15 -ാം കേരള നിയമസഭ

13 -ാം സമ്മേളനം

നക്ഷത്ര ചിഹ്നം ഇല്ലാത്ത ചോദ്യം നം. 1036 **11-02-2025 - ൽ മറുപടിയ്ക്ക്**

വാട്ടർ ടേബിൾ സംബന്ധിച്ച പഠനം

ചോദ്യം		ഉത്തരം	
ശ്രീ. ടി. സിദ്ദിഖ്		**ശ്രീ. റോഷി അഗസ്റ്റിൻ (ജലവിഭവ വകുപ്പ് മന്ത്രി)**	
(എ)	സംസ്ഥാനത്തെ വാട്ടർ ടേബിൾ സംബന്ധിച്ച് ജല വകുപ്പ് പഠനം നടത്തിയിട്ടുണ്ടോ; ഇത് സംബന്ധിച്ച് ഒടുവിൽ നടത്തിയ പഠന റിപ്പോർട്ടിന്റെ പകർപ്പ് ലഭ്യമാക്കാമോ?	(എ)	**സംസ്ഥാനമൊട്ടാകെയുള്ള ഭൂജലവകുപ്പിന്റെ നിരീക്ഷണ കിണറുകളിൽ നിന്നും കേന്ദ്ര ഭൂജല ബോർഡിന്റെ നിരീക്ഷണ കിണറുകളിൽ നിന്നും ശേഖരിക്കുന്ന ഭൂജല വിതാന ഡാറ്റായുടെ അടിസ്ഥാനത്തിൽ സംസ്ഥാനത്തെ വാട്ടർ ടേബിൾ സംബന്ധിച്ച പഠനം നടത്തുന്നുണ്ട്. ഭൂജലവകുപ്പും കേന്ദ്ര ഭൂജല ബോർഡും സംയുക്തമായി ജല വിതാന ഡാറ്റ, മഴയുടെ അളവ്, റീചാർജ്ജ്, ജല ഉപഭോഗം എന്നിവയുടെ അടിസ്ഥാനത്തിൽ ഗ്രൗണ്ട് വാട്ടർ എസ്റ്റിമേഷൻ കമ്മിറ്റി റിപ്പോർട്ട് വർഷം തോറും തയ്യാറാക്കാറുണ്ട്. ഈ പഠന റിപ്പോർട്ടിന്റെ പകർപ്പ് (സോഫ്റ്റ് കോപ്പിയായി) ഇതോടൊപ്പം ഉള്ളടക്കം ചെയ്യുന്നു.**

സെക്ഷൻ ഓഫീസർ

CGWB/KR/TR SERIES/2023-02

DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

Prepared by

भूजल विभाग/ केंद्रीय भूजल बोर्ड, केरल क्षेत्र

केरल सरकार/ भारत सरकार

Ground Water Department & Central Ground Water Board,
Government of Kerala Government of India

तिरुवनंतपुरम/**THIRUVANATHAPURAM**

दिसंबर/ **December 2023**

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DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

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DYNAMIC GROUNDWATER RESOURCES OF KERALA (2023)

1.0 INTRODUCTION

Kerala is a tiny strip of land, located in the southwestern tip of India between north latitudes 8^0 18'and 12^0 48' and east longitudes 74^0 52' and 77^0 22', occupying only 1.2 percent of India's land area. Geographically, an elongated strip of land, cushioned between the Western Ghats on the east and the sandy shores of the Arabian Sea along west. Its land area is 38,863 sq.km, stretching 580 km in length and varying in width from 30 to 120 km. Even though Kerala has got only 1.2% of the total area of India (3,287,263 sq. km), 3 percent of country's population inhabits the state. The state is subdivided into 14 districts and 152 community development blocks for administrative convenience.

The occurrence and availability of ground water vary considerably from place to place within the state depending on the prevailing climatic, geomorphological and hydrogeological conditions. About 88 percent of the total geographical area of the state is underlain by crystalline rocks devoid of any primary porosity, with limited ground water prospects. In the alluvial formations having multiple aquifer systems, quality is sometimes a constraint in the optimal development of available resources. Increasing population and rapid urbanization has resulted in increasing use of ground water resources over the last few decades in the state. Judicious and planned development of ground water and its scientific management have become necessary to ensure long-term sustainability of this precious natural resource of Kerala. The ground water resources of the state are being periodically assessed jointly by the Central Ground Water Board (CGWB) with the State Ground Water Department and other Central Government as well as State Government agencies according to the methodology recommended by the Groundwater Estimation Committee constituted by Govt. of India from time to time. The previous assessment was carried out in 2022. Salient features of the estimation of dynamic ground water resources of Kerala on 2023, as per GEC-2015 recommendations are detailed in this report.

In order to improve the GEC assessment a new 'INDIA-GEC Software/Web Based Application namely, Automation of Estimation of Dynamic Ground Water Resources using GEC-2015' was used in this assessment (developed by CGWB through Vassar labs in collaboration with by IIT-Hyderabad). India GEC system will take data input through Excel as well as through other forms, compute various ground water components (recharge, draft, flux, etc.), classify the assessment unit into appropriate categories, develop visibility of 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 required formats.

1.1 Background

The first attempt to estimate the groundwater resources of the country on a scientific basis date back to the year 1979, when the 'Ground Water Over-Exploitation Committee' was constituted by Agriculture Refinance and Development Corporation (ARDC) of Reserve Bank of India for the purpose. The ground water resources of India were assessed based as per the norms recommended by the above committee. Subsequently, with the objective of refining the assessment methodology, the "Groundwater Estimation Committee (GEC)" headed by the Chairman, Central Ground Water Board (CGWB) came into existence. Based on the information gathered during the studies carried out by CGWB, the committee formulated the detailed methodology for estimation of groundwater resources in 1984 (GEC-84). The methodology was reviewed in 1997 in the light of feedback from different agencies and information gathered from various studies by the departments, a modified methodology was formulated in 1997(GEC-97) for computation of groundwater resources. This GEC-1997 methodology was modified subsequently, and GEC-2015 norms were issued. For the current analysis methodology as per GEC-2015 is being used with the aid of INDIA-GEC Software.

1.2. Constitution of the State Level Committee

Directions were issued by the Ministry of Water Resources; Government of India vide D.O. No.3/16/2008-GW dated 5.1.2010 to all States/Union Territories for the constitution of state Level Committees for co-ordination of various activities related to estimation of dynamic ground water resources as in 2009. Subsequently, a request (vide letter No.11(T20)10-11/561 dated 29.4.2010) was made for constitution of the committee by the Regional Director, Central Ground Water Board, Kerala Region, Thiruvananthapuram also for the constitution of the committee. In response, Water Resources Department, Government of Kerala issued orders vide G.O. (Rt) No.590/2010/WRD dated 18.05.2010 constituted the State Level Committee for Re-estimation of Ground Water Resources of Kerala. The committee had continued for the estimation of dynamic ground water resources of Kerala in the years 2011, 2013, 2017, 2020,2022 (**Annexure I (a)**).

Currently, as per the direction from Central Head quarter of Central Ground Water Board, ground water Resources estimation has to be carried out as per the methodology GEC-2015 as on 2023. In this regard the committee was again re-constituted (in accordance with the request from the Regional Director, CGWB) by vide G.O. (Rt) No.GW1/309/2021-WRD dated 10.06.2022 (**Annexure I (b)**). The members of the committee are as enlisted:

Additional Chief Secretary, Water Resources Department	**Chairman**
The Director Ground Water Department	Member
The Director, Agriculture Department	Member
The Managing Director, Kerala Water Authority	Member
The Chief engineer, Irrigation and Administration	Member
The Director, Dept. of Industry & Commerce	Member
The Executive Director, Centre for Water Resources Development & Management	Member
Regional Director, CGWB, Thiruvananthapuram	Member Secretary

The assessment of the dynamic resources of Kerala as on 2023 was approved by the committee and the Chairman directed Regional Director, CGWB to share the report/presentation with all members. Copy of the minutes of the meeting of 1st and 2nd SLC is presented in **Annexure II.**

1.3 Ground Water Estimation Procedure

As per directions of the Central Ground Water Board, dedicated Ground Water Resource Assessment Cells were constituted at both Central Ground Water Board and State Ground Water Department to facilitate realistic and co-ordinated estimation of ground water resources. The exercise of resource estimation commenced with the collection, collation, compilation, and validation of relevant data from various sources. A critical evaluation of the results of the ground water resource assessment taken up during 2017 was undertaken with focus on assessment units categorized as “Over-exploited” and “Critical”. The present ground water scenario in these assessment units were reviewed with the help of field data.

The estimation of ground water resources as on 2023 was undertaken as per the GEC-2015 methodology and ground water resources were computed for all the assessment units. The results were validated in consultation with field professionals of CGWB and State Ground Water Department. Additional field data was collected and incorporated into the computations wherever required before finalizing the report.

As the ground water resources are to be computed block-wise, the basic data pertaining to the blocks were computerized initially such as geographic area, command and non-command area, recharge worthy area etc. As per available statistics on agriculture appears to indicate no significant increase in ground water extraction for the purpose of irrigation of food-crops. On the other hand, there is increase in the ground water extraction for drinking and domestic uses consequent of the population growth. The ground water extraction data collected during 6th

Minor Irrigation census and the additional data available from Ground water Department, Agricultural Department and local government bodies are utilized for the ground water resources computations. It is assumed that there is not much variations in ground water irrigations in the state and a proportional increase in the number of structures for homestead irrigation in the blocks as per the available field data were also incorporated. The dependency on domestic ground water extraction had some changes due to the availability of new surface water schemes in some of the cities and adjoining areas in the state.

Till 2013, only the dynamic ground water resources of each of the assessment unit were computed; but from assessment year-2017 onwards, the in-storage ground water resources (for both phreatic and confined aquifers) of each block were also computed. The total ground water resources of the assessment unit were attained by the addition of resources in dynamic as well as in-storage part.

The assessment of the ground water resources of Kerala as on 2023 was computed as per GEC-2015 norms and was approved in the 2nd meeting of the State Level Committee for the re-estimation of ground water resources of Kerala on 18.08.2023.

2.0 HYDROGEOLOGY

The occurrence and movement of groundwater in various litho-units underlying the State are mainly controlled by the physiography, geological setting, and structural features.

2.1 Physiography

The state can be sub-divided into three major units based on their Physiographic characteristics viz. the coastal plains/Lowlands, the midlands and the hill ranges/Highlands. The coastal plains have an elevation of less than 7.6m above mean sea level (a.m.s.l). The elevation of the midland region ranges from 7.6 to 76 m amsl and that of the hill ranges is more than 76 m above mean sea level. Along the hill ranges two distinct plateau regions are seen, the important being the Wayanad plateau, covering major part of Wayanad district, with elevations above 700 m.amsl and the Munnar plateau, located along the northern part of Idukki district with a general elevation of about 1000 m.amsl are the prominent plateaus in the hilly region of the state.

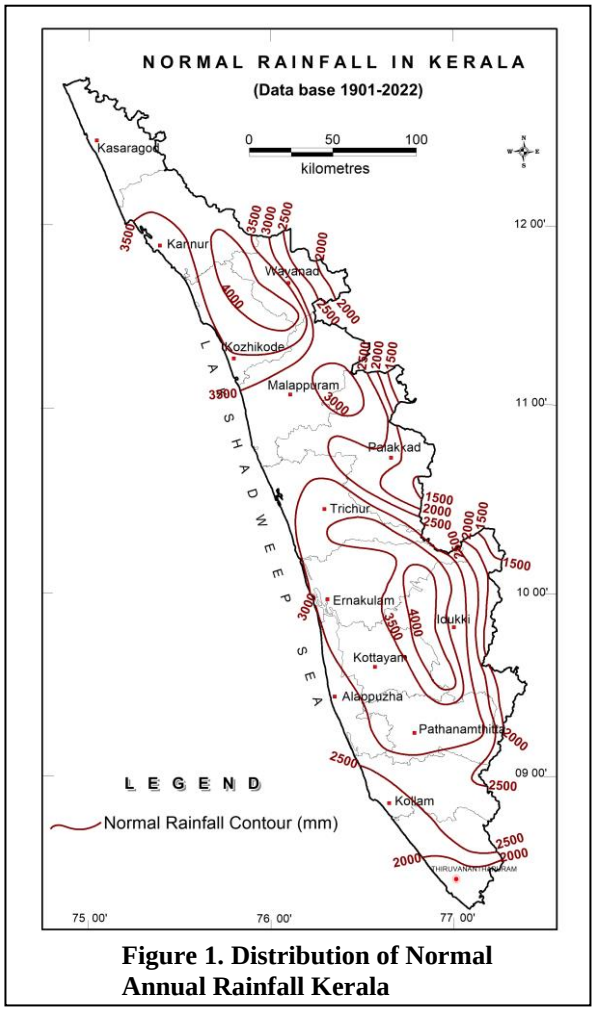

Figure 1. Distribution of Normal Annual Rainfall Kerala

2.2 Rainfall

Kerala receives normal annual rainfall of 2807 mm (2022-23), received mainly during the Southwest Monsoon period, extending from May to October, followed by the Northeast Monsoon in the months of November and December. The period between May and October accounts for about 77 percent of the annual rainfall. This period has been considered as monsoon season for computation of monsoon rainfall recharge. The amount of rainfall received shows a gradual decrease from North to South. The spatial distribution of normal annual rainfall in the State is shown in **Fig 1.**

2.3 Geology

As much as 88% of the State is underlain by crystalline rocks of Archaean age comprising schistose formations, Charnockites, Khondalites and gneisses. All these formations are intruded by dykes of younger age. The sedimentary formations of Tertiary age occurring along the western parts of the State comprise four distinct beds viz. Alleppey, Vaikom, Quilon and Warkali. The crystalline and the Tertiary formations are lateralized along the midland area. Alluvial deposits of recent origin are seen along the coastal plains. The general stratigraphic sequence is given in **Table 1.**

Table 1: Stratigraphic Succession of Geological Formations in Kerala

AGE	FORMATION	LITHOLOGY
Recent	Alluvium	Sand, clay, riverine alluvium etc.
Sub-recent	Laterite	Derived from crystalline and sedimentaries
Tertiary	Warkali	Sandstone, clays with lignite
	Quilon	Limestone, marl and clay
	Vaikom	Sandstone with pebbles, clay and lignite
	Alleppey	Carbonaceous clay and fine sand
Undated	Intrusives	Dolerite, Gabbro, Granites, Quartzo - feldspathic Veins.
Archaean	Wayanad group	Granitic gneiss, Schists etc.
	Charnockites	Charnockites and associated rocks
	Khondalites	Khondalites suite of rocks and its associates

2.4 Occurrence of Groundwater

A generalized Hydro-geological Map of Kerala is given in **Fig 2.** In hard rock terrain, comprising weathered crystallines and laterites, ground water occurs under phreatic conditions in the weathered residuum and the shallow fractures hydraulically connected to it; below this semi-confined to confined conditions prevails in the deep fracture zones. In the alluvial terrain, ground water in the shallow systems is in phreatic condition. Granular zones in the Tertiary sedimentary formations at deeper levels and forms potential confined to semi-confined aquifers.

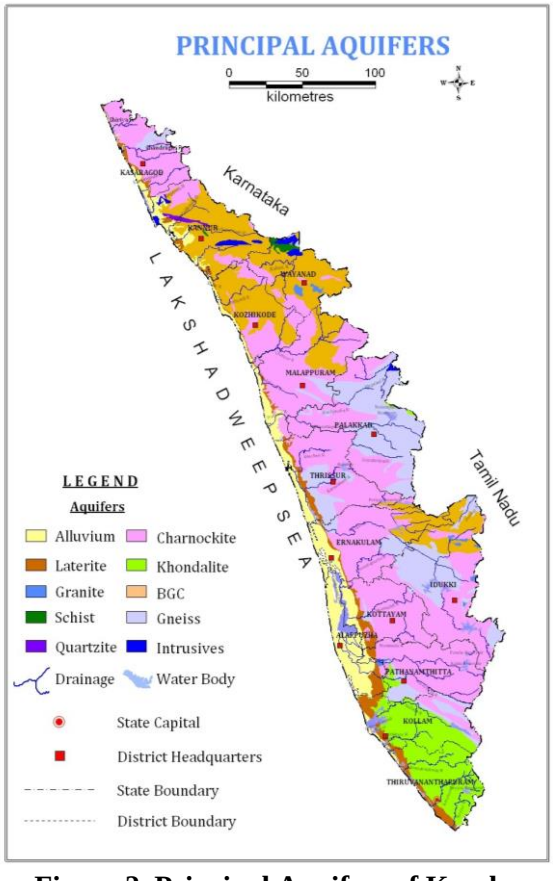

Figure 2. Principal Aquifers of Kerala

2.4.1 Crystalline Rock Aquifers

The shallow aquifers of the crystalline rocks are made up of the highly decomposed weathered zone or partly weathered and fractured rocks. Thick weathered zone is seen along the midland area either beneath the laterites or exposed. In the hill ranges thin weathered zone is seen along topographic lows and area with lesser elevation and gentle slope. In areas along the hill ranges generally rock

exposures are seen. The depth to water level in this aquifer varies from 2 to 16 mbgl and the yield of the well ranged between 2 to 10 m^3 per day.

Exploratory drilling carried out by Central Ground Water Board in the state in the crystalline formations has indicated that the fractures are encountered at depths ranging between 30 to 175 m.bgl with yield varying from less than 1 to as much as 35 litres per second (lps). In Charnockites, more than 40% of the wells have yielded more than 10 lps or above indicating that in Kerala, Charnockite suite of rocks are better aquifers compared to Khondalite group.

2.4.2 Tertiary Rock Aquifers

Groundwater occurs under phreatic condition in the shallow zone and under semi-confined to confined conditions in the deeper aquifers. The Tertiary formation of Kerala coast is divided into four distinct beds viz. Alleppey, Vaikom, Quilon and Warkali. These formations except the Alleppey beds seen as outcrops are lateritized wherever they are exposed. The maximum thickness of Tertiary sediments is found between Karunagapally and Kattoor and all the four beds are found in this area.

