%	Safe
West Tripura	Mandwi	1520.35	322.55	317.06	90.3	2085.24	225.03	1860.21	0	0	104.75	104.75	108.35	1751.86	5.63%	Safe
West Tripura	Mohanpur	1458.75	335.57	335.07	234.77	2191.29	236.41	1954.88	190.13	5.6	163.09	358.81	168.68	1590.48	18.35%	Safe
West Tripura	Old Agartala	838.94	217.64	174.96	151.65	1216.73	138.32	1078.41	88.2	54.93	122.99	266.11	127.21	808.08	24.68%	Safe
West Tripura	**Dist. Total**	**11691.33**	**2313.76**	**2290.86**	**1379.91**	**16681.17**	**1666.9**	**15014.27**	**773.19**	**211.93**	**2238.95**	**3224.07**	**2315.68**	**11713.47**	**21.47%**	**Safe**
Tripura	**Grand Total**	**102634.28**	**16050.6**	**19878.07**	**6728.34**	**132163.22**	**14149.29**	**118013.93**	**2505.35**	**261.37**	**8419.22**	**11185.92**	**8736.3**	**106510.9**	**9.48%**	**Safe**

6 APPENDIX

6.1 CONSTITUTION OF THE PERMANENT STATE LEVEL COMMITTEE.

Government of Tripura
PUBLIC WORKS DEPARTMENT(WR)
Kunjaban: Agartala

No.F.15(76)/SE/WRPC/1566-77 **Dated: 30-01-2023**

MEMORANDUM

Sub:- Constitution of Permanent State Level Committee for assessment of Dynamic Ground Water Resourses Estimation.

In accordance with the approval of the Government, a Permanent State Level Committee for assessment of Dynamic Ground Water Resourses Estimation in Tripura, is hereby constituted with the following officials:-

1. Secretary,PWD, Tripura.	Chairman
2. Conservator of Forest, Territorial Tripura.	Member
3. Regional Director,CGWB, NE Region Guwahati.	**Member Secretary**
4. Chief Engineer, PWD (WR),Tripura.	Member
5. Chief Engineer, PWD (DWS),Tripura.	Member
6. Chief Engineer, Agriculture, Tripura.	Member
7. Chief Engineer, RD Deptt. Tripura.	Member
8. Director Industries, Tripura.	Member
9. Scientist-B/Engineer, Tripura Space Application Centre, Gurkhabasti.	Member
10. General Manager, NABARD, Tripura.	Member
11. Officer – in – Charge, CWGB, State Unit Tripura.	Member
12. Executive Engineer, W.R. Investigation Division, PWD(WR), Kunjaban.	**Nodal Officer cum Member**

The broad Terms of Reference of the Committee would be as follows:

i. To estimate annual replenishable ground water resources of the State in accordance with the Ground Water Recourses Estimation Methodology.
ii. To estimate the status of utilization of the annual replenishable ground water resourses.

30/01/2023

DEPUTY SECRETARY
PWD(Water Resourses)

Forwarded to :-

1. The Secretary, PWD,Tripurafor information please.
2. The Conservator of Forest,Territorial, AranyaBhawan, Gurkhabasti, Agartala,for information please.
3. The Regional Director,CGWB, NE Region Guwahati, for information please.
4. The Chief Engineer, PWD (WR) Kunjaban, Agartala,for information please.
5. The Chief Engineer, PWD (DWS) Gurkhabasti, Agartala, for information please.
6. The Chief Engineer, Agriculture, KrishiBhavan, Agartala, for information please.
7. The Chief Engineer, RD Deptt. Gurkhabasti, Agartala, for information please.
8. The Director Industries, Tripura, Agartala, for information please.
9. The Head of Office (DDO),Tripura State Council for Science & Technology, Gurkhabasti, Agartala for information please.
10. The General Manager, NABARD, KhejurBagan, Agartala, for information please.
11. The Officer-in - Charge, State Unit Tripura,CGWB, Agartala, for information please.
12. The Executive Engineer, W.R. Investigation Division PWD(WR), Kunjaban, AgartalaVisvesvaraya Complex for information please.