Groundwater is commonly developed through dug wells tapping the sandy zones at shallow depth in the Tertiary sediments. The depth to water level in this shallow zone ranges from 2.0 to 27 m.bgl and the yield of the wells range from 500 lpd to 10 m^3 per day.

The Vaikom and Warkali beds form the most potential aquifers in the Tertiary group. The Alleppey bed has been encountered at deeper levels in the bore holes drilled in the coastal tract of Alappuzha district and the formation water is found to be saline and hence, no tube well has been constructed tapping this formation.

In the Vaikom aquifers, the piezometric level is between 2 and 20 m above msl. The yield of the tube wells constructed in this formation ranges from 1 to 57 lps. This bed forms auto flow zones along the coast between Karunagapally in Kollam district and Nattika and Kaipamangalam in Thrissur district. The water is generally fresh south of Karuvatta in Alappuzha district. Also, exploration by CGWB proved that good quality groundwater pockets are in existence in this formation in and around Cochin and NW of Kottayam around Kallara-Udayanapuram areas.

Warkali aquifers are the most developed aquifer system among the Tertiary group. The urban and rural water supply in the coastal area between Kollam and Alappuzha is mostly dependent on this. The piezometric head is about 3 m. above msl along the eastern part of the sedimentary basin whereas it is 10 m. below msl in and around Alappuzha. The yield of the wells tapping this formation ranges from 3 to 14 lps.

The hydrogeological information on Quilon beds is very limited. The formation is a poor aquifer compared to Vaikom and Warkali beds.

2.4.3 Laterite Aquifers

Laterites are the most widely distributed lithological unit in the state and the thickness of this formation varies from a few meters to about 30 m. Laterite forms potential aquifers along topographic lows and valleys. The depth to water level in this formation ranges from 2 to 25 mbgl and the yield ranges from 0.5 to 30 m^3 per day. The occurrence and movement of groundwater in the laterites are mainly controlled by the topography. Laterite is a highly porous rock formation, which can form potential aquifers along topographic lows. However, due to the porosity, groundwater is drained from elevated places and slopes immediately after monsoon and hence water scarcity is experienced in the elevated places and hill slopes.

2.4.4 Alluvial Aquifers

The alluvial deposits form potential aquifer along the coastal plains and groundwater occurs under phreatic and semi-confined conditions in this aquifer. The thickness of this

formation varies from few meters to above 100 m and the depth to water level ranges from less than a meter to 6 mbgl. Filter point wells are feasible wherever the saturated thickness exceeds 5m. This potential aquifer is extensively developed by dug wells and filter point wells throughout the state and the yield ranges from 5 to 35 m^3 per day.

The depth to water level is being monitored from 1610 monitoring wells distributed throughout the state during the months of April, August, November and January. The water level measured during the month of April is taken as pre-monsoon water level and the data of August and November are taken as post-monsoon water level depending on the rainfall distribution. The depth to water level mostly depends on the hydrogeological conditions of the area as well as topography, rainfall pattern etc. In coastal plains the depth to water level is generally restricted to 6 mbgl. In midland areas, where the undulating topography is seen, the depth to water level generally varies from near ground level to 25 mbgl. The variation is mostly due to topographical variations, thickness of lateritic overburden etc. In areas where laterites are underlain by sedimentary aquifers of Tertiary age, the water level goes very deep, even to the extent of 55 mbgl. In highlands the depth to water level is in the range of few cm to 10 mbgl depending on the topography and thickness of overburden (weathered zone).

2.5 Groundwater Level conditions

2.5.1 Depth to water level during Pre-monsoon Period (April 2022)

During the month of April 2022, the depth to water level in the State ranges from 0.16 mbgl (Ernakulam district) to 51.7 mbgl (Thiruvananthapuram district). The salient feature of the analysis is that the depth to water level over major part of the State lies within 10 m bgl. 85% of wells analysed are showing water level within 10 mbgl, while 15% of wells show depth to water level more than 10 m bgl.

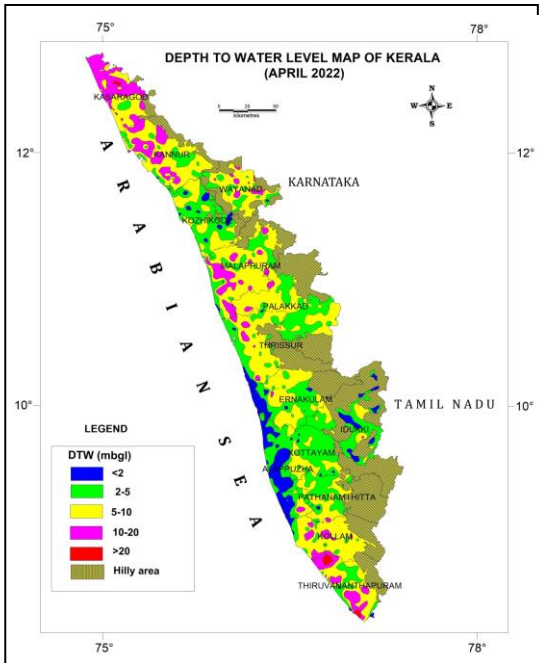

Figure 3 Spatial Distribution of Ground Water Levels in Kerala (Apr. 2022)

Depth to water level of less than 2 m bgl has been recorded in 11% of the analysed wells and noted in almost all districts of the State except Kasargod district. Depth to water level in the range of 2 to 5 m bgl has been recorded in 31% of wells analysed and observed in almost all the districts. Depth to water level in the range of 5 to 10 m bgl has been recorded in 42% of wells analysed and observed in entire Kerala State. Depth to water level in the range of 10 to 20 m bgl has been observed in 14% of wells analysed and is observed in almost all districts except Pathanamthitta district. Depth to water level of more than 20 m bgl has been recorded in 1% of wells analysed and is observed as patches in Kannur and Thiruvananthapuram district. Spatial variation of ground water levels in Kerala during pre-monsoon season (April 2022) is given in figure 3.

2.5.2 Depth to water level during August 2022

The Ground Water scenario during August 2022 reveals that the depth to water level in the State ranges from 0.01 mbgl (Alappuzha, Ernakulam and Palakkad districts) to 52.2 mbgl (Thiruvananthapuram district). The salient feature of the analysis is that the depth to water level over major part of the State lies within 10 m bgl. 94% of wells analysed are showing water level within 10 mbgl, while 6% of wells show depth to water level more than 10 m bgl. Depth to water level of less than 2 m bgl has been recorded in 28% of the analysed wells and is observed in almost all districts of the State. Depth to water level in the range of 2 to 5 m bgl has been

recorded in 35% of wells analysed and observed in almost all the districts. Depth to water level in the range of 5 to 10 m bgl has been recorded in 31% of wells analysed and observed in entire Kerala State. Depth to water level in the range of 10 to 20 m bgl has been observed in 5% of wells analysed and is observed in almost all districts except Idukki, Kottayam and Pathanamthitta districts. Depth to water level of more than 20 m bgl has been recorded in 1% of wells analysed and is observed as patches in Kasaragod and Thiruvananthapuram districts.

2.5.3 Depth to Water Level during Post-monsoon Period (November 2022)

The Ground Water scenario during November 2022 reveals that the depth to water level in the State ranges from 0.01 mbgl (Kottayam district) to 52.82 mbgl (Thiruvananthapuram district). The salient feature of the analysis is that the depth to water level over major part of the State lies within 10 m bgl. 91% of wells analysed are showing water level within 10 mbgl, while 9% of wells show depth to water level more than 10 m bgl.

Depth to water level of less than 2 m bgl has been recorded in 21% of the analysed wells and is observed in almost all districts of the State except Kasaragod district. Depth to water level in the range of 2 to 5 m bgl has been recorded in 33% of wells analysed and observed in almost all the districts. Depth to water level in the range of 5 to 10 m bgl has been recorded in 38% of wells analysed and observed in entire Kerala State. Depth to water level in the range of 10 to 20 m bgl has been observed in 8% of wells analysed and is observed in almost all districts except Idukki, Palakkad and Pathanamthitta districts. Depth to water level of more than 20 m bgl has been recorded in 1% of wells analysed and is observed as patches in Thiruvananthapuram district. Spatial variation of ground water levels in Kerala during post-monsoon season (Nov-2022) is given in **figure 4.**

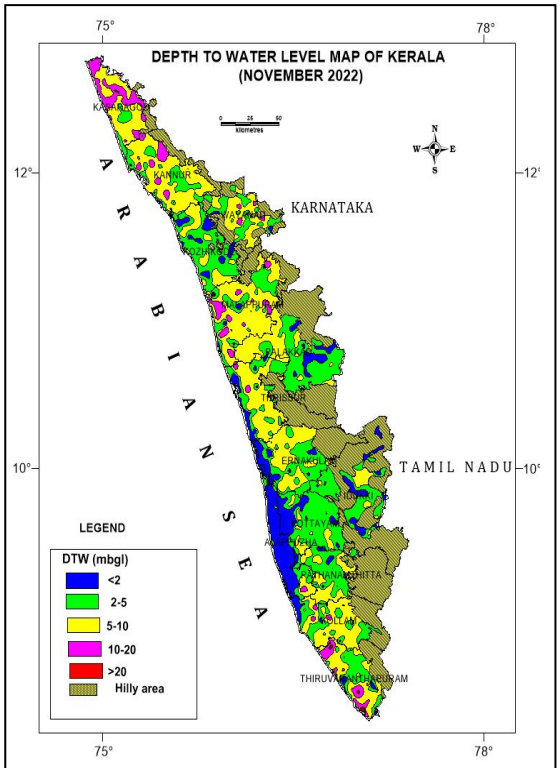

Figure 4. Spatial Distribution of Ground Water Levels in Kerala (Nov. 2022)

2.5.4 Depth to water level during January 2023

The Ground Water scenario during January 2023 reveals that the depth to water level in the State ranges from 0.15 mbgl (Kollam district) to 53 mbgl (Thiruvananthapuram district). The salient features of the analysis is that the depth to water level over major part of the State lies within 10 m bgl. 87% of wells analysed are showing water level within 10 mbgl, while 13% of wells show depth to water level more than 10 m bgl. Depth to water level of less than 2 m bgl has been recorded in 11% of the analysed wells and noted in almost all districts of the State except Kasargod district. Depth to water level in the range of 2 to 5 m bgl has been recorded in 32% of wells analysed and observed in almost all the districts. Depth to water level in the range of 5 to 10 m bgl has been recorded in 44% of wells analysed and noted in all districts of Kerala State.Depth to water level in the range of 10 to 20 m bgl has been observed in 12% of wells analysed and is observed in almost all districts. Depth to water level of more than 20 m bgl has been recorded in 1% of wells analysed and is observed as isolated patches in Thiruvananthapram and Thrissur districts.

2.5.5 Fluctuation of Ground Water Levels between April 2022 and November 2022

Comparison of November 2022 water level with April 2022 indicates that 1268 wells show rise in water level in 84% wells (1066 wells) and fall in water level in 16% wells (202 wells). Rise in the water level in the range of 0-2 m has been observed in 66% of wells analysed and observed in all over the State.Rise in the water level in the range of 2-4 m has been observed in 14% of wells analysed and observed in all the districts of the state, mainly in Kollam, Palakkad & Kasaragod districts. Rise in water level greater than 4 m has been observed in 4% of wells analysed and observed as isolated pockets in almost all districts except Alappuzha & Idukki districts. Fall in water level in the range of 0-2 m has been observed in 14% of wells analysed and observed in all the districts of the state, significantly in Ernakulam & Pathanamthitta districts. Fall in water level greater than2 m has been observed in 2% of wells analysed as isolated pockets. Figure 5 depicts the water level fluctuations between Apr-2022 and Nov-2022 in the State.

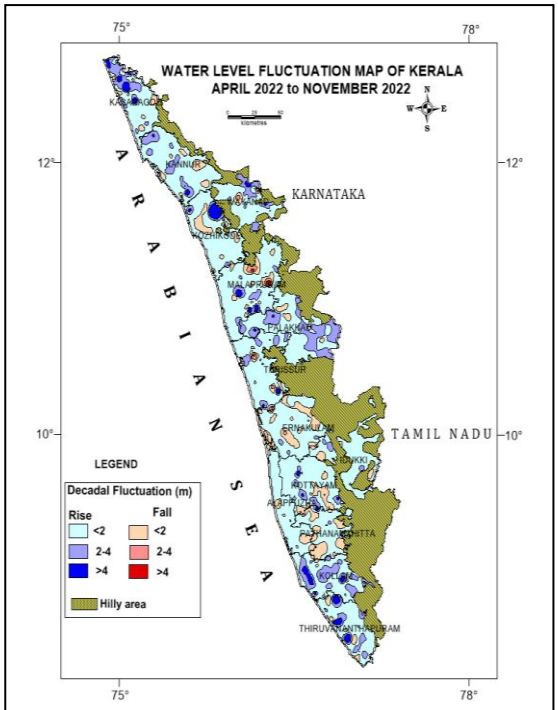

Figure 5. Water level fluctuation between April 2022 and November 2022

2.5.6 Long-term Fluctuation of Ground Water levels

The long-term water level data was analysed for the period of 2013-2022. The analysis of pre-monsoon water level trend for the last decadal period (i.e during 2013-2022) indicates that 32% of GWMWs have recorded negligible change in water level in the range of +0.05 to –0.05 m/year. 20 % of monitoring wells have recorded declining trend in the range of 0.05 to 0.2 m/year and11 % of monitoring wells have recorded declining trend above 0.2 m/year.23% of monitoring wells have recorded rising trend in the range of 0.05 to 0.2 m/year and 14% of monitoring wells have recorded rising trend above 0.2 m/year. Out of 1360 wells analysed declining trend in water level observed in 47% wells and rising trend in water level observed 53% wells. The analysis of post-monsoon water level trend for the last decadal period (i.e during 2013-2022) indicates that 24.8 % of GWMWs have recorded negligible change in water level in the range of +0.05 to –0.05 m/year. 7.7 % of monitoring wells have recorded declining trend in the range of 0.05 to 0.2 m/year and 2.3 % of monitoring wells have recorded declining trend above 0.2 m/year. 29.4 % of monitoring wells have recorded risingtrend in the range of 0.05 to 0.2 m/year and 35.8 % of monitoring wells have recorded rising trend above 0.2 m/year. Out of 1387 wells analsed rising trend in water level observed in 80.2% wells and declining trend in 19.8% wells. The data analysis indicates that the long-term ground water level trend shows rising trend in major portions of the state.

2.5.6.1 Fluctuation between Mean April (2012-2021) and April 2022

The change in water level over the last ten years period is brought out by the comparison of April 2022 water level with the mean value of April (2012-2021). A comparison of water level shows that a rise in the water level is recorded in 78% of wells analysed, while 22% recorded fall.

2.5.6.2 Fluctuation between Mean November (2012-2021) and November 2022

The change in water level over the last ten years period is brought out by the comparison of November 2022 water level with the mean value of November (2013-2021). A

comparison of water level shows that a rise in the water level is recorded in 46% of wells analysed, while 54% recorded fall.

2.6 Quality of Ground Water

Ground water in phreatic aquifers in Kerala, in general, is fresh and suitable for domestic, irrigation and industrial uses. About 84 % observation wells tapping the phreatic zone have electrical conductivity below 500 µS/cm at 25^0C. Isolated occurrence of brackish/saline ground water has been observed, mainly in the coastal districts and in the vicinity of tidal estuaries and streams. Fluoride above permissible limit of 1.5 mg/l has been observed in parts of Palakkad district in the phreatic zone and around Alappuzha town in the deeper zones and presence of Iron more than permissible limits in parts of most of the distrits, especially in the mid land areas. Nitrate is another constituent present above permissible limits in isolated pockets of most of the districts in the State. Bacterial contamination is observed in parts of most of the distrits and is found more in Alappuzha district.

3.0 GROUND WATER RESOURCES ESTIMATION METHODOLOGY, 2015.

Ground water resource as in 2023 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 is given below:

The methodology recommends aquifer wise ground water resource assessment of both the Groundwater resources components, i.e., Replenishable ground water resources or Dynamic Ground Water Resources and In-storage Resources or Static Resources. Wherever the aquifer geometry has not been firmly established for the unconfined aquifer, the in-storage ground water resources have to be assessed in the alluvial areas down to the depth of bed rock or 300 m, whichever is less. In case of hard rock aquifers, the depth of assessment would be limited to 100 m. In case of confined aquifers, if it is known that groundwater extraction is being done from this aquifer, the dynamic as well as in-storage resources are to be estimated. If it is firmly established that there is no ground water extraction from this confined aquifer, then only in-storage resources of that aquifer have to be estimated. Until aquifer geometry is established on appropriate scale, the existing practice of using watershed in hard rock areas and blocks/mandals/ firkas in soft rock areas may be continued.

It is also pertinent to add that as it is advisable to restrict the groundwater development as far as possible to annual replenishable resources, the categorization also takes into account 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 of time. Thus, water augmentation efforts can be successful in such areas, where the groundwater potential is high and there is scope for augmentation

In GEC-2015, two approaches were recommended for estimation of ground water recharge - water level fluctuation method and rainfall infiltration method. The water level fluctuation method is based on the concept of storage change due to difference between various input and output component. Input refers to recharge from rainfall and other sources and subsurface inflow into the unit of assessment. Output refers to groundwater extraction, evapotranspiration, base flow to streams and subsurface outflow from the unit. Since the data on subsurface inflow/outflow are not readily available, it is advantageous to adopt the unit for groundwater assessment as basin/sub basin/watershed, as the inflow/outflow across these boundaries may be taken as negligible.

Thus, it is ideal to have the groundwater resources assessment unit as watershed particularly in hard rock areas. In case of alluvium areas and where there is no data on water shed wise is available, administrative block can also be the assessment unit. In each assessment unit, hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge. Further, areas where the quality of groundwater is beyond the usable limits should be identified and handled separately. The remaining area after deleting the hilly area and separating the area with poor groundwater quality is to be delineated into command

and non-command areas. Groundwater assessment in command and non-command areas are done separately for monsoon and non-monsoon seasons.

3.1 Ground Water Assessment of Unconfined Aquifer

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

3.1.1 Assessment of Annually Replenishable or Dynamic Ground Water Resources

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

Inflow- Outflow= Change in Storage (of an Aquifer) …… (1)

The above equation can be further elaborated as –

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

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

It is preferred that all the components of water balance equation should be estimated in an assessment unit. Due to lack of data for all the components in most of the assessment units, it is proposed that at present the water budget may be restricted to the major components only, taking into consideration certain reasonable assumptions. The estimation is to be 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.

3.1.2 Rainfall Recharge

It is recommended that ground water recharge should be 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. This, however, requires adequately spaced representative water level measurement for a sufficiently long period. It is proposed that there should be at least three spatially well distributed observation wells in the assessment unit, or one observation well per 100 sq. Km. Water level data should also be available for a minimum period of 5 years (preferably 10 years), along with corresponding rainfall data. Regarding frequency of water level data, two water level readings, during pre and post monsoon seasons, are the minimum requirement. It would be ideal to have monthly water level measurements to record the peak rise and maximum fall in the ground water levels. In units or subareas where adequate data on ground water level fluctuations are not available as specified above, ground water recharge may be estimated using rainfall infiltration factor method only.

The rainfall recharge during non-monsoon season may be estimated using rainfall infiltration factor method only.

(a) Ground Water Level Fluctuation Method

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

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

Where,

ΔS - Change is storage

R_{RF} - Rainfall recharge

R_{STR} - Recharge from stream channels

R_{SWI} - Recharge from surface water irrigation

R_{GWI} - Recharge from ground water irrigation

R_{TP} - Recharge from Tanks& Ponds

R_{WCS} - Recharge from water conservation structures

VF - Vertical flow across the aquifer system

LF - Lateral flow along the aquifer system (through flow)

GE - Ground water extraction

T - Transpiration

E - Evaporation

B - Base flow

Whereas the water balance equation in command area will have another term i.e., Recharge due to canals (RC) and the equation will be as follows:

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

A couple of important observations in the context of water level measurement must be followed. It is important to bear in mind that while estimating the quantum of ground water extraction, the depth from which ground water is being extracted should be considered. One should consider only the draft from the same aquifer for which the resource is being estimated

The change in storage can be estimated using the following equation:

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

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 above equation 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 subunits,

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

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

Where base flow/ recharge to/from streams have not been estimated, the same is assumed to be zero. The rainfall recharge obtained by using equation (6) and (7) provides the recharge in any particular monsoon season for the associated monsoon season rainfall. This estimate is to be 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 ri 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, Ri 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 Ri and ri have been obtained as described above, a normalization procedure is to be 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 normalization procedure. The first method is based on a linear relationship between recharge and rainfall of the form.

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

Where,

R = Rainfall recharge during monsoon season

r = Monsoon season rainfall

a = a constant

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

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

Where,

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

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

r(normal) - Normal monsoon season rainfall

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

N - No. of years for which data is available

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

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

Where,

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

r(normal) - Normal monsoon season rainfall

a and b – constants

The two constants 'a' and 'b' in the above equation are obtained through a linear regression analysis. The computational procedure to be followed in the second method is as given below:

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

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

Where,

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

(b) Rainfall Infiltration Factor Method

The rainfall recharge estimation based on Water level fluctuation method reflects actual field conditions since it considers 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, it is recommended to compare the rainfall recharge obtained from water level fluctuation approach with that estimated using rainfall infiltration factor method. Recharge from rainfall is estimated by using the following relationship –

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

Where,

R_{RF} - Rainfall recharge in ham

A - Area in hectares

RFIF - Rainfall Infiltration Factor

R - Rainfall in mm

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

The threshold limit of minimum and maximum rainfall event which can induce recharge to the aquifer is to be 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. It is suggested that 10% of Normal annual rainfall may be taken as minimum rainfall threshold and 3000 mm as maximum rainfall limit. While computing the rainfall recharge, 10% of the normal annual rainfall is to be deducted from the monsoon rainfall and balance rainfall would be considered for computation of rainfall recharge. The same recharge factor may be used for both monsoon and non-monsoon rainfall, with the condition that the recharge due to non-monsoon rainfall may be 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 may be estimated for normal rainfall, based on recent 30 to 50 years of data.

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 have to be compared with each other. A term, Percent Deviation (PD) which is the difference between the two expressed as a percentage of the later is computed as

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

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

3.1.3 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 as follows;

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

Sl. No.	Source	Estimation Formula	Parameters
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

Lateral Flow along the Aquifer System (Through Flow)

In equations 6 & 7, if the area under consideration is a watershed, the lateral flow across boundaries can be considered as zero in case such estimates are not available. If there is inflow and outflow across the boundary, theoretically, the net inflow may be calculated using Darcy law, by delineating the inflow and outflow sections of the boundary. Besides such delineation, the calculation also requires estimate of transmissivity and hydraulic gradient across the inflow and outflow sections. These calculations are most conveniently done in a computer model. It is recommended to initiate regional scale modelling with well-defined flow boundaries. Once the modelling is complete, the lateral throughflows (LF) across boundaries for any assessment unit can be obtained from the model. In case Lateral Flow is calculated using computer model, the same should be included in the water balance equation.

Base Flow and Stream Recharge

If stream gauge stations are located in the assessment unit, the base flow and recharge from streams can be computed using Stream Hydrograph Separation method, Numerical Modelling and Analytical solutions. If the assessment unit is a watershed, a single stream monitoring station at the mouth of the watershed can provide the required data for the calculation of base flow. Any other information on local-level base flows such as those collected by research centres, educational institutes or NGOs may also be used to improve the estimates on base flows.

Base flow separation methods can be divided into two main types: non-tracer-based and tracer based separation methods. Non-tracer methods include Stream hydrograph analysis, water balance method and numerical ground water modelling techniques. Digital filters are available for separating base flow component of the stream hydrograph.

Hydro-chemical tracers and environmental isotope methods also use hydrograph separation techniques based on mass balance approach. Stream recharge can be computed either using modelling techniques or simply by applying the Darcy Law. Base flow assessment and Stream recharge should be carried out in consultation with Central Water Commission in order to avoid any duplicity in the estimation of total water availability in a river basin.

Vertical Inter Aquifer Flow

This can be estimated provided aquifer geometry and aquifer parameters are known. This can be calculated using the Darcy's law if the hydraulic heads in both aquifers and the hydraulic conductivity and thickness of the aquitard separating both the aquifers are known. Ground water flow modelling is an important tool to estimate such flows. As envisaged in this report regional scale modelling studies will help in refining vertical inter aquifer flow estimates.

Evaporation and Transpiration

Evaporation can be estimated for the aquifer in the assessment unit if water levels in the aquifer are within the capillary zone. It is recommended to compute the evaporation through field studies. If field studies are not possible, for areas with water levels within 1.0mbgl, evaporation can be 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 should be taken as zero.

Transpiration through vegetation can be estimated if water levels in the aquifer are within the maximum root zone of the local vegetation. It is recommended to compute the transpiration through field studies. Even though it varies from place to place depending on type of soil &vegetation, in the absence of field studies the following estimation can be followed. If water levels are within 3.5m bgl, transpiration can be estimated using the transpiration rates available for other areas. If it is greater than3.5m bgl, the transpiration should be taken as zero.

For estimating evapotranspiration, field tools like Lysimeters can be used to estimate actual evapotranspiration. Usually, agricultural universities and IMD carry out lysimeter experiments and archive the evapotranspiration data. Remote sensing-based techniques like SEBAL (Surface Energy Balance Algorithm for Land) can be used for estimation of actual evapotranspiration. Assessing offices may apply available lysimeter data or other techniques for estimation of evapotranspiration. In case where such data is not available, evapotranspiration losses can be empirically estimated from PET data provided by IMD.

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 subunit 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 subunits available in the assessment unit.

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 subunit and stream inflows & outflows during non-monsoon season is the total recharge/ accumulation during non-monsoon season for the subunit. Similarly, this is to be computed for all the subunits available in the assessment unit.

3.2. 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 subunit. Similarly, this is to be computed for all the subunits available in the assessment unit.

3.3. 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.

Annual Extractable Groundwater Recharge = Total Annual Groundwater Recharge - Natural discharge.

The ground water base flow contribution limited to the ecological flow of the river should be determined which will be deducted from Annual Ground Water Recharge to determine Annual Extractable Ground Water Resources (EGR). The ecological flows of the rivers are to be determined in consultation with Central Water Commission and other concerned river basin agencies. In case base flow contribution to the ecological flow of rivers is not determined then following assumption is to be followed.

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, present practice (GEC 1997) of allocation of unaccountable natural discharges to 5% or 10% of annual recharge may be retained. If the rainfall recharge is assessed using water level fluctuation method this will be 5% of the annual recharge and if it is assessed using rainfall infiltration factor method, it will be 10% of the annual recharge. The balance will account for Annual Extractable Ground Water Resources (EGR)

3.4. Estimation of Annual Ground Water Extraction

Ground water draft or extraction is to be 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

(a)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 (e.g. 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.

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

There are several methods for estimation of extraction for domestic use(GE_{DOM}). Some of the commonly adopted methods are described here.

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

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

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

Where,

Lg = 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.

(c) 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,

Lg = 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.

3.5 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.

3.6 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

3.7 Categorization of Assessment Unit

As emphasized 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.

(a) Categorization of Assessment Unit Based on Quantity

The categorization 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

(b) Categorization of Assessment Unit Based on Quality

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

3.8. Allocation of Ground Water Resource for Utilization

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 has to be based on population as 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 is recommended

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

Where,

Alloc = Allocation for domestic water requirement

N = population density in the unit in thousands per sq. km.

Lg = fractional load on ground water for domestic water supply (≤ 1.0)

In deriving equation (19), it is assumed that the requirement of water for domestic use is 60 lpd per head. The equation can be suitably modified in case per capita requirement is different. If by chance, the estimation of projected allocation for future domestic needs is less than the current domestic extraction due to any reason, the allocation must be equal to the present-day extraction. It can never be less than the present-day extraction; in Kerala conditions it is 150 lpcd hence 22 in eqn--(19) becomes 55.

3.9 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 should be 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 will be zero.

3.10 Additional Potential Resources under Specific Conditions

(a) 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 not to be used for Categorization. Spring discharge measurement is to be 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. The committee recommends that in hilly areas with substantial potential of spring discharges, the discharge measurement should be made at least 4 times a year in parity with the existing water level monitoring schedule.

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

Where,

Q = Spring Discharge

No of days = No of days spring yields

(b)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 can be done by adopting the following equation:

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

Where,

D = Depth to water table below ground surface in pre-monsoon period in shallow aquifers.

A = Area of shallow water table zone.

S_Y = Specific Yield

(c) 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 to be calculated over the water spread area and only for the retention period using the following formula.

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

Where,

N = No. of Days Water is Retained in the Area

A = Flood Prone Area

3.11 Apportioning of Ground Water Assessment from Watershed to Development Unit

Where the assessment unit is a watershed, the groundwater assessment is converted in terms of an administrative unit such as block / taluk / mandal. This is done by converting the volumetric resource into depth unit and then multiplying this depth with the corresponding area of the block.

3.12 Assessment of In-Storage Ground Water Resources or Static Ground Water Resources

The computation of the static or in-storage ground water resources may be done after delineating the aquifer thickness and specific yield of the aquifer material. The computations can be done as follows: -

$$SGWR = A \times (Z_2 - Z_1) \times S_Y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (23)$$

Where,

SGWR = Static or in-storage ground water resources

A = Area of the assessment unit

Z2= Bottom of unconfined aquifer

Z1 = Pre-monsoon water level

SY= Specific yield in the in-storage zone

3.13 Assessment of Total Ground Water Availability in Unconfined Aquifer

The sum of Annual Exploitable Ground Water Resource and the In-storage Ground Water Resources of an unconfined aquifer is the Total Ground Water Availability of that aquifer.

3.14 Ground Water Assessment of Confined Aquifer System

The assessment of the ground water resources of the confined aquifers is done by following ground water storage approach. If the areal extent of the confined aquifer is “A” then the total quantity of water added to or released from the entire aquifer is

$$Q = S \times A \times \Delta h \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (24)$$

Where,

Q = Quantity of water confined aquifer can release (m^3)

S = Storativity

A = Areal extent of the confined aquifer (m^2)

Δh = Change in Piezometric head (m)

Once the piezometric head reaches below the top confining bed, it behaves like an unconfined aquifer and directly dewaters the aquifer and there is a possibility of damage to the aquifer as well as topography. The quantity of water released in confined aquifer due to change in pressure can be computed between piezometric head (ht) at any given time 't' and the bottom of the top confining layer (ho) by using the following equation.

$$\boldsymbol{Q_P = S \times A \times \Delta h = S \times A \times (h_t - h_0)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (25)$$

Where,

QP = Ground Water Potential of Confined Aquifer

S = Storativity

A = Areal extent of the confined aquifer

Δh = Change in Piezometric head

h_t = Piezometric head at any particular time

h_0 = Bottom of the top Confining Layer

3.15. In-storage Ground Water Resources

The in-storage ground water resources are also calculated in this assessment. The depth zone considered for this calculation is 100 metres below ground level excluding water table fluction zone in hard rock area. In the soft rock area, the depth zone is 300 metres below ground level excluding the water table fluctuation zone. The thickness of clay zone also excluded as per the available data. The saline/ non potable water zones were also excluded for the in-storage ground water resource computations.

4.0 PROCEDURE FOLLOWED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

The dynamic ground water resources of Kerala, as on 2023 have been assessed as per the GEC-2015 norms.

4.1 Norms used in the Computation of Resources

Salient details of the norms used in the estimation of dynamic ground water resources are discussed below in brief:

4.1.1 Rainfall Infiltration Factor (RIF)

In the absence of documented studies for determination of Rainfall Infiltration Factor (RIF) in the State, standard values recommended by GEC have been used. The RIF values used for various geological formations in the State are shown below **(Table.2)**

Table 2: Values of Rainfall Infiltration Factor used for Computation of Dynamic Ground Water Resources of Kerala.

Sl.No	Geological Formation	Rainfall Infiltration Factor (RIF) (%)
1	Alluvium	8-12
2	Laterite	6-8
3	Weathered Granites/Gneisses	5-9
4	Rocks of Granulite facies	4-6
5	Massive/poorly fractured rock	1-3

4.1.2 Specific Yield

Specific yield values were taken as per the recommended norms in general, with appropriate corrections, considering the field conditions and data availability. The specific yield values taken for computation are given below **(Table.3).**

Table 3: Specific Yield Values of Different Hydrogeological Units Used in the Computation of Ground Water Resources of Kerala.

Sl.No.	Hydrogeological unit	Specific yield (%)
1	Sandy alluvial area	12-18
2	Valley fills	10-14
3	Silty/clayey alluvial area	5-12
4	Granites	0.2-2
5	Laterite	2-5
6	Weathered Granites & Gneisses	1-4
7	Massive/poorly fractured rocks	0.2-0.5

For instorage ground water resources computations, in the phreatic zone (Unconfined aquifer), the specific yield value of 10 to 20% of the water table fluctuation zone is taken up. In the semi confined and confined zones, the specific yield value of 5 to 10% of the water table fluctuation zone is taken up.

4.1.3 Unit Ground Water Extraction

As in the previous assessment (2022), ground water Extraction for domestic uses has been computed based on the population in 2011, projected to the year 2022. In the current analysis population in census year 2011 is projected to the assessment year of 2023. A per-capita requirement of 150 litre/ day has been assumed for domestic uses in the State. The fractional load of this requirement is computed based on the extent of surface water supply for domestic use in the assessment unit. In the allocation of water for domestics use as on 2025, projection of population from 2011 to 2025 was made as per standard population growth rates in the district.

Values of unit ground water extraction for irrigation for different types of wells, adopted in the previous assessment (2017), modified wherever necessary based on sample surveys in the present assessment for computation of ground water extraction. The unit extraction values for different types of wells in the State are shown in Table.4.

Table 4: Unit Ground Water Extraction for Irrigation in Different Types of Wells in Kerala.

Sl. No.	Type of Well	Unit Extraction (ha.m)
1	Non-energized dug wells	0.06 to 0.12
2	Energized dug wells	0.3 to 0.54
3	Shallow tube/bore wells	0.30 to 1.0
4	Domestic wells used for irrigation	0.007 to 0.05

4.1.4 Norms for recharge due to Tanks and Ponds

As the field study for computing recharge from tanks and ponds are limited, it was advised to follow the same norm as followed in GEC 1997. The norm recommended by GEC 2015 for seepage from tanks and ponds is 1.4 mm/day.

4.1.5 Norms for recharge due to Irrigation

For surface water, the recharge is to be estimated based on water released at the outlet. For groundwater, recharge is to be estimated based on the gross draft. Where continuous supply is used instead of rotational supply, an additional recharge of 5% of application may be used.

Where specific results are available from case studies, the adhoc norms are to be replaced by norms evolved from these results. The norms used for recharge from irrigation in the state is given in Table-5

Table 5: Recharge due to Irrigation

DTW mbgl	Ground water		Surface water	
	Paddy	Non Paddy	Paddy	Non Paddy
<=10 m bgl	45	25	50	30
11	43.3	23.7	48.3	28.7
12	40.4	22.1	45.1	26.7
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

4.1.6 Norms for recharge due to Water Conservation Structures

As per GEC 2015, the norms for Recharge from water conservation structures is 40% of the Gross storage during a year which is 40% of gross storage during a year which means 20% during monsoon season and 20% during non-monsoon season.