30/01/2023

DEPUTY SECRETARY
PWD(Water Resourses)

6.2 MINUTES OF THE 1ST MEETING OF THE PSL COMMITTEE.

Government of Tripura
Office of the Executive Engineer
Water Resource Investigation Division
Visvesvaraya Complex
Kunjaban, Agartala

No.F.1(38)/EE/WRID/TECH/2020/384-407 Dated:13-05-2024

MINUTES OF THE MEETING OF PERMANENT STATE LEVEL COMMITTEE (PSLC) ON DYNAMIC GROUNDWATER RESOURCE ESTIMATION OF TRIPURA, 2024.

Venue: Hall No.III, Secretariat Complex, Agartala.

The First meeting of Permanent State Level Committee (PSLC) on Dynamic Ground Water Resource Estimation of Tripura, for the year 2024 was convened on the 4thMay, 2024 at 16.00 hrs. at the Hall no. III, Secretariat Complex, under the Chairmanship of Secretary, PWD (WR) & Chairman PSLC, Shri Kiran Gitte, IAS.

The meeting was attended by the Members of the PSLC. The list of participants is enclosed as Annexure.

With the permission of Chair, Shri Biplab Ray, Regional Director (NER), CGWB &the Member secretary, PSLC- for GWRA (Tripura) welcomed the Chair and all the representative members of the PSLC. He highlighted that, the Ground Water Resource Estimation of Tripura is being carried out jointly by Central Ground Water Board and PWD (Water Resources), Government of Tripura (the State Nodal Department) in coordination with other members/departments of PSLC. He also highlighted that the socio-economic condition of the state may be enhanced through sustainable development of groundwater by the stakeholders.

This was followed by a brief presentation on GWRE-2024, its methodology, data gaps and data requirements by Dr. Raja Ram Purohit, Scientist-D & OIC SUO, Agartala, CGWB. It was also informed to the members that the computation of dynamic ground water resources of Tripura is currently being done through IN-GRES software. The IN-GRES is a software/web-based application developed by CGWB in collaboration with Vassar Lab, IIT- Hyderabad. In the process he requested the member for providing requisite data for GWR Estimation.

The committee members of PSLC discussed in detail on the methodology of the estimation, various factors utilized / considered as per norm- or otherwise, constrains of non-availability of various field data, source of various field data utilized for resource calculation etc.

CGWB urged that the nodal department of state should have their own groundwater level monitoring mechanism, to start with, at least two (if feasible, 2 Shallow and 2 Deep Pz) fitted with DWLR in each block of the state, so that the data gap can be minimized. This data generated will also help the upcoming State Ground Water Authority, likely to be formed soon by the State for Ground Water regulation.

The Secretary, PWD, also the Chairman, PSLC, instructed the Water Resource Department to make a proposal for DWLRs in this regard. He also urged that all the PSLC member departmentsto proactively participate and provide requisite data for meaningful and accurate calculations. As requested by CGWB, a working group of active officers (junior level, one each from each member department) should be formed. The group should sit together for the data assimilation. The Members of PSLC were requested to nominate officers for the same.

The meeting ended with Thanks to the Chair and all the members of the PSLC.

13/5/24

Er. M. Majumder
Nodal Officer cum Member and Executive Engineer
Water Resource Investigation Division
Kunjaban, Agartala

Copy to:

1. The PS to Secretary, PWD (WR), Govt. of Tripura, Secretariat Complex, Agartala, Tripura (W), *for favour of his kind information please.*
2. The Conservator of Forest (Territorial), Department of Forest (Member), AranyaBhawan, Gurkhabasti, Agartala, Tripura (W)
3. The Regional Director, NE Region, CGWB (Member Secretary), Guwahati, Assam
4. The Chief Engineer, PWD (WR) (Member), Visvesvaraya Complex, Kunjaban, Agartala, Tripura (W).
5. The Chief Engineer, PWD (DWS) (Member), Gurkhabasti, Agartala, Tripura (W).
6. The Chief Engineer, Agriculture, (Member), Krishi Bhavan, Agartala, Tripura (W).
7. The Chief Engineer, RD Department (Member),Nehru Complex, Gurkhabasti, Agartala, Tripura (W).
8. The Director Industries, Tripura(Member), Khejur Bagan, Agartala, Tripura (W).
9. The Head of Office, Tripura Space Application Centre (Member), Gurkhabasti, Agartala.
10. The General Manager, NABARD, Tripura (Member),Khejur Bagan, Agartala, Tripura (W).
11. The Director, Geological Survey of India (Member), Chandmari, 79 Tilla, Agartala, Tripura (W)
12. The Director - Fisheries (Member), P N Complex, Gurkhabasti, Agartala, Tripura (W)
13. The Commissioner, Agartala Municipal Corporation (Member), City Centre, Agartala (W).
14. The Officer-in-Charge, State Unit Office, Agartala, CWGB, (Member) State Unit Tripura, Agartala.