5.0 COMPUTATION OF GROUND WATER RESOURCES OF KERALA (2023)

5.1 Introduction

In the absence of watershed wise data on various components of recharge and discharge, the ground water resources have been computed for administrative units in the State, with block as the assessment unit. Accordingly, the computations have been made for 152 assessment units spread across 14 districts of the State. The ground water resources of urban habitations comprising 6 Municipal Corporations, 87 Municipalities and 1 Township have not been assessed separately due to constraints of data availability. Instead, they have been combined with one of the adjoining blocks based on their hydrogeologic setting. The list of such urban habitations and the blocks with which they have been combined is given in **Table.6.**

The area under command and non-command could not be separated mainly due to non-availability of data pertaining to canal command areas of the State. Further, the irrigation projects of Kerala are mostly planned for irrigating paddy along the topographic lows and as such the irrigation canals are all center controlled. Hence in each unit there are large areas along the upstream side of the canal, which do not get benefits of surface water irrigation. Due to the highly undulating topography of the mid land area where most of the canals exist, it is quite difficult to accurately demarcate the areas under command and non-command. In view of the factors mentioned above, the computations have been made by taking all assessment units as non-canal command area. However, the recharge from canal segments and return seepage from irrigation due to surface water in the command area have been incorporated into the computations. Salient details of assessment units in the State are furnished in **Annexure III A**. Data variables used in the estimation are shown in **Annexure III B** and details of parameters used in the computation in **Annexure III C**.

The data required for computation of resources have been collected, to the extent possible, with 2022 as the base year. Wherever data pertaining to 2022 are not available, the data pertaining to the most recent period have been collected and used for computation.

5.2. Method Adopted for Computing Rainfall Recharge During Monsoon:

Based on the analysis of long-term rainfall data in the State, the period from May to October has been considered as the monsoon period and from November to April as non-monsoon period. The method adopted for computation of rainfall recharge during normal monsoon season depends on the Percent Deviation (PD), which is the difference between the recharge computed using the Water Table Fluctuation method (WTFM) and Rainfall Infiltration Factor methods (RIFM), expressed as a as a percentage of the later is computed as;

$$PD = \frac{R_{rf}(normal,wtfm) - R_{rf}(normal,rifm)}{R_{rf}(normal,wtfm)} \times 100$$

where,

R_{rf} (*normal, wtfm*) = Rainfall recharge for normal monsoon season rainfall estimated by the ground water table 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

Table 6: List of Urban Habitations in Kerala which have been Combined with Adjacent Blocks for Assessment of Dynamic Ground Water Resources

Sl.No	District	Urban Habitation	Habitation Type	Block
1	Alappuzha	Cherthala	Municipality	Thycattusserry
2		Alappuzha	Municipality	Aryad
3		Kayamkulam	Municipality	Muthukulam
4		Chengannur	Municipality	Chenganur
5		Mavelikara	Municipality	Mavelikara
6		Harippad	Municipality	Harippad
7	Ernakulam	Aluva	Municipality	Vazhakulam
8		Angamaly	Municipality	Angamaly
9		Kalamassery	Municipality	Vazhakulam
10		Kothamangalam	Municipality	Kothamangalam
11		Maradu	Municipality	Palluruthy
12		Muvattupuzha	Municipality	Muvattupuzha
13		Paravur	Municipality	Paravur
14		Perumbavur	Municipality	Koovapady
15		Thrippunithura	Municipality	Mulanthuruthy
16		Kochi (Cochin)	Municipal Corporation	Edapally
17		Eloor	Municipality	Edapally
18		Thrikkakara	Municipality	Vazhakulam
19		Koothatukulam	Municipality	Pampakuda
20		Piravom	Municipality	Pampakuda
21	Idukki	Idukki Township	Township	Idukki
22		Thodupuzha	Municipality	Thodupuzha
23		Kattapana	Municipality	Kattapana
24	Kannur	Kannur	Municipal Corporation	Kannur
25		Koothuparambu	Municipality	Koothuparamabu
26		Mattanur	Municipality	Iritty
27		Payyannur	Municipality	Payyannur
28		Thaliparambu	Municipality	Thaliparambu
29		Thalassery	Municipality	Thalassery
30		Anthoor	Municipality	Taliparamba
31		Panur	Municipality	Panur
32		Iritty	Municipality	Iritty
33		Sreekantapuram	Municipality	Irikkur
34	Kasargod	Kanhangad	Municipality	Kanhangad
35		Kasargod	Municipality	Kasargod
36		Nileswaram	Municipality	Nileswar
37	Kollam	Karunagappalli	Municipality	Oachira
38		Kollam	Municipal Corporation	Mukhathala
39		Paravoor	Municipality	Ithikara
40		Punalur	Municipality	Pathanapuram
41		Kottarakkara	Municipality	Kottarakkara
42	Kottayam	Pala	Municipality	Lalam
43		Vaikom	Municipality	Vaikom
44		Kottayam	Municipality	Pallom
45		Chanaganassery	Municipality	Madapally
46		Ettumanoor	Municipality	Ettumanoor
47		Eratupetta	Municipality	Eratupetta
48	Kozhikode	Kozhikode	Municipal Corporation	Kozhikode
49		Quilandy	Municipality	Panthalayani
50		Vadakara	Municipality	Vadakara
51		Payyoli	Municipality	Mekadi
52		Mukkam	Municipality	Kunnamangalam
53		Koduvally	Municipality	Koduvally
54		Ramanattukara	Municipality	Kozhikode
55		Faroke	Municipality	Kozhikode
56	Malappuram	Kottakkal	Municipality	Vengara
57		Malappuram	Municipality	Malappuram
58		Manjeri	Municipality	Areakode
59		Nilambur	Municipality	Nilambur

Sl.No	District	Urban Habitation	Habitation Type	Block
60		Perinthalamanna	Municipality	Perinthalamanna
61		Ponnani	Municipality	Ponnani
62		Tirur	Municipality	Tirur
63		Parappanangadi	Municipality	Tirurangadi
64		Valancheri	Municipality	Kuttipuram
65		Tirurangadi	Municipality	Tirurangadi
66		Tanur	Municipality	Tanur
67		Kondotty	Municipality	Kondotty
68	Palakkad	Chittur-Thathamangalam	Municipality	Chittur
69		Ottapalam	Municipality	Ottapalam
70		Palakkad	Municipality	Palakkad
71		Shoranur	Municipality	Pattambi
72		Pattambi	Municipality	Pattambi
73		Mannarkkad	Municipality	Mannarkkad
74		Cherupalussery	Municipality	Sreekrishnapuram
75	Pathanamthitta	Adoor	Municipality	Parakkode
76		Patahanamthitta	Municipality	Konni
77		Thiruvalla	Municipality	Mallapally
78		Pandalam	Municipality	Pandalam
79	Thiruvananthapuram	Attingal	Municipality	Chirayinkeezh
80		Nedumangad	Municipality	Nedumanagad
81		Neyyattinkara	Municipality	Athiyannur
82		Varkala	Municipality	Varkala
83		Trivandrum	Municipal Corporation	Nemom
84	Thrissur	Chalakkudy	Municipality	Chalakkudy
85		Chavakkad	Municipality	Chavakkad
86		Guruvayur	Municipality	Chavakkad
87		Irinjalakuda	Municipality	Irinjalakuda
88		Kodungalur	Municipality	Mathilakam
89		Kunnamkullam	Municipality	Chowannur
90		Thrissur	Municipal Corporation	Puzhakkal
91		Wadakkanchery	Municipality	Wadakkanchery
92	Wayanad	Kalpetta	Municipality	Kalpetta
93		Sulthanbathery	Municipality	Sulthanbathery
94		Mananthavady	Municipality	Mananthavady

5.3 Total Annual Ground Water Recharge

The Total Annual Ground Water Availability in Kerala State as on 2023, has been computed as **5.53 Billion Cubic Metre (BCM)**. Rainfall recharge accounts for about **81.91** percent of the annual recharge, and the rest contributed from other sources. The contribution of districts to the total annual recharge of the State is shown in **Fig.6.** Details of block-wise total annual ground water recharge are shown in **Annexure III D.**

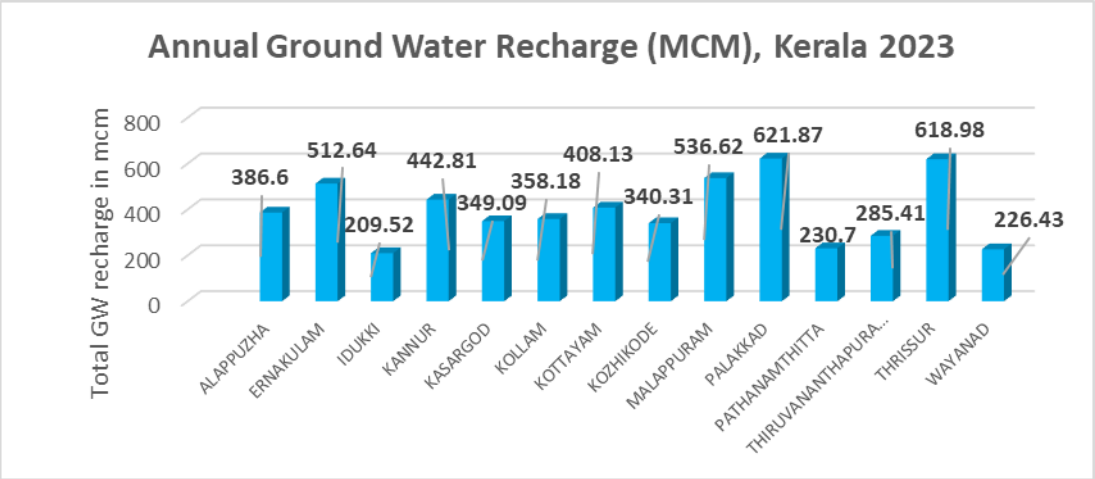

Figure 6. Contribution of districts to the Total Ground Water Recharge in Kerala

5.4 Annual Extractable Ground Water Recharge

The annual extractable ground water recharge was calculated as per the norms recommended in the 2015 methodology by deducting un-accounted losses and natural discharge (Environmental Flows) during the non-monsoon season from the Total Annual Recharge available. Such losses were considered to account for 10% of the total annual recharge in assessment units where the monsoon rainfall recharge was calculated using Rainfall Infiltration Factor Method and 5% in assessment units where the monsoon rainfall re-charge was calculated by Water Table Fluctuation Method. Block wise Annual Extractable Ground water Recharge in the State as in March 2022 is given in **Annexure III D.** As per the computation, Annual Extractable Ground Water Recharge for the entire State is **5.01 billion cubic metre (BCM)**. The district-wise availability in the State ranges from **188.57 MCM** in Idukki district to **567.68 MCM** in Palakkad district. The spatial distribution of Annual Extractable Ground Water Recharge in Kerala as on 2023 in depth units (m) is shown in **Fig.7.**

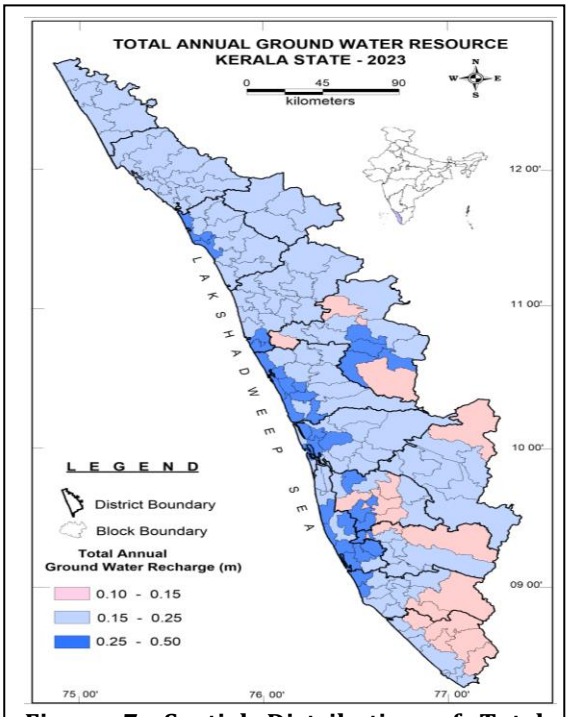

Figure 7. Spatial Distribution of Total Annual Ground Water Recharge in Kerala (2023)

5.5 Ground Water Extraction

Ground water Extraction in Kerala is mainly for domestic uses and for irrigation. There are several methods for the computation of extraction for domestic use (GE_{DOM}), irrigation use (GE_{IRR}) and industrial use (GE_{IND}). In view of the non-availability of data on the number of wells being used for domestic purposes, the ground water Extraction for domestic uses has been computed using consumptive use method in which block-wise based on 2011 population for Urban and Rural areas, projected to the year of assessment (2022). Domestic requirement of water in the State has been computed as the product of the population and the per-capita water requirement (assumed as 150 litres per capita per day). The fractional Load on ground water in the requirement has been computed as value ranging from 0 to 1 based on availability of surface water sources for domestic water supply (1 if entirely dependent on ground water and 0 if entirely on surface water sources). The Groundwater Extraction of Domestic use is estimated to be **1.59 BCM.**

The ground water Extraction for Irrigation uses has been computed using unit draft method, in which block-wise number of irrigation wells and its season-wise unit draft of each type of well collected by the State Ground Water Dept., Government of Kerala and MI 6th census. The unit draft of different types (eg. Dug well, dug cum bore well, shallow 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. The Groundwater Extraction of Irrigation use is estimated to be **1.12 BCM.**

The Extraction for Industrial uses is very less when compared to Domestic and Irrigation use, and has been estimated using unit draft and consumptive use pattern method, in which assessment unit wise number of wells, industrial units & type and season wise unit draft of each type of well collected by the State Ground Water Dept., Government of Kerala and extraction computed to be **0.01BCM**.

The Annual Ground Water Extraction for all uses in the State is of the order of **2.73 BCM** and ranges from **56.38 MCM** in Wayanad district to **346.53 MCM** in Malappuram district. Details of block- wise groundwater Extraction are given in **Annexure IIID**. The spatial distribution of ground water Extraction among districts in the State is shown in **Fig.8**.

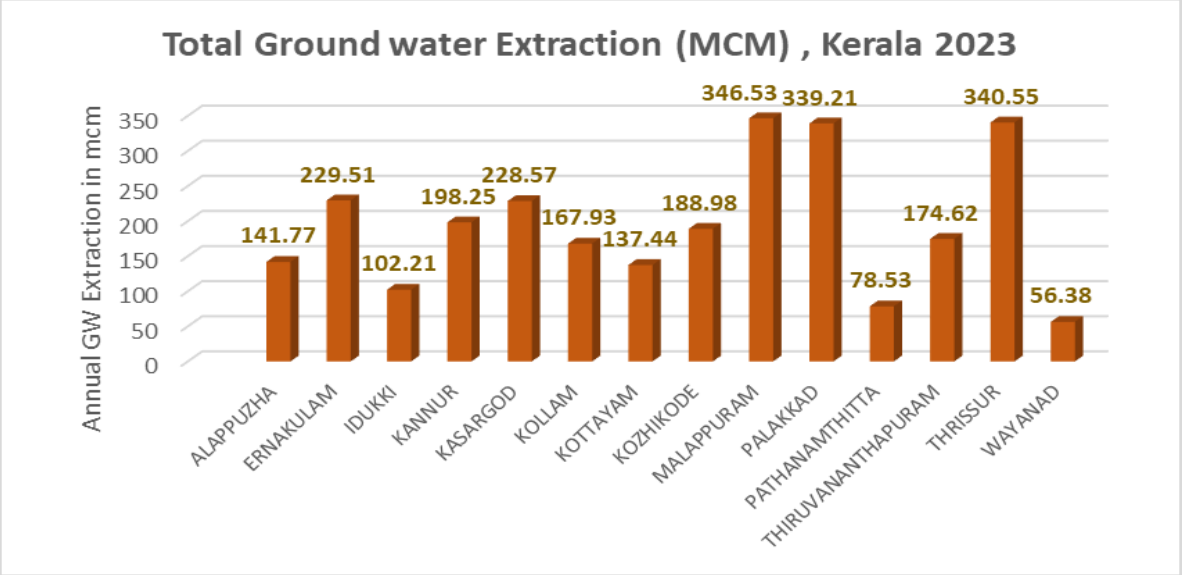

Figure 8. Distribution of Ground Water Extraction in Kerala as in March 2022

5.6 Annual Ground water Allocation for Domestic Use as on 2025

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. Based on population as 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. The estimate of allocation for domestic water requirement has been computed to be **2.19 BCM** as per GEC-2015 norms. The block-wise figures are given in **Annexure III D**

5.7 Net 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 and is computed to be **2.016 BCM**. The district-wise net ground water availability ranges from **55.29 MCM** in Kasaragod district to **228.99 MCM** in Kottayam district. The block-wise balance ground water available is shown in **Annexure III D**.