13/5/24

Er. M. Majumder
Nodal Officer cum Member and Executive Engineer
Water Resource Investigation Division
Kunjaban, Agartala

Annexure

List of participants for the 1st meeting on PSLC on GWRE
Date: 4th May, 2024 at 4:00pm
Venue: Conference Hall No-III, Secretariat Complex, Agartala

Sl No	Name	Designation	Organisation
1.	Sh. Kiren Gitte (IAS) – in chair	Secretary, PWD (WR)	Govt of Tripura
2.	Ms. Vishwasree B. (IAS)	Director (I&C)	Govt of Tripura
3.	Er. Swapan Kr. Das.	CE (Agri.)	A&FW Dept., Govt. of Tripura
4.	ShBiplab Ray – Member Secy.	Regional Director (IC), NER	Central Ground Water Board
5.	Sh. RatnakarBhaisal	Director GSI, Agartala	Geological Survey of India
6.	Sh. Diganta Kumar Das	Dy. General Manager,	NABARD
7.	Sh. SudhanDebbarma	Addl. CE	PWD (WR), Govt. of Tripura
8.	Smt. Sutirtha Paul	State Geologist (I&C),	(I&C), Govt. of Tripura
9.	Sh. Bodhayan Ghosh	Asst. General Manager,	NABARD
10.	Dr. Raja Ram Purohit	Scientist-D & OIC, SUO Agartala	SUO Agartala, CGWB
11.	Smt. Maitrayee Deb	SE (HQ), RD	RD, Govt. of Tripura
12.	Dr. DigantaDebbarma	SE PWD (WR)	PWD (WR), Govt. of Tripura
13.	Sh. P.S. Goswami	Scientist	TSAC, Govt. of Tripura
14.	Sh. Pikan Das	EE (PWD, DWS)	PWD (DWS), Govt. of Tripura
15.	Er. MaitreyeeMajumdar – Nodal Officer	EE (WR ID)	PWD (WR), Govt. of Tripura
16.	Sh. LuangmeiLimpou	Sr. Geologist	Geological Survey of India
17.	Ms. Ritu Kumari Oraon	Scientist-C	SUO Agartala, CGWB

6.3 CO-OPTING MEMBERS TO THE PSL COMMITTEE

Government of Tripura
:Office of the Executive Engineer
Water Resource Investigation Division
Visvesvaraya Complex
Kunjaban:Agartala

No.F. 1(38)/EE/WRID/TECH/2020/ 317-22 **Dated:** 02-05-2024

To

1. The Commissioner,
Agartala Municipal Corporation,
City Centre, Agartala, Tripura (W).

2. The Director Fisheries,
P.N Complex, Gurkhabasti ,
Agartala, Tripura (W).

3. The Director
Geological Survey of India,
Chandmari, 79 Tilla,
Agartala, Tripura(W).

Sub:- First meeting of the GWRA – 2024 under the Permanent State level Committee (PSLC)) for assessment of Ground Water Resource Estimation along with preparation of database –reg.

Ref.No.:- Letter No.F.1(38)/EE/WRID/TECH/2020/304-15 Dt.30-04-2024.

Sir,

In inviting the above captioned subject at issue, kindly find enclosed herewith a copy of meeting notice for estimation of Ground Water Resources at Tripura to be held on 4th May' 2024 at 4 PM in the Conference Hall No.III, New Secretariat Complex, Agartala.

In this connection, I am directed to request your good self to make it convenient to attend the meeting

Yours faithfully,

Enclo:- As stated above.

(Er. M. Majumder)
Nodal Officer cum Member
Executive Engineer
Water Resource Investigation Division
Kunjaban : Agartala

Copy to :-

1. The Chief Engineer, PWD (WR), Visvesvaraya Complex, Kunjaban, Agartala, Tripura (W) for favour of kind information please.
2. The Addl. Chief Engineer, P&D Unit, PWD (WR), Visvesvaraya Complex, Kunjaban, Agartala, Tripura (W) for favour of kind information please.
3. The Regional Director, CGWB, NE Region, Guwahati for favour of kind information please.

2/5/24

Executive Engineer
Water Resource Investigation Division
Kunjaban : Agartala

6.4 MINUTES OF THE FINAL MEETING OF THE PSL COMMITTEE.

Government of Tripura
Office of the Executive Engineer
Water Resource Investigation Division
Visvesvaraya Complex
Kunjaban, Agartala

No.F.1(38)/EE/WRID/TECH/2020/1503-19 Dated: 03-09-2024

MINUTES OF THE MEETING OF PERMANENT STATE LEVEL COMMITTEE (PSLC) ON DYNAMIC GROUNDWATER RESOURCE ESTIMATION FOR TRIPURA, 2024.

Venue: Chamber of Secretary PWD (WR) & Chairman PSLC, Sh. Kiran Gitte, IAS, New Secretariat Complex, Agartala.

The meeting of Permanent State Level Committee (PSLC) on Dynamic Ground Water Resource Estimation of Tripura, for the year 2024 was convened on the 29th August, 2024 at 17.30 hrs at the Chamber of Secretary PWD (WR) & Chairman PSLC, Sh. Kiran Gitte, IAS, New Secretariat Complex, Agartala.

The meeting was chaired by Sh. Kiran Gitte, IAS, Secretary PWD (WR) to Government of Tripura & Chairman of PSLC. The meeting was attended by the members of the PSLC. The list of participants is enclosed as Annexure.

With the permission of Chair, Dr. Raja Ram Purohit, Sc-D and Officer In-charge, State Unit Office, Agartala, CGWB welcomed the Chair and all the esteem members of the PSLC and their representatives. He highlighted that, the Ground Water Resource Estimation of Tripura is being carried out jointly by Central Ground Water Board and PWD (Water Resources), Government of Tripura (the State Nodal Department) in coordination with other members/departments of PSLC. He also highlighted that the socio-economic condition of the state may be enhanced through sustainable development of groundwater by the stakeholders.

This was followed by a brief presentation on GWRE-2024, its methodology, Calculations, estimation, data gaps and data requirements by Dr. Raja Ram Purohit. It was also informed to the members that the computation of dynamic ground water resources of Tripura is currently being done through IN-GRES software. The IN-GRES is a software/web-based application developed by CGWB in collaboration with Vassar Lab, IIT- Hyderabad. In the process he requested the member for providing requisite data for GWR Estimation.

The Chairman of the committee appreciated the effort taken jointly by the Investigation Division, PWD (Water Resources) and SUO, Agartala, CGWB. He also appreciated the effort taken by all other Member Departments and Organisations for timely providing the data for GWRE computation. He advised to take Indian Meteorological Department, Agartala onboard the PSLC as they are the sole custodian on Rainfall related data.

Cont.P/2

As per request by CGWB, the Chairman PSLC urged that the Nodal Department of State should submit the proposal at the earliest to start for its own Ground Water Regime monitoring with DWLR in some of the existing / defunct wells, atleast for 2 Shallow wells at each Block with additional few at AMC.

Chairman PSLC also advised the Nodal department to explicitly process the formation of State Ground Water Authority (SGWA) for Ground Water regulation with requisite support from CGWB.

At the end of the presentation, the concept of Water Grid for Tripura was presented to the Chair and the committee Members. The concept emphasises the extraction of Ground Water from the Artesian Wells of the valley and through Multi stage pumping can be provided at the higher hills devoid of water specifically for Drinking and Domestic use. Similarly all the 6/7 valleys with surplus water can be interconnected in to a Grid and water can be transported. Chairman PLSC appreciated the idea and urges CGWB to take-up a study on estimation of volume of surplus water available in Khowai Artesian Valley, which can then be transported to Mungiakami Block and other nearby water scarce area. Chairman PLSC advised to get in touch with Secretary, PWD (DWS) to take the proposal further.

After a through discussion, all the members of the PSLC along with Chairman PSLC agreed and accepted upon the computations of the Dynamic Ground Water Resource Assessment, 2024.

The meeting ended with Thanks to the Chair and all the members of the PSLC.