District-wise status of Annual Extractable Ground Water Recharge and Ground Water Extraction for all uses is shown in **Fig.9.**

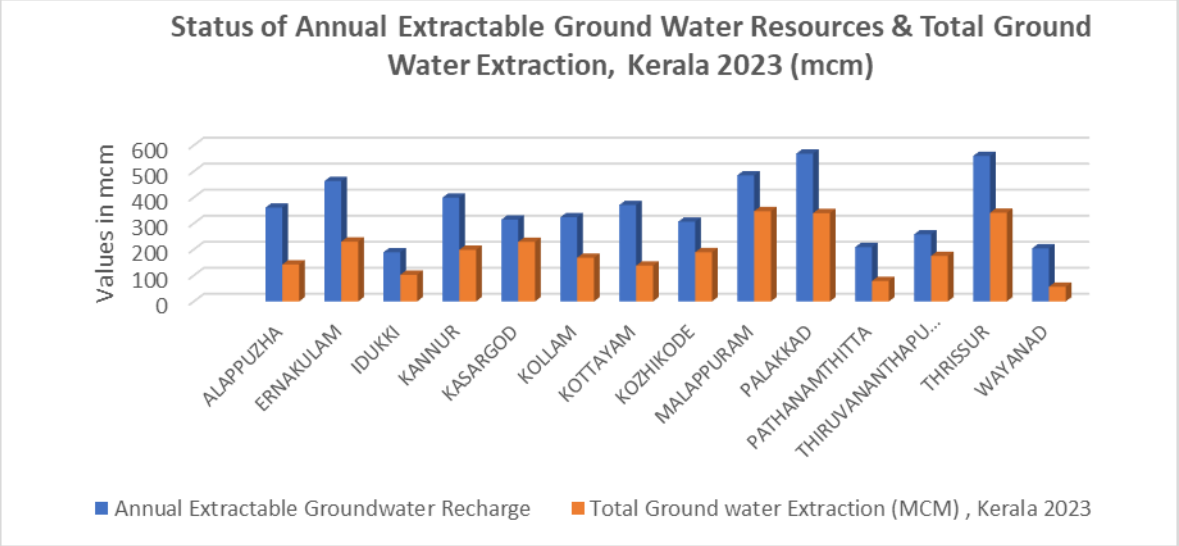

Figure 9. Status of Annual Extractable Ground Water Resources & Ground Water Extraction (As on 2023)

5.8 Stage of Ground Water Extraction and its Validation

The Stage of Ground Water Extraction of assessment units computed as the ratio of Existing Gross Ground Water Extraction for all uses and the Annual Extractable Ground Water Recharge expressed in percentage. Long term water level trends of ground water levels are prepared for a minimum period of 10 years for both pre-monsoon and post-monsoon period. The average water level trend as obtained from the different observation wells in the area is validated with the 'Stage of Ground Water Extraction'. The stage of Ground water extraction for the Kerala State is **54.55** %. The Stage of Ground Water Extraction is the highest in Kasaragod district **(72.75%)** and the lowest in Wayanad district **(27.67%).** Block-wise details of Stage of Ground Water Extraction as in 2023 are given in **Annexure III D.**

5.9 Categorization of Blocks

The Assessment units have been categorized as "Over-exploited", "Critical", "Semi-critical" and "Safe" based on Stage of Ground Water Extraction and the long-term decline of average ground water levels in the observation wells in the assessment unit, as per the criteria suggested in GEC-2015 methodology. After that the analysis has to be validated. If in a safe block (SOE≤70%) decadal water level trends are showing falling patterns, then the calculation is unacceptable and re-calculation needs to be made. Again, reassessment is necessary if in an OE block (SOE >100%) long term water level trends in observation wells are showing rising pattern.

Out of 152 assessed units in the State, **3** blocks (Chittur & Malampuzha blocks of Palakkad district and Kasaragod block of Kasaragod district) have been categorized as "Critical"; **30** blocks are "Semi-critical" and **119** blocks are in "Safe" category. The block-wise details of categorization, along with ground water quality issues wherever prevalent are furnished in **Annexure IIIE** and district-wise details of blocks under different categories are furnished in **Annexure IIIF**. The Stage of Ground Water Extraction and the block-wise long-term (2013-2022) water level trends of the observation wells being monitored by Central Ground Water Board and the State Ground Water Department for pre and post-monsoon were considered for categorization of the blocks. The spatial distribution of different categories of assessment units is given in **Figure 10**.

5.9.1 Quality tagging

Quality assessment of ground water is equally important as the quantity assessment. The major sources of quality concern are salinity, fluoride, and arsenic. It can vary depending on the area also. To adequately inform management decisions, quality of ground water is also an essential criterion. It was realized that based on the available water quality monitoring mechanism and available database on ground water quality it may not be possible to categorize the assessment units in terms of the extent of quality hazard. 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 the parameter is influencing an area in mappable units, then the parameter should be tagged to the assessment subunit. Apart from the salinity, fluoride, and arsenic, if there is any other parameter which is also mentioned. Five assessment units are affected by fluoride and are Chittur, Kollengode, Palakkad, Nenmara and Kuzhalmannam blocks of Palakkad district. Only one assessment unit is slightly affected by salinity i.e, Thalikulam block of Thrissur District. Other parameters like Iron and Nitrate wherever prevalent are furnished in **Annexure IIIE.**

5.10 District-wise Ground Water Resource Scenario

A summary of major components of dynamic ground water resources of Kerala is furnished in **Table. 6**. The summary of total ground water resources of Kerala is furnished in **Table.7**. Brief accounts of the resource scenario in the districts are given below:

5.10.1 Alappuzha

The district is underlain by unconsolidated sediments of Recent age and formations of Tertiary age. The sedimentary formations cover about 83% of the geographical area of the district. The alluvium and laterite form potential phreatic aquifers. The shallow ground water is generally fresh with low fluoride and nitrate content and is suitable for drinking, irrigation, and industrial uses. The Annual Extractable Ground Water Recharge of the district is **360.44 MCM** and existing Gross Ground Water Extraction is of the order of **141.77 MCM. The** Stage of Ground Water Extraction is **39.33 %.** All the blocks in the district are Safe from the point of view of ground water extraction.

5.10.2 Ernakulam

Charnockites and gneisses of Archaean age, laterite of sub recent age form the main geological units in the district. Ground water occurs under phreatic conditions in the weathered and fractured hard crystalline rocks, laterites and unconsolidated coastal sediments. The quality of ground water from the shallow zone in hard rocks, residual laterite and coastal alluvium is suitable for drinking and agricultural purposes. Localized salinity problems are observed. The Annual Extractable Ground Water Recharge of the district is **462.48 MCM** and existing Gross Ground Water Extraction is of the order of **229.51 MCM. The** Stage of Ground Water Extraction is **49.63%.** All the blocks in the district are Safe from the point of view of ground water extraction.

5.10.3 Idukki

Groundwater occurs under phreatic condition in the weathered crystallines and laterite throughout the district. The thickness of weathering and lateralization generally ranges from 3 to 20 mbgl. Along steep slopes and high ranges, the weathered mantle is absent or very thin, and is devoid of perennial phreatic aquifers. The Annual Extractable Ground Water Recharge of the district is **188.57 MCM** and existing Gross Ground Water Extraction is of the order of **102.21 MCM. The** Stage of Ground Water Extraction is **54.21%.** Out of 8 blocks in the district, 2 have been categorized as 'Semi-critical' (Kattappana and Nedumkandam) and 6 blocks as 'Safe'.

5.10.4 Kannur

Laterites and underlying Crystallines form important aquifers in the district. Bore wells and large diameter dug wells are the most common groundwater abstraction structures in the district. The chemical quality of ground water is generally good. The Annual Extractable Ground Water Recharge of the district is **398.53 MCM** and existing Gross Ground Water Extraction is of the order of **198.25 MCM.** The Stage of Ground Water Extraction is **49.75 %.** Out of 11 blocks in the district, 3 have been categorized as 'Semi-critical' viz; **Kannur, Thalassery and Panur** and 8 blocks as 'Safe'.

5.10.5 Kasaragod

The major aquifer types are Alluvium, Laterite and Crystallines. The yield of wells in alluvium ranges from 10 to 50m^3/day. The dug wells have the depth ranges from 4 to 16 mbgl, some of the wells in laterite uplands in Kasaragod taluk have depth upto 26 m bgl. Filter point wells with a depth of about 6 meters are constructed long the coastal areas especially along Kasargod, Kanhangad and Padannakkad areas. The yield of wells in laterite ranges from 5 to 50 m^3 /day in winter period and it returns to 2 to 10 m^3 /day in summer. In weathered crystallines the yield of well ranges from 1 to 10 m^3 /day in summer period. The Annual Extractable Ground Water Recharge of the district is **314.18 MCM** and existing Gross Ground Water Extraction is of the order of **228.57 MCM. The** Stage of Ground Water Extraction is **72.75%.** Out of 6 blocks in the district, 1 has been categorized as 'Critical' **viz. Kasaragod;** 1 as 'Semi-critical' viz. **Manjeshwar block** and 4 blocks as 'Safe'.

5.10.6 Kollam

The aquifer system of the district can be divided into three provinces i.e. the crystalline provinces covering the eastern upland, foothills and hilly tract, laterite province covering the midland region and the coastal province covering the alluvium and Tertiary sediments. The depth of weathering in crystalline (hard rock) province varies from 15 to 20m. The wells tapping these aquifers range in diameter from 2 to 5m and their depth vary from 5.0 to 20.0 mbgl. The yield of these wells is of the order of 12 m^3/day. The wells located in Charnockite vary in depth from 6 to 13 mbgl. The yield of the wells ranges from 4 to 5 m^3/day. A major part of the district is underlain by Laterite. The thickness of laterite capping in Charnockite area varies from 1 to 3 m and from 15 to 20 m in Khond alites. The depth of wells in laterite ranges from 5 to 30 mbgl. The coastal province has Tertiary sediments and Quaternary alluvium. The Tertiary formation consists of Warkali, Quilon and Vaikom beds overlain by 10 to 15 m thick alluvium. Ground water occurs in Warkali formation under phreatic and confined conditions. The dug wells in the Warkali beds tap groundwater from the laterite cappings. Often very deep dug wells are sunk into the underlying sandstone beds. Shallow dug wells sunk into the alluvium overlying the lateritic horizon of Tertiary sediments range in depth from 2 to 15 mbgl.

Apart from the coastal alluvial deposits, alluvial material composed mainly of clay and sand which are limited in aerial extent are confined to the flood plains of Achenkovil river and vary in depth from 3 to 5 m. Another type of aquifer is the inter mountain valley fills, which are composed of a highly assorted mixture of sand, gravels, pebbles and boulders. The Annual Extractable Ground Water Recharge of the district is **323.35 MCM** and existing Gross Ground Water Extraction is of the order of **167.93 MCM.** The Stage of Ground Water Extraction is **51.93%.** Out of 11 blocks in the district, 2 blocks **(Mukhathala and Sasthamkotta)** is 'Semi-critical' and 9 blocks are 'Safe'.

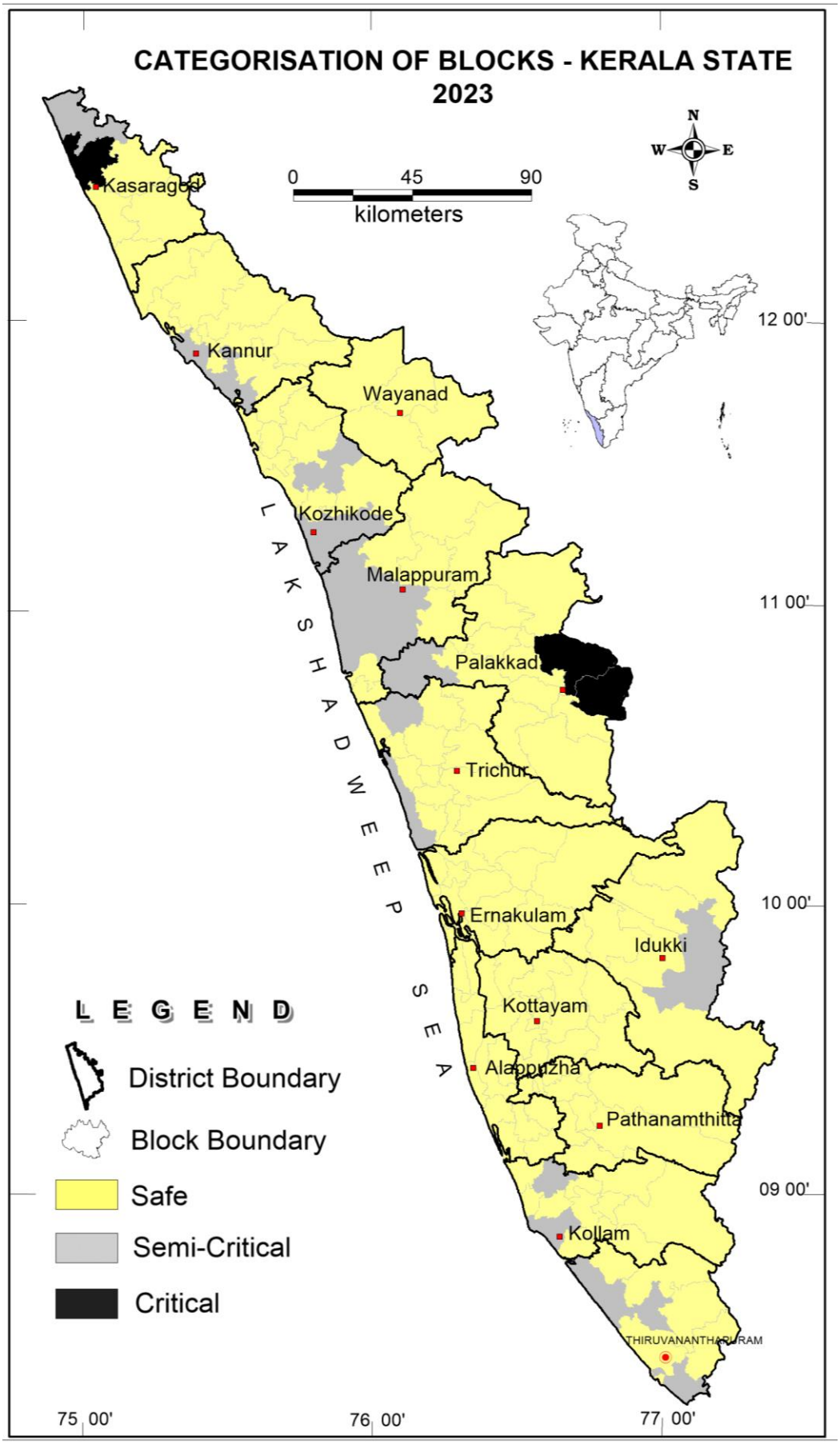

Figure 10. Categorization of Blocks in Kerala (2023)

5.10.7 Kottayam

The aquifers in the district can be grouped into four distinct groups viz. alluvial aquifers, lateritic aquifers, Tertiary sedimentary aquifers and crystalline rock aquifers. The crystalline rock aquifers can further be classified as shallow and deep aquifers. The shallow aquifers of the crystalline rocks in the area occur within a depth of 15 mbgl. They are composed of weathered crystalline and fractured crystalline occurring just below the weathered zone. The Tertiary sediments in the district are composed mainly of Vaikom beds. Groundwater occurs under phreatic condition in the shallow zone and under confined condition in the deeper zones. Groundwater is developed through both dug wells and tube wells in this formation. Laterites form potential aquifers along valley and topographic lows where the saturated zone is more and can sustain large diameter open wells. Alluvial aquifer is the most potential aquifer in the district and is commonly developed through dug wells. The Annual Extractable Ground Water Recharge of the district is **370.31 MCM** and existing Gross Ground Water Extraction is of the order of **137.44 MCM.** The Stage of Ground Water Extraction is **37.11%.** All the blocks in the district are in 'Safe' category.

5.10.8 Kozhikode

Groundwater occurs under phreatic conditions in the weathered and fractured crystalline rocks, laterite and shallow coastal aquifers. It occurs under semi confined to confined conditions in the deep-seated fractured aquifers of the crystalline rocks. The depth of dug wells tapping the shallow zones in the weathered/fractured crystalline area varies from 3 to 11 mbgl. The Annual Extractable Ground Water Recharge of the district is **306.28 MCM** and existing Gross Ground Water Extraction is of the order of **188.98 MCM.** The Stage of Ground Water Extraction is **61.70%.** Out of 12 blocks in the district, 3 are 'Semi-critical' **(Balussery, Kozhikode and Kunnamangalam)** and others are 'Safe'.

Table 7: Summary of Major Components of Dynamic Ground Water Resources of Kerala (2023)

Sl. No.	Assessment Unit/ District	Command / Non-Command / Total	Recharge from rainfall during monsoon season (MCM)	Recharge from other sources during monsoon season (MCM)	Recharge from rainfall during non-monsoon season (MCM)	Recharge from other sources during non-monsoon season (MCM)	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)] (MCM)	Provision for Total Natural Discharges (MCM)	Annual Extractable Ground Water Resource [(8)-(9)] (MCM)
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	ALAPPUZHA	Non-command	281.17	4.25	33.37	67.80	386.60	26.16	360.44
2	ERNAKULAM	Non-command	363.61	12.64	67.19	69.20	512.64	50.16	462.48
3	IDUKKI	Non-command	181.47	3.12	6.36	18.57	209.52	20.95	188.57
4	KANNUR	Non-command	381.96	8.57	14.64	37.64	442.81	44.28	398.53
5	KASARGOD	Non-command	282.13	11.69	14.06	41.20	349.09	34.91	314.18
6	KOLLAM	Non-command	256.17	8.37	66.56	27.08	358.18	34.84	323.35
7	KOTTAYAM	Non-command	298.42	7.69	46.36	55.67	408.13	37.81	370.31
8	KOZHIKODE	Non-command	310.07	4.55	11.51	14.18	340.31	34.03	306.28
9	MALAPPURAM	Non-command	406.13	10.12	43.14	77.23	536.62	52.28	484.34
10	PALAKKAD	Non-command	301.15	42.27	30.44	248.01	621.87	54.19	567.68
11	PATHANAMTHITTA	Non-command	170.08	4.90	36.55	19.17	230.70	22.00	208.70
12	TRIVANDRUM	Non-command	191.44	5.86	61.50	26.61	285.41	27.59	257.82
13	THRISSUR	Non-command	451.59	10.64	12.61	144.14	618.98	60.17	558.81
14	WAYANAD	Non-command	215.24	4.41	0.00	6.77	226.43	22.64	203.78
	KERALA STATE		**4090.62**	**139.08**	**444.30**	**853.27**	**5527.28**	**522.01**	**5005.27**
	TOTAL (BCM)		**4.09**	**0.14**	**0.44**	**0.85**	**5.53**	**0.52**	**5.01**

Table.7 (Continued)

Sl. No.	Assessment Unit/ District	Command / Non-Command	Annual Extractable Ground Water Recharge (MCM)	Current Annual Ground Water Extraction (MCM)				Annual Groundwater Allocation for Domestic use as on 2025	Net Ground Water Availability for future use (4-5-6-9)	Stage of Ground Water Extraction (%) (8/4) *100
				Irrigation Use	Industrial Use	Domestic Use	Total Extraction (5+6+7)			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	ALAPPUZHA	Non-command	360.44	37.37	2.62	101.78	141.77	104.55	215.90	39.33
2	ERNAKULAM	Non-command	462.48	79.46	2.14	147.91	229.51	190.56	190.32	49.63
3	IDUKKI	Non-command	188.57	60.66	0.13	41.42	102.21	41.42	86.35	54.21
4	KANNUR	Non-command	398.53	81.53	0.43	116.29	198.25	143.22	174.85	49.75
5	KASARGOD	Non-command	314.18	153.72	0.23	74.62	228.57	114.02	55.29	72.75
6	KOLLAM	Non-command	323.35	48.44	0.22	119.27	167.93	126.10	148.59	51.93
7	KOTTAYAM	Non-command	370.31	49.28	0.10	88.05	137.44	91.94	228.99	37.11
8	KOZHIKODE	Non-command	306.28	43.29	0.07	145.62	188.98	209.24	67.82	61.70
9	MALAPPURAM	Non-command	484.34	92.15	0.06	254.32	346.53	550.24	137.81	71.55
10	PALAKKAD	Non-command	567.68	178.56	6.13	154.52	339.21	223.22	182.20	59.75
11	PATHANAMTHITTA	Non-command	208.70	37.76	0.04	40.73	78.53	41.96	128.94	37.63
12	TRIVANDRUM	Non-command	257.82	48.92	0.07	125.62	174.62	135.68	73.14	67.73
13	THRISSUR	Non-command	558.81	199.02	0.39	141.14	340.55	171.27	188.12	60.94
14	WAYANAD	Non-command	203.78	13.24	1.59	41.55	56.38	50.47	138.48	27.67
	KERALA STATE		**5005.27**	**1123.41**	**14.22**	**1592.84**	**2730.47**	**2193.90**	**2016.80**	**54.55**
	TOTAL (BCM)		**5.01**	**1.12**	**0.01**	**1.59**	**2.73**	**2.19**	**2.02**	**54.55**

5.10.9 Malappuram

Ground water occurs in phreatic condition in almost all the geological formations in the district and under semi confined to confined condition in the deep-seated fractures in the crystalline rocks and in Tertiary sediments. Broadly the aquifer system in the district can be divided into three provinces viz. the crystalline province covering the eastern uplands, foothills and hilly tracts, the laterite province (covering the midland regions) and the coastal province covering the alluvium and Tertiary sediments. The eastern crystalline province essentially constitutes the hard rock aquifers and other intrusive. The depth of weathering varies from a few metres to 22 m and major portion of the district is covered by laterites and the thickness of it varies highly. Along the western part of the district coastal alluvium of Recent age is seen as a thin strip. Vaikom beds of Tertiary group are seen underlying the coastal alluvium The Annual Extractable Ground Water Recharge of the district is **484.34 MCM** and existing Gross Ground Water Extraction is of the order of **346.53 MCM.** The Stage of Ground Water Extraction is **71.55 %**. Out of 15 blocks in the district, 8 are 'Semi-critical' (Kondotty, Kuttipuram, Malappuram, Mankada, Thanur, Thirurangadi, Tirur & Vengara) and remaining blocks are 'Safe'.

5.10.10 Palakkad

Groundwater occurs in phreatic condition in the laterites, alluvium and in weathered crystallines. It is under semi confined to confined conditions in the deeper fractured rocks. Alluvium encountered along the bank of Bharathapuzha river (the largest river in Kerala) act as potential phreatic aquifer. The yield of the wells tapping the alluvium ranges from 5000 to 50000 lpd. The thickness of laterites varies from 2 to15 mbgl and the depth of dug wells ranges from 4 to 10 mbgl. The thickness of laterites increases towards the western parts of the district where the dug wells are potential. Along the western part the yield of the dugwells ranges from 500 to 10000 lpd. Along the eastern part the dug wells are quite deep, and it varies in depth from 7 to 32 mbgl with a varying yield in the range of 200 to 10000 lpd. The shallow and deep fractures in the crystalline rocks also form potential aquifers in the district and bore wells tapping these aquifers range in depth from 80.77 to 300.81 mbgl. The yield of these bore wells ranges from 2 to 25 lps. The Annual Extractable Ground Water Recharge of the district is **567.68 MCM** and existing Gross Ground Water Extraction is of the order of **339.21 MCM.** The Stage of Ground Water Extraction is **59.75%.** Out of 13 blocks in the district, 2 are 'Critical' (**Chittur & Malampuzha),** 2 blocks are 'Semi-critical'(**Pattambi and Thrithala)** and 9 blocks are 'Safe'.

5.10.11 Pathanamthitta

Groundwater in the district occurs under phreatic condition in the alluvium, laterite and weathered/fractured crystalline rocks. It occurs in semi confined/confined condition in the Tertiary sediments and deep-seated fractured aquifers in crystalline rock. Charnockites are the dominant crystalline rock type of the district. The dug wells in the crystalline rock area ranges in depth from 11 to 15 mbgl. The Tertiary sediments belonging to the Vaikom bed occurs below the alluvium and form potential semi consolidated aquifers. Groundwater occurs under confined/semi confined condition. The average thickness of unconsolidated Recent alluvium ranges from 4 to 6m. The Annual Extractable Ground Water Recharge of the district is **208.70 MCM** and existing Gross Ground Water Extraction is of the order of **78.53 MCM. The** Stage of Ground Water Extraction is **37.63%.** All the 8 blocks of the district have been categorized as 'Safe'.

5.10.12 Thiruvananthapuram

A major part of the district is underlain by the crystalline rocks. At places, sedimentary formations overlie the crystallines, especially in the western part of the district. Coastal belt is mostly occupied by the alluvial deposits of Recent origin. Ground Water exploration in the deeper aquifers of hard

rock area has indicated that yield varies from 1to7 lps whereas in sedimentaries, the yield goes up to 10 lps. The shallow aquifers are generally developed through dug wells in the hard rock areas; the yield varies from 1 to 3 lps. In alluvial areas, dug wells/ filter point wells are common structures; the yield varies from 2 to 5 lps. The Annual Extractable Ground Water Recharge of the district is **257.82 MCM** and existing Gross Ground Water Extraction is of the order of **174.62 MCM. The** Stage of Ground Water Extraction is **67.73 %.** Out of 11 blocks, 6 are 'Semi critical' (**Athiyannur, Chirayinkil, Nedumangad, Parassala, Pothencode and Varkala)** and 5 are 'Safe'.

5.10.13 Thrissur

Groundwater occurs both under water table and confined/semi confined condition in almost all the geological formations in the district. Confined/semi confined conditions are encountered in the deep fracture of the crystalline rocks and in the Vaikom beds of the sedimentaries. The dug wells tapping the phreatic aquifers range in depth from 3.5 to 22 mbgl. The yield of these wells' ranges from 1200 to 20000 lph. The Vaikom beds are encountered at depth ranges of 6-51 mbgl. The thickness of the beds ranges from 8-30m. The yield of tube wells tapping Vaikom beds varies from 24000 to 115000 lph. The laterite formations encountered along the midland regions of the districts act as a very good water table aquifer along valleys and low-lying regions. The depth of dug wells tapping the laterite formation ranges from 9 to 19 mbgl and the yield of these wells ranges from 800 and 20000 lph. The sandy coastal alluvium also constitutes a potential water table aquifer with depth of dug wells ranging between 4 and 7 m. Shallow filter point tube wells are constructed in areas where the thickness of the alluvium exceeds about 5 m. The yield of wells tapping the coastal alluvium ranges between 15000 and 40000 lph.

The Annual Extractable Ground Water Recharge of the district is **558.81 MCM** and existing Gross Ground Water Extraction is of the order of **340.55 MCM. The** Stage of Ground Water Extraction is **60.94%.** Out of 16 blocks in the district, 3 are 'Semi-critical' (**Chowannur, Mathilakam and Thalikulam).** All the other blocks are safe.

5.10.14 Wayanad

The district is covered by peninsular shield of Western Ghats and form the tri-junction of the Charnockites of the Western Ghats – The Nilgiri range and the southern extension of the Dharwars of Mysore. Major rock types are Wayanad supracrustals, gneisses and charnockites of Archaean, basic and acidic intrusives of Proterozoic, laterite of Sub-Recent age and the alluvium of the Recent age. Groundwater occurs in the weathered rocks, fractures of crystalline rocks and the alluvial formations. In weathered formations water occur under phreatic conditions and is mostly developed by dug wells for domestic and irrigation purposes. The Annual Extractable Ground Water Recharge of the district is **203.78 MCM** and existing Gross Ground Water Extraction is of the order of **56.48 MCM.** The Stage of Ground Water Extraction is **27.67 %.** All four blocks in the district are 'Safe'.

5.11 Comparison of the Dynamic Ground Water Resources as in (2022) & (2023)

A comparison of the major components of dynamic ground water resources of Kerala during 2022 and 2023, along with justification is given in **Table. 8.** A comparative analysis of the components of dynamic ground water resources during 2022 and 2023 shows that the annual extractable ground water recharge for Kerala during 2023 has decreased by 3.57 % when compared with the corresponding figures during 2022. The annual ground water Extraction for all uses has slightly increased during the period. The net ground water availability for future use in the state shows an decrease of 7.34 % in 2023 when compared to the corresponding figures computed in 2022. The Stage of Ground Water Extraction in the State shows an increase from 52.56 % during 2022 to

54.55 % during 2023. The variation in the spatial distribution of various recharge and discharge components resulting from changes in the precipitation (also during summer periods), increase in recharge from other sources and consequent water level fluctuations and attributed due to increased dependency on surface water sources for irrigation and domestic uses with increase in population has resulted in the change in the number of blocks in various categories when compared to the previous assessment. The number of 'Semi-critical' blocks in the State has increased from 27 to 30 whereas the number of 'Safe' blocks decreased from 122 to 119. There is no change in the number of Critical blocks. There is no overexploited category blocks.

Table 8: Comparison of Major Components of Dynamic Ground Water Resources of Kerala (2022 & 2023)

Sl. No	**Component**			**Variation in 2022 w.r. to 2020**	**Variation (%)**	**Remarks /Justification**
		2022	2023			
1	Total Annual Ground Water Recharge (MCM)	5732	5527	205	3.57	Variation due mainly to the changes in the precipitation (also during summer periods, delayed monsoon), and consequent water level fluctuations.
2	Annual Extractable Ground Water Recharge (MCM)	5193	5005	188	3.62	- do -
3	Total Ground Water Extraction (MCM)	2729	2730	1		Variation attributed due to increased dependency on surface water sources for irrigation and domestic uses with increase in population.
4	Net Ground Water Availability for Future use (MCM)	2177	2017	160	7.34	The variation is due to increase in the extractable ground water recharge as per GEC-2015 computation.
5	Stage of Ground Water Extraction (%)	52.56	54.55	1.99	1.70	

CONTRIBUTORS PAGE

I COMPUTATION OF GROUND WATER RESOURCES

CENTRAL GROUND WATER BOARD

1.	Roopesh G Krishnan	Scientist-C (HG)
2.	Rakhi U.R	Scientist-C (HG)
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4.	Dr. Aneesh Kumar V	Scientist-C (HG)
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4	Bushra A	Jr. Hydrogeologist
5	Aswin	Hydrogeologist
6	Indu P Nair	Jr. Hydrogeologist

II SCRUTINY

1.	Roopesh G Krishnan	Scientist-C (HG)
2.	Rakhi U.R	Scientist-C (HG)

III FINALISATION OF REPORT

1.	Mini Chandran	Head of Office, Kerala Region, Thiruvananthapuram
2	John V Samuel IAS	Director, Ground Water Department, Thiruvananthapuram

ANNEXURES

ANNEXURE I A: GOVERNMENT ORDER ON CONSTITUTION OF STATE LEVEL COMMITTEE FOR RE-ESTIMATION OF DYNAMIC GROUND WATER RESOURCES OF KERALA DATED 18.5.2010.

Abstract

Water Resources Department-State Level Committee for Re-estimation of Ground Water Resources-Constituted – Orders issued

_WATER RESOURCES (GROUND WATER) DEPARTMENT
G.O. (Rt)No:590/2010/WRD. Dated, Thiruvananthapuram, 18..05..2010

Read: 1. G.O. (Rt) No.900/2008/WRD. Dated 29.08.2008
2. G.O. (Rt) No. 262/2010/WRD. Dated, 06.08.2010
3. Letter No.11(T 20)/10-11/561 dated 29.04.2010 from the Regional Director, Central Ground water Board, Kerala region, Thiruvananthapuram

ORDER

Government have constituted a Committee for Estimation of Ground Water Resources of Kerala, as per the Ground Water Estimation Committee 1997 methodology with 2007-08 as base year vide Government Order read as 1st paper above. The above Committee is made a permanent Standing Committee for the State to do the ground water estimation of the State, vide Government Order 2nd cited.

Now the Regional director, Central Ground Water Board in his letter read as 3rd paper above has requested Government to constitute the State Level Committee for Re-estimation of Ground Water Resources as per the recommendation of Central Headquarters. After examination of the suggestion by the Regional director, Central Ground Water Board, Government are pleased to constitute a State Level Committee for Re-estimation of Ground Water Resources of Kerala, with the following members:

The Principal Secretary, Water Resources Department	-	Chairman
The Director, Ground Water Department, Thiruvananthapuram	-	Member
The Director, Agriculture Department	-	Member
The Managing Director, Kerala Water Authority	-	Member
The Chief Engineer, Irrigation & Administration	-	Member
The Director, Department of Industries & Commerce	-	Member
The General Manager, NABARD, Thiruvananthapuram	-	Member
The Executive Director, Centre for Water Resources Development and Management	-	Member
The Regional Director, Central Ground Water Board Thiruvananathapuram	-	Member Secretary

Terms of reference : The broad terms of reference of the Committee will be as follows:

(1) To estimate annual replenishable ground water resources of the State in accordance with the ground water resources estimation methodology
(2) To estimate the status of utilization of the annual replenishable ground water resource.

The Committee will submit its report within 6 months from the date of its constitution.

(BY ORDER OF THE GOVERNOR)

L. RADHAKRISHNAN
PRINCIPAL SECRETARY TO GOVERNMENT

To
The Members of the Committee
S/F, O/C

Forwarded / By order
Sd/
Section Officer

ANNEXURE I B: GOVERNMENT ORDER ON CONSTITUTION OF STATE LEVEL COMMITTEE FOR RE-ESTIMATION OF DYNAMIC GROUND WATER RESOURCES OF KERALA DATED 10.06.2022

629/2022

GOVERNMENT OF KERALA

Water Resources (GW) Department

No.GW1/309/2021-WRD 10-06-2022,Thiruvananthapuram

From

Additional Chief Secretary to Government

To

The Director, Ground Water Department, Thiruvananthapuram.
The Chief Engineer, Irrigation & Administration, Thiruvananthapuram.
The Director, Agriculture Department, Thiruvananthapuram.
The Managing Director, Kerala Water Authority, Thiruvananthapuram.
Director, Department of Industries and Commerce,
Thiruvananthapuram.
The Executive Director, CWRDM, Kozhokode
The Regional Director, CGWB, Thiruvananthapuram.

Sir,

Sub: Water Resources (GW) Department- Presentation of the salient features of the findings of GWRA- 2020- Virtual Conference on 26.02.2022 - Minutes forwarding of Reg

Ref: 1 . Letter No. CGWB/KR/T-20/20-21-592 dated 21.12.2021 from Regional Director, Ministry of Jal Sakti, Government of India.
2. Government letter of even no. dated 22.02.2022 & 26.02.2022

I am directed to forward herewith a copy of the minutes of the first State Level meeting on Re-estimation of Ground Water Resources of Kerala State as on March 2022.

Yours Faithfully,
G S SURABHI
UNDER SECRETARY
For Additional Chief Secretary to Government.

O.(Rt)No.388/2022/WRD

Diary No 1054
Date 17.5.22

RD-8
17/5/22

GOVERNMENT OF KERALA

Abstract

Water Resources Department- Ground Water Department-State Level Committee for Re-estimation of Ground Water Resources-Re-Constituted-Orders issued.

WATER RESOURCES (GROUND WATER) DEPARTMENT

G.O.(Rt)No.388/2022/WRD Dated,Thiruvananthapuram, 09-05-2022

Read 1 G.O(Rt) No. 612/2020/WRD dated, 28.09.2020

2 Lr. No.11/CGWB/KR/T-20-1/2021-22-04 dated 04.01.2022 from Regional Director, Central Ground Water Board, Kerala Region, Kesavadasapuram, Thiruvananthapuram

ORDER

Government had Reonstituted a State level Committee on Re-estimation of Ground Water Resources vide Government Order read as 1st paper above .

As per letter read as 2nd paper above, the Regional Director, Central Ground Water Board has requested Government to reconstitute the State Level Re-estimation of Ground Water Resources of Kerala to compute the Ground Water resources as on March 2022.

Government have examined the matte in detail and are pleased to reconstitute a permanent Standing Committee for all ensuing Re-estimation of ground water resources for the assessment of groundwater resources as on March 2022 with the following members.