30/8/24

(Er. M. Majumder)
Nodal Officer cum Member and Executive Engineer
Water Resource Investigation Division
Kunjaban, Agartala

Copy to:

1. The PS to Secretary, PWD (WR), Govt. of Tripura, Secretariat Complex, Agartala, Tripura (W), *for favour of his kind information please.*
2. The Conservator of Forest (Territorial), Department of Forest (Member), Aranya Bhawan, Gurkhabasti, Agartala, Tripura (W)
3. The Regional Director, NE Region, CGWB (Member Secretary), Guwahati, Assam.
4. The Commissioner, Agartala Municipal Corporation (Member), City Centre, Agartala (W).
5. The Chief Engineer, PWD (WR) (Member), Visvesvaraya Complex, Kunjaban, Agartala, Tripura (W).
6. The Chief Engineer, PWD (DWS) (Member), Gurkhabasti, Agartala, Tripura (W).
7. The Chief Engineer, Agriculture, (Member), Krishi Bhavan, Agartala, Tripura (W).
8. The Chief Engineer, RD Department (Member), Nehru Complex, Gurkhabasti, Agartala, Tripura (W).
9. The Director Industries, Tripura (Member), Khejur Bagan, Agartala, Tripura (W).
10. The Head of Office, Tripura Space Application Centre (Member), Gurkhabasti, Agartala.

Cont.P/3

11. The General Manager, NABARD, Tripura (Member), Khejur Bagan, Agartala, Tripura (W).
12. The Director, Geological Survey of India (Member), Chandmari, 79 Tilla, Agartala, Tripura (W).
13. The Director - Fisheries (Member), P N Complex, Gurkhabasti, Agartala, Tripura (W)
14. The Officer Incharge, Indian Meteorological Department, Agartala (Near Airport), Agartala (W)
15. Scientist, Tripura State Pollution Control Board, Agartala
16. The Officer-in-Charge, State Unit Office, Agartala, CWGB, (Member) State Unit Tripura, Agartala.
17. The Executive Engineer, Water Resource Investigation Division, Nodal officer cum Member, Visvesvaraya Complex, Kunjaban, Agartala, Tripura (W).

30/8/24

(Er. M. Majumder)
Nodal Officer cum Member and Executive Engineer
Water Resource Investigation Division
Kunjaban, Agartala

6.5 SIGNED APPROVAL OF THE PSL COMMITTEE ON GWRE.

Approval of the GWRE-2024 by the members of the Permanent State Level Committee for Dynamic Ground Water Resource Estimation, Tripura

The meeting of the Permanent State Level Committee (PSLC) for Dynamic Ground Water Resource Estimation (DGWRE) was held on 29th August, 2024 at 5:00pm at the new Secretariat Complex, Government of Tripura under the chairmanship of Sh. Kiren Gitte, IAS, Secretary, PWD (WR), Government of Tripura. The meeting was attended by the esteem members of the PSLC. The State Unit Office Agartala presented the GWRE- 2024 of Tripura with the detailed methodology in front of the Committee Members.

The Committee unanimously cleared and accepted the GWRE-2024 for the State of Tripura. The Committee also emphasized the need for GWRE of the deeper aquifer & static resources in particular.

(Sh. Kiren Gitte, IAS)
Secretary, PWD (WR)
Government of Tripura

Conservator of Forest
Territorial, Tripura

Chief Engineer, PWD (WR)
Government of Tripura

Chief Engineer, PWD (DWS)
Government of Tripura

Chief Engineer, Agriculture
Government of Tripura

Chief Engineer, RD Dept.
Government of Tripura

Director Industries
Government of Tripura

General Manager
NABARD, Tripura

OIC, GSI, State Unit Tripura
Government of India

TSPCB.

AMC / MC
Agartala

Scientist/Engineer
TSAC, Tripura

Scientist-D & Officer In-charge
State Unit Office Agartala, CGWB

Executive Engineer, WR Inv. Div, PWD (WR)
Government of Tripura

7 PLATES

Figure 7-1: 1st meeting of the PSLC for GWRE-2024, Tripura under the Chairmanship of Secretary, PWD (WR) (Dt:04/05/2024)

Figure 7-2: 1st meeting of the PSLC for GWRE-2024, Tripura under the Chairmanship of Secretary, PWD (WR) (Dt:04/05/2024)

Figure 7-3: Presentation before the Secretary, PWD (WR) for the acceptance of GWRE-2024 on Tripura (Dt:29/08/2024)

Figure 7-4: Presenting a copy of GWRE-2024 Report to the Secretary PWD(WR), Govt. of Tripura.

State Unit Office, Agartala
Central Ground Water Board
11, Dhaleswar Lane, Ashram Choumuhani,
Agartala, 799007, Tripura
Telephone: 0381-2553099, 2555876
Email: oic.agt-cgwb@gov.in ; oic.cgwb.agartala@gmail.com