Secretary, Water Resources Department	Chairman
The Director, Ground Water Department	Member
The Director, Agriculture Department	Member

/2022/WRD

The Managing Director, Kerala Water Authority	Member
The Chief Engineer, Irrigation & Administration	Member
The Director, Industries &Commerce	Member
The General Manager, NABARD	Member
The Executive Director, Centre for Water Resources Development and Management	Member
The Regional Director, Central Ground Water Board	Member Secretary

The broad terms of reference of the Committee will be as follows:

(1) To estimate annual replenishable ground water resources of the State in accordance with the Ground Water Estimation methodology 2015 . The committee will adopt improved procedures and practiced wherever possible.
(2) To estimate the status of utilization of the annual replenishable ground water resource.
The Committee shall submit its report within six months.

(By order of the Governor)
BEENA P S
DEPUTY SECRETARY

To:

Secretry to Government, Water Resources Department
All Members of the Committee

The Regional Director, Central Ground Water Board, Kerala Region, Kesavadasapuram, Thiruvananthapuram.

ThePrincipal Accountant General (Audit), Kerala, Thiruvananthapuram

The Accountant General (A&E), Kerala, Thiruvananthapuram.

Stock/Office Copy.

22/WRD

Forwarded /By order
Signed by Praneesh M P
Date: 10-05-2022 11:05:40
Section Officer

ANNEXURE II: MINUTES OF THE MEETINGS OF THE STATE LEVEL COMMITTEE

MINUTES OF THE 2nd MEETING OF THE PERMANENT STATE LEVEL COMMITTEE (SLC) ON RE-ESTIMATION OF GROUND WATER RESOURCES OF KERALA STATE AS ON MARCH 2023

The 2nd meeting of the State Level Committee (SLC) for the re- estimation of Ground Water Resources of Kerala as on 2023 was held on 18.8.2023 under the Chairmanship of Shri. Ashok Kumar Singh IAS, Secretary, Water Resources Department, Govt. of Kerala and the Chairman of the committee at 12.00 noon. The following Members attended the meeting:

1	Smt Bhandari Swagat Managing Director, Kerala Water Authority.	Member
2	Smt. Mini Chandran Head Of Office, CGWB, Kerala Region.	Member Secretary
3	Shri John V Samuel IAS Director, Ground Water Department	Member
4	Shri Sajeev S DGM , NABARD,	Member
5	Dr Dipu S, Scientist CWRDM	Member Nominee
6	Smt. Padmakumari M Agriculture Department	Member Nominee
7	Smt. Indu N Irrigation Department	Member Nominee
8	Smt. Asha V Irrigation Department	Member Nominee
9.	Smt Deepa NC DS, WRD	Invitee
9	Smt Bindhu J Viju Scientist. D, CGWB, Kerala Region	Invitee
10	Smt Rakhi U R, Scientist. C, CGWB, Kerala Region	Invitee
11	Shri. Aneesh Kumar V, Scientist. C, CGWB, Kerala Region	Invitee
12	Smt Indu P Nair, Jr Hydrogeologist GWD	Invitee

At the outset, the Chairman welcomed the members and stressed the importance of periodic re-assessment of ground water resources in proper planning and optimum utilization. The Chairman then invited the Head of office, CGWB to present the salient outcomes of the assessment carried out as on 2023. Smt. Mini Chandran Head of Office, CGWB, Kerala Region and Member Secretary of the committee briefed the methodology adopted for the estimation of ground water resources and appraised the status of ground water resource of Kerala state as on 2023.

The ground water resources have been computed jointly by State GWD and CGWB for administrative units in the State, with community development blocks as assessment units. Accordingly, the computations have been made for 152 assessment units spread across 14 districts in the State. The ground water resources of urban habitations comprising 6 Municipal Corporations, 87 Municipalities and 1 Township have been combined with the adjoining blocks based on their hydrogeological set up

- Annual Extractable Groundwater Recharge for the entire State is **5005.27 MCM** (ranges from **188.57 MCM** in Idukki district to **567.68 MCM** in Palakkad district).
- The Annual Ground Water Extraction for all uses is of the order of **2730.47 MCM** (ranges from **56.38 MCM** in Wayanad district to **346.53 MCM** in Malappuram)
- The Annual Ground Water Allocation for Domestic use up to 2025 is of the order of **2193.90 MCM** (ranges from **41.42 MCM** in Idukki district to **550.24 MCM** in Malappuram)
- The Net Ground Water Availability for future use is of the order of **2016.80 MCM** (ranges from **55.29 MCM** in Kasaragod district to **228.99 MCM** in Kottayam district).
- The Stage of ground water extraction of assessment units is of the order of **54.55 %** for the State (highest in Kasargod district **(72.75%)** and the lowest in Wayanad district **(27.67%).**
- 3 blocks (Chittur & Malampuzha blocks of Palakkad district and Kasargod block of Kasargod district) have been categorized as "Critical". Out of the remaining blocks, **30** blocks are "Semi-critical" and **119** blocks comes under "Safe" category.
- Three blocks have deteriorated its category from Safe to Semi-critical viz. Kozhikode (Kozhikode district), Sasthamcotta (Kollam district) and Varkala (Thiruvananthapuram district).

After the presentation, the Chairman of the committee emphasized the importance of proper data documentation and sharing of the outcomes in report format with State government agencies for prioritizing their water conservation and artificial recharge activities in Critical and Semi- critical blocks.

The assessment of dynamic ground water resources of Kerala as on 2023 was approved by the Committee after discussions and deliberations by the members. The meeting ended with thanks to the chair.

APPROVED

ASHOK KUMAR SINGH (IAS)

Secretary, WRD, GoK

ASHOK KUMAR SINGH IAS
PEN : 325215
Secretary to Government
Water Resources & CSIN Dept.
Government Secretariat
Thiruvananthapuram-1.

ANNEXURE IIIA: GENERAL DESCRIPTION OF GROUND WATER ASSESSMENT UNITS

State			**KERALA**							
District			**ALAPPUZHA**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Ambalappuzha	KL010100	Alluvial	6890	0.00	0.00	6890	0.00	6890.00	0.00
2	Aryad	KL010200	Alluvial	8772	0.00	0.00	8772	0.00	8772.00	0.00
3	Bharanikkavu	KL010300	Alluvial	12995	0.00	0.00	12995	0.00	2500.00	0.00
4	Champakkulam	KL010400	Alluvial	15383	0.00	0.00	15383	0.00	7500.00	0.00
5	Chengannur	KL010500	Alluvial	14996	0.00	0.00	14996	0.00	6890.00	0.00
6	Harippad	KL010600	Alluvial	11439	0.00	0.00	11439	0.00	11439.00	0.00
7	Kanjikkuzhy	KL010700	Alluvial	11013	0.00	0.00	11013	0.00	9000.00	0.00
8	Mavelikkara	KL010800	Alluvial	10044	0.00	0.00	10044	0.00	4000.00	0.00
9	Muthukulam	KL010900	Alluvial	11651	0.00	0.00	11651	0.00	5000.00	0.00
10	Pattanakkad	KL011000	Alluvial	10871	0.00	0.00	10871	0.00	10871.00	0.00
11	Thycattussery	KL011100	Alluvial	14159	0.00	0.00	14159	0.00	14159.00	0.00
12	Veliyanad	KL011200	Alluvial	13190	0.00	0.00	13190	0.00	10000.00	0.00
Total (ha)				**141403**	**0.00**	**0.00**	**141403.00**	**0.00**	**97021.00**	**0.00**
Total (Sq.km)				**1414.03**	**0.00**	**0.00**	**1414.03**	**0.00**	**970.21**	**0.00**

State			**KERALA**							
District			**ERNAKULAM**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Alangad	KL020100	Hard Rock	7331	0	0	7331	0	5090.00	0.00
2	Angamaly	KL020200	Hard Rock	23197	2000	0	21197	0	0.00	0.00
3	Edappally	KL020300	Alluvial	16053	0	0	16053	0	12000.00	0.00
4	Koovappady	KL020400	Hard Rock	38560	2999.5	0	35560.5	0	0..00	0.00
5	Kothamangalam	KL020500	Hard Rock	82997	60000	0	22997	0	0.00	0.00
6	Moovattupuzha	KL020600	Hard Rock	21480	1500	0	19980	0	0.00	0.00
7	Mulamthuruthy	KL020700	Hard Rock	16327	0	0	16327	0	0.00	0.00
8	Palluruthy	KL020800	Alluvial	6651	0	0	6651	0	6651.00	0.00
9	Pampakkuda	KL020900	Hard Rock	18740	1000	0	17740	0	0.00	0.00
10	Parakkadavu	KL021000	Hard Rock	11881	0	0	11881	0	0.00	0.00
11	Paravoor	KL021100	Alluvial	7665	0	0	7665	0	4665.00	0.00
12	Vadavukodu	KL021200	Hard Rock	18595	0	0	18595	0	0.00	0.00
13	Vazhakkulam	KL021300	Hard Rock	19328	0	0	19328	0	0.00	0.00
14	Vypeen	KL021400	Alluvial	5642	0	0	5642	0	4500.00	0.00
Total (ha)				**294447**	**67499.5**	**0**	**226947.5**	**0.00**	**32906.00**	**0.00**
Total (Sq.km)				**2944.47**	**674.99**	**0.00**	**2269.48**	**0.00**	**329.06**	**0.00**

State			**KERALA**								
District			**IDUKKI**								
Assessment Year			**2023**								
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)							
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**	
						Command area	**Non-command area**	**Poor ground water quality area**			
1	Adimali	KL030100	Hard Rock	51914	30714	0	21200	0.00	0.00	0.00	
2	Azhutha	KL030200	Hard Rock	107442	92900	0	14542	0.00	0.00	0.00	
3	Devikulam	KL030300	Hard Rock	96343	80300	0	16043	0.00	0.00	0.00	
4	Elam Desom	KL030400	Hard Rock	18722	9000	0	9722	0.00	0.00	0.00	
5	Idukki	KL030500	Hard Rock	73482	60000	0	13482	0.00	0.00	0.00	
6	Kattappana	KL030600	Hard Rock	37238	26000	0	11238	0.00	0.00	0.00	
7	Nedumkandam	KL030700	Hard Rock	34190	22000	0	12190	0.00	0.00	0.00	
8	Thodupuzha	KL030800	Hard Rock	16474	6000	0	10474	0.00	0.00	0.00	
Total (ha)				**435805**	**326914**	**0**	**108891**	**0.00**	**0.00**	**0.00**	
Total (Sq.km)				**4358.05**	**3269.14**	**0.00**	**1088.91**	**0.00**	**0.00**	**0.00**	

State			**KERALA**							
District			**KANNUR**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Edakkad	KL040100	Hard Rock	8948	0	0	8948	0.00	0.00	0.00
2	Irikkur	KL040200	Hard Rock	41290	5000	0	36290	0.00	0.00	0.00
3	Iritty	KL040300	Hard Rock	42709	11200	0	31509	0.00	0.00	0.00
4	Kallyasseri	KL040400	Hard Rock	14339	0	0	14339	0.00	0.00	0.00
5	Kannur	KL040500	Hard Rock	12678	0	0	12678	0.00	0.00	0.00
6	Kuthuparamba	KL040600	Hard Rock	18235	5300	0	12935	0.00	0.00	0.00
7	Panur	KL040700	Hard Rock	7383	0	0	7383	0.00	0.00	0.00
8	Payyannur	KL040800	Hard Rock	39212	5000	0	34212	0.00	0.00	0.00
9	Peravoor	KL040900	Hard Rock	42542	21200	0	21342	0.00	0.00	0.00
10	Taliparamba	KL041000	Hard Rock	57403	16700	0	40703	0.00	0.00	0.00
11	Thalassery	KL041100	Hard Rock	12057	0	0	12057	0.00	0.00	0.00
Total (ha.)				**296796**	**64400**	**0**	**232396**	**0.00**	**0.00**	**0.00**
Total (Sq.km)				**2967.96**	**644.00**	**0.00**	**2323.96**	**0.00**	**0.00**	**0.00**

State			**KERALA**								
District			**KASARGOD**								
Assessment Year			**2023**								
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)							
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**	
						Command area	**Non-command area**	**Poor ground water quality area**			
1	Kanhangad	KL050100	Hard Rock	24508	0	0	24508	0.00	1000.00	0.00	
2	Karadka	KL050200	Hard Rock	37247	11000	0	26247	0.00	0.00	0.00	
3	Kasaragod	KL050300	Hard Rock	25876	0	0	25876	0.00	0.00	0.00	
4	Manjeswar	KL050400	Hard Rock	34136	1000	0	33136	0.00	0.00	0.00	
5	Nileswaram	KL050500	Hard Rock	19695	0	0	19695	0.00	2350.00	0.00	
6	Parappa	KL050600	Hard Rock	54668	19300	0	35368	0.00	0.00	0.00	
Total (ha.)				**196130**	**31300**	**0**	**164830**	**0.00**	**3350.00**	**0.00**	
Total(Sq.km)				**1961.30**	**313.00**	**0.00**	**1648.30**	**0.00**	**33.50**	**0.00**	

State			**KERALA**							
District			**KOLLAM**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Anchal	KL060100	Hard Rock	94622	30000	0	64622	0.00	0.00	0.00
2	Chadayamangalam	KL060200	Hard Rock	24903	0	0	24903	0.00	0.00	0.00
3	Chavara	KL060300	Alluvial	7490	0	0	7490	0.00	3500.00	0.00
4	Chittumala	KL060400	Hardrock	12125	0	0	12125	0.00	0.00	0.00
5	Ithikkara	KL060500	Alluvial	12573	0	0	12573	0.00	1200.00	0.00
6	Kottarakkara	KL060600	Hard Rock	13310	0	0	13310	0.00	0.00	0.00
7	Mukhathala	KL060700	Alluvium	14703	0	0	14703	0.00	0.00	0.00
8	Oachira	KL060800	Alluvium	11641	0	0	11641	0.00	4500.00	0.00
9	Pathanapuram	KL060900	Hardrock	27995	7900	0	20095	0.00	0.00	0.00
10	Sasthamkotta	KL061000	Hard Rock	12791	0	0	12791	0.00	0.00	0.00
11	Vettikkavala	KL061100	Hardrock	16947	0	0	16947	0.00	0.00	0.00
Total (ha)				**249100**	**37900**	**0**	**211200**	**0.00**	**9200.00**	**0.00**
Total (Sq.km)				**2491.00**	**379.00**	**0.00**	**2112.00**	**0.00**	**92.00**	**0.00**

State			**KERALA**							
District			**KOTTAYAM**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Erattupetta	KL070100	Hard Rock	27560	13000	0	14560	0.00	0.00	0.00
2	Ettumanoor	KL070200	Hard Rock	21460	0	0	21460	0.00	0.00	0.00
3	Kaduthuruthy	KL070300	Hard Rock	15806	0	0	15806	0.00	0.00	0.00
4	Kanjirappally	KL070400	Hard Rock	35290	12000	0	23290	0.00	0.00	0.00
5	Lalam	KL070500	Hard Rock	19110	0	0	19110	0.00	0.00	0.00
6	Madappally	KL070600	Alluvial	11950	0	0	11950	0.00	0.00	0.00
7	Pallom	KL070700	Hard Rock	17802	0	0	17802	0.00	0.00	0.00
8	Pampady	KL070800	Hard Rock	20550	0	0	20550	0.00	0.00	0.00
9	Uzhavoor	KL070900	Hard Rock	22460	0	0	22460	0.00	0.00	0.00
10	Vaikom	KL071000	Alluvial	13190	0	0	13190	0.00	3000.00	0.00
11	Vazhoor	KL071100	Hard Rock	16910	0	0	16910	0.00	0.00	0.00
Total (ha)				**222088**	**25000**	**0**	**197088**	**0.00**	**3000.00**	**0.00**
Total (Sq.km)				**2220.88**	**250.00**	**0.00**	**1970.88**	**0.00**	**30.00**	**0.00**

State			**KERALA**							
District			**KOZHIKODE**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Ballussery	KL080100	Hard Rock	27853	13900	0	13953	0.00	0.00	0.00
2	Chelannur	KL080200	Hard Rock	13866	0	0	13866	0.00	0.00	0.00
3	Koduvally	KL080300	Hard Rock	39048	11750	0	27298	0.00	0.00	0.00
4	Kozhikode	KL080400	Hard Rock	16351	0	0	16351	0.00	0.00	0.00
5	Kunnamangalam	KL080500	Hard Rock	33794	16800	0	16994	0.00	0.00	0.00
6	Kunnummal	KL080600	Hard Rock	26252	13100	0	13152	0.00	0.00	0.00
7	Melady	KL080700	Alluvial	8407	0	0	8407	0.00	4500.00	0.00
8	Panthalayani	KL080800	Alluvial	9855	0	0	9855	0.00	1500.00	0.00
9	Perambra	KL080900	Hard Rock	27502	9600	0	17902	0.00	0.00	0.00
10	Thodannur	KL081000	Hard Rock	9677	0	0	9677	0.00	0.00	0.00
11	Tuneri	KL081100	Hard Rock	14397	2900	0	11497	0.00	0.00	0.00
12	Vadakara	KL081200	Hard Rock	7228	0	0	7228	0.00	1000.00	0.00
Total (ha)				**234230**	**68050**	**0**	**166180**	**0.00**	**7000.00**	**0.00**
Total (Sq.km)				**2342.30**	**680.50**	**0.00**	**1661.80**	**0.00**	**70.00**	**0.00**

State			**KERALA**							
District			**MALAPPURAM**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Areacode	KL090100	Hard Rock	33357	5000	0	28357	0.00	0.00	0.00
2	Kalikavu	KL090200	Hard Rock	68912	44500	0	24412	0.00	0.00	0.00
3	Kondotty	KL090300	Hard Rock	18624	0	0	18624	0.00	0.00	0.00
4	Kuttippuram	KL090400	Hard Rock	17868	0	0	17868	0.00	0.00	0.00
5	Malappuram	KL090500	Hard Rock	18032	0	0	18032	0.00	0.00	0.00
6	Mankada	KL090600	Hard Rock	15245	0	0	15245	0.00	0.00	0.00
7	Nilamboor	KL090700	Hard Rock	62120	40300	0	21820	0.00	0.00	0.00
8	Perinthalmanna	KL090800	Hard Rock	28203	1000	0	27203	0.00	0.00	0.00
9	Perumpadappu	KL090900	Alluvial	5899	0	0	5899	0.00	0.00	0.00
10	Ponnani	KL091000	Alluvial	9706	0	0	9706	0.00	1500.00	0.00
11	Thanur	KL091100	Hard Rock	12756	0	0	12756	0.00	1500.00	0.00
12	Thriurangadi	KL091200	Hard Rock	13001	0	0	13001	0.00	0.00	0.00
13	Tirur	KL091300	Alluvial	11105	0	0	11105	0.00	2000.00	0.00
14	Vengara	KL091400	Hard Rock	14845	0	0	14845	0.00	0.00	0.00
15	Wandoor	KL091500	Hard Rock	25308	10000	0	15308	0.00	0.00	0.00
Total (ha)				**354981**	**100800**	**0**	**254181**	**0.00**	**5000.00**	**0.00**
Total (Sq.km)				**3549.81**	**1008.00**	**0.00**	**2541.81**	**0.00**	**50.00**	**0.00**

State			**KERALA**							
District			**PALAKKAD**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Alathur	KL100100	Hard Rock	31447	8000	0	23447	0.00	0.00	0.00
2	Attappadi	KL100200	Hard Rock	70323	48000	0	22323	0.00	0.00	0.00
3	Chittur	KL100300	Hard Rock	31468	0	0	31468	0.00	0.00	0.00
4	Kollengode	KL100400	Hard Rock	21411	1500	0	19911	0.00	0.00	0.00
5	Kuzhalmannam	KL100500	Hard rock	19212	0	0	19212	0.00	0.00	0.00
6	Malampuzha	KL100600	Hard rock	40394	20000	0	20394	0.00	0.00	0.00
7	Mannarkkad	KL100700	Hard rock	45535	16000	0	29535	0.00	0.00	0.00
8	Nenmara	KL100800	Hard Rock	79847	55894	0	23953	0.00	0.00	0.00
9	Ottappalam	KL100900	Hard rock	27306	0	0	27306	0.00	0.00	0.00
10	Palakkad	KL101000	Hard Rock	20706	0	0	20706	0.00	0.00	0.00
11	Pattambi	KL101100	Hard Rock	20744	0	0	20744	0.00	0.00	0.00
12	Sreekrishnapuram	KL101200	Hard Rock	22013	0	0	22013	0.00	0.00	0.00
13	Thrithala	KL101300	Hard rock	17216	0	0	17216	0.00	0.00	0.00
Total (ha)				**447622**	**149394**	**0**	**298228**	**0.00**	**0.00**	**0.00**
Total (Sq.km)				**4476.22**	**1493.94**	**0.00**	**2982.28**	**0.00**	**0.00**	**0.00**

State			**KERALA**							
District			**PATHANAMTHITTA**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Elanthoor	KL110100	Hard Rock	10622	0	0	10622	0.00	0.00	0.00
2	Koipuram	KL110200	Hard Rock	12367	0	0	12367	0.00	0.00	0.00
3	Konni	KL110300	Hard Rock	86477	60500	0	25977	0.00	0.00	0.00
4	Mallappally	KL110400	Hard Rock	15418	0	0	15418	0.00	0.00	0.00
5	Pandalam	KL110500	Hard Rock	11641	0	0	11641	0.00	0.00	0.00
6	Parakode	KL110600	Hard Rock	27152	4510	0	22642	0.00	0.00	0.00
7	Pulikeezh	KL110700	Alluvium	6866	0	0	6866	0.00	0.00	0.00
8	Ranni	KL110800	Hard Rock	92132	68000	0	24132	0.00	5000.00	0.00
Total (ha)				**262675**	**133010**	**0**	**129665**	**0.00**	**5000.00**	**0.00**
Total (Sq.km)				**2626.75**	**1330.10**	**0.00**	**1296.65**	**0.00**	**50.00**	**0.00**

State			**KERALA**							
District			**THIRUVANANTHAPURAM**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Athiyannur	KL120100	Hard Rock	7629	0	0	7629	0.00	0.00	0.00
2	Chirayinkil	KL120200	Hard Rock	10151	0	0	10151	0.00	0.00	0.00
3	Kilimanoor	KL120300	Hard Rock	17977	0	0	17977	0.00	0.00	0.00
4	Nedumangad	KL120400	Hard Rock	15603	0	0	15603	0.00	0.00	0.00
5	Nemom	KL120500	Hard Rock	33727	0	0	33727	0.00	0.00	0.00
6	Parassala	KL120600	Hard Rock	8221	0	0	8221	0.00	0.00	0.00
7	Perumkadavila	KL120700	Hard Rock	28538	1500	0	27038	0.00	0.00	0.00
8	Pothencode	KL120800	Alluvium	7415	0	0	7415	0.00	0.00	0.00
9	Vamanapuram	KL120900	Hard Rock	42115	15000	0	27115	0.00	0.00	0.00
10	Varkala	KL121000	Alluvial	10209	0	0	10209	0.00	0.00	0.00
11	Vellanad	KL121100	Hard Rock	37212	8000	0	29212	0.00	0.00	0.00
Total (ha)				**218797**	**24500**	**0**	**194297**	**0.00**	**0.00**	**0.00**
Total (Sq.km)				**2187.97**	**245.00**	**0.00**	**1942.97**	**0.00**	**0.00**	**0.00**

State			**KERALA**							
District			**THRISSUR**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Anthikkad	KL130100	Alluvial	9904	0	0	9904	0.00	0.00	0.00
2	Chalakkudy	KL130200	Hard Rock	61069	40700	0	20369	0.00	0.00	0.00
3	Chavakkad	KL130300	Alluvial	9917	0	0	9917	0.00	2500.00	0.00
4	Cherpu	KL130400	Hard Rock	8448	0	0	8448	0.00	0.00	0.00
5	Chowannur	KL130500	Hard Rock	17774	0	0	17774	0.00	0.00	0.00
6	Iringalakkuda	KL130600	Hard Rock	12073	0	0	12073	0.00	0.00	0.00
7	Kodakara	KL130700	Hard Rock	29812	9000	0	20812	0.00	0.00	0.00
8	Mala	KL130800	Hard Rock	12713	0	0	12713	0.00	0.00	0.00
9	Mathilakom	KL130900	Alluvial	14635	0	0	14635	0.00	2500.00	0.00
10	Mullassery	KL131000	Alluvial	6585	0	0	6585	0.00	1500.00	0.00
11	Ollukkara	KL131100	Hard Rock	31572	11000	0	20572	0.00	0.00	0.00
12	Pazhayannur	KL131200	Hard Rock	23695	0	0	23695	0.00	0.00	0.00
13	Puzhakkal	KL131300	Hard Rock	22892	0	0	22892	0.00	0.00	0.00
14	Thalikkulam	KL131400	Alluvial	6568	0	0	6568	0.00	2000.00	0.00
15	Vadakkancherry	KL131500	Hard Rock	23659	5000	0	18659	0.00	0.00	0.00
16	Vellangallur	KL131600	Hard Rock	11069	0	0	11069	0.00	0.00	0.00
Total (ha)				**302385**	**65700**	**0**	**236685**	**0.00**	**8500.00**	**0.00**
Total (Sq.km)				**3023.85**	**657.00**	**0.00**	**2366.85**	**0.00**	**85.00**	**0.00**

State			**KERALA**							
District			**WAYANAD**							
Assessment Year			**2023**							
Sl. No.	**Name of Ground water Assessment Unit**	**Location code in INGRES**	**Type of rock formation**	**Areal extent** (in hectares)						
				Total Geographical Area	**Hilly Area**	**Ground Water Recharge Worthy Area**			**Shallow Water Table Area**	**Flood Prone Area**
						Command area	**Non-command area**	**Poor ground water quality area**		
1	Kalpetta	KL140100	Hard Rock	58351	17000	0	41351	0.00	0.00	0.00
2	Mananthavady	KL140200	Hard Rock	66651	25600	0	41051	0.00	0.00	0.00
3	Panamaram	KL140300	Hard Rock	35086	11800	0	23286	0.00	0.00	0.00
4	Sulthanbathery	KL140400	Hard Rock	52974	15900	0	37074	0.00	0.00	0.00
Total (ha)				**213062**	**70300**	**0**	**142762**	**0.00**	**0.00**	**0.00**
Total (Sq.km)				**2130.62**	**703.00**	**0.00**	**1427.62**	**0.00**	**0.00**	**0.00**

ANNEXURE III B: DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

State		**KERALA**				
District		**ALAPPUZHA**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/ Non-command/ Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Ambalappuzha	Non-Command	2274.01	1.93	1.66	0.27
2	Aryad	Non-Command	2274.01	2.47	1.18	1.29
3	Bharanikkavu	Non-Command	2274.01	7.5	7.35	0.15
4	Champakkulam	Non-Command	2274.01	1.26	0.77	0.49
5	Chengannur	Non-Command	2274.01	5.52	3.73	1.79
6	Harippad	Non-Command	2274.01	2.65	1.19	1.46
7	Kanjikkuzhy	Non-Command	2274.01	2.26	0.89	1.37
8	Mavelikkara	Non-Command	2274.01	2.75	1.48	1.27
9	Muthukulam	Non-Command	2274.01	1.92	1.9	0.02
10	Pattanakkad	Non-Command	2274.01	2.26	1.42	0.84
11	Thycattussery	Non-Command	2274.01	1.9	1.1	0.8
12	Veliyanad	Non-Command	2274.01	1.89	1.25	0.64
Total		**Non-Command**	**2274.01**	**2.85**	**1.99**	**0.86**

m: metre,
m bgl: metres below ground level;
mm: millimetre

State		**KERALA**				
District		**ERNAKULAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Alangad	Non-Command	3360.07	3.01	1.76	1.25
2	Angamaly	Non-Command	3360.07	6.07	5.5	0.57
3	Edappally	Non-Command	3360.07	2.25	2.04	0.21
4	Koovappady	Non-Command	3360.07	5.6	5.71	0.11
5	Kothamangalam	Non-Command	3360.07	3.49	3.77	0.28
6	Moovattupuzha	Non-Command	3360.07	5.68	4.5	1.18
7	Mulamthuruthy	Non-Command	3360.07	6.7	3.82	2.88
8	Palluruthy	Non-Command	3360.07	1.82	1.08	0.74
9	Pampakkuda	Non-Command	3360.07	5.13	4.3	0.83
10	Parakkadavu	Non-Command	3360.07	5.69	5.5	0.19
11	Paravoor	Non-Command	3360.07	0.88	0.64	0.24
12	Vadavukodu	Non-Command	3360.07	5.66	5.9	0.24
13	Vazhakkulam	Non-Command	3360.07	8.18	6.29	1.89
14	Vypeen	Non-Command	3360.07	1.02	0.45	0.57
Total		**Non-Command**	**3360.07**	**4.37**	**3.66**	**0.70**

State		**KERALA**				
District		**IDUKKI**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Adimali	Non-Command	3421.5	5.94	6.18	0.24
2	Arudai	Non-Command	3421.5	4.04	2.25	1.79
3	Devikulam	Non-Command	3421.5	4	3.74	0.26
4	Elam Desom	Non-Command	3421.5	4.18	3.63	0.55
5	Idukki	Non-Command	3421.5	3.41	3.71	0.3
6	Kattappana	Non-Command	3421.5	5.06	4.68	0.38
7	Nedumkandam	Non-Command	3421.5	2.64	3.13	0.49
8	Thodupuzha	Non-Command	3421.5	3.38	3.25	0.13
TOTAL		**Non-Command**	**3421.5**	**4.08**	**3.82**	**0.26**

State		**KERALA**				
District		**KANNUR**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Edakkad	Non-Command	2691.87	10.21	8.9	1.31
2	Irikkur	Non-Command	2691.87	6.94	5.62	1.32
3	Iritty	Non-Command	2691.87	6.15	4.86	1.29
4	Kallyasseri	Non-Command	2691.87	9.15	5.98	3.17
5	Kannur	Non-Command	2691.87	7.25	5.77	1.48
6	Kuthuparamba	Non-Command	2691.87	8.73	7	1.73
7	Panur	Non-Command	2691.87	7.86	6.36	1.5
8	Payyannur	Non-Command	2691.87	8.31	7.26	1.05
9	Peravoor	Non-Command	2691.87	5.06	4.81	0.25
10	Taliparamba	Non-Command	2691.87	10.44	8.5	1.94
11	Thalassery	Non-Command	2691.87	7.4	4.35	3.05
Total		**Non-Command**	**2691.87**	**7.95**	**6.31**	**1.64**

State		**KERALA**				
District		**KASARGOD**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command /Non-command /Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Kanhangad	Non-Command	3077.47	8.23	7.77	-0.46
2	Karadka	Non-Command	3077.47	12.23	10.49	-1.74
3	Kasaragod	Non-Command	3077.47	13.76	10.95	-2.81
4	Manjeswar	Non-Command	3077.47	10.97	8.43	-2.54
5	Nileswaram	Non-Command	3077.47	7.72	5.2	-2.52
6	Parappa	Non-Command	3077.47	8.88	7.11	-1.77
Total		**Non-Command**	**3077.47**	**10.29**	**8.32**	**1.97**

State		**KERALA**				
District		**KOLLAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Anchal	Non-Command	2014.48	7.52	5.76	1.76
2	Chadayamangalam	Non-Command	2014.48	7.48	5.46	2.02
3	Chavara	Non-Command	2014.48	2.3	0.63	1.67
4	Chittumala	Non-Command	2014.48	12.61	8.53	4.08
5	Ithikkara	Non-Command	2014.48	9.84	7.83	2.01
6	Kottarakkara	Non-Command	2014.48	8.6	5.11	3.49
7	Mukhathala	Non-Command	2014.48	7.96	4.25	3.71
8	Oachira	Non-Command	2014.48	3.76	2.5	1.26
9	Pathanapuram	Non-Command	2014.48	7.01	6.08	0.93
10	Sasthamkotta	Non-Command	2014.48	8.74	7.04	1.7
11	Vettikkavala	Non-Command	2014.48	5.35	4.58	0.77
Total		**Non-Command**	**2014.48**	**7.37**	**5.25**	**2.12**

State		**KERALA**				
District		**KOTTAYAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Erattupetta	Non-Command	2993.39	2.77	2.6	0.17
2	Ettumanoor	Non-Command	2993.39	3.28	2.83	0.45
3	Kaduthuruthy	Non-Command	2993.39	2.61	2	0.61
4	Kanjirappally	Non-Command	2993.39	4.88	3.89	0.99
5	Lalam	Non-Command	2993.39	5.27	4.1	1.17
6	Madappally	Non-Command	2993.39	5.4	3.35	2.05
7	Pallom	Non-Command	2993.39	5.45	3.56	1.89
8	Pampady	Non-Command	2993.39	3.7	3.3	0.4
9	Uzhavoor	Non-Command	2993.39	3.7	2.8	0.9
10	Vaikom	Non-Command	2993.39	2.02	1.8	0.22
11	Vazhoor	Non-Command	2993.39	6.1	4.9	1.2
Total		**Non-Command**	**2993.39**	**4.10**	**3.19**	**0.91**

State		**KERALA**				
District		**KOZHIKODE**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Balussery	Non-Command	3069.15	4.04	3.98	0.06
2	Chelannur	Non-Command	3069.15	5.19	4.64	0.55
3	Koduvally	Non-Command	3069.15	3.58	3.15	0.43
4	Kozhikode	Non-Command	3069.15	6.13	5.09	1.04
5	Kunnamangalam	Non-Command	3069.15	6.41	5.82	0.59
6	Kunnummal	Non-Command	3069.15	4.96	4.9	0.06
7	Melady	Non-Command	3069.15	3.43	3.1	0.33
8	Panthalayani	Non-Command	3069.15	4.92	3.54	1.38
9	Perambra	Non-Command	3069.15	3.04	2.36	0.68
10	Thodannur	Non-Command	3069.15	6.24	4.72	1.52
11	Tuneri	Non-Command	3069.15	6.09	4.75	1.34
12	Vadakara	Non-Command	3069.15	4.63	3.23	1.4
Total		**Non-Command**	**3069.15**	**4.88**	**4.10**	**0.78**

State		**KERALA**				
District		**MALAPPURAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Areacode	Non-Command	2548.85	7.83	6.52	1.31
2	Kalikavu	Non-Command	2548.85	6.02	4.56	1.46
3	Kondotty	Non-Command	2548.85	5.97	4.2	1.77
4	Kuttippuram	Non-Command	2548.85	9.01	7.61	1.4
5	Malappuram	Non-Command	2548.85	9.16	7.1	2.06
6	Mankada	Non-Command	2548.85	7.6	5.64	1.96
7	Nilamboor	Non-Command	2548.85	7.84	4.61	3.23
8	Perinthalmanna	Non-Command	2548.85	7.92	6.34	1.58
9	Perumpadappu	Non-Command	2548.85	6.92	4.46	2.46
10	Ponnani	Non-Command	2548.85	12.02	10.01	2.01
11	Tanur	Non-Command	2548.85	3.78	1.98	1.8
12	Tirurangadi	Non-Command	2548.85	8.69	7.15	1.54
13	Tirur	Non-Command	2548.85	4.2	3.4	0.8
14	Vengara	Non-Command	2548.85	11.49	11.01	0.48
15	Wandoor	Non-Command	2548.85	6.54	4.79	1.75
Total		**Non-Command**	**2548.85**	**7.08**	**5.48**	**1.60**

State		**KERALA**				
District		**PALAKKAD**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Alathur	Non-Command	1928.97	3.61	2.53	1.08
2	Attappadi	Non-Command	1928.97	5.07	4.93	0.14
3	Chittur	Non-Command	1928.97	6.08	3.54	2.54
4	Kollengode	Non-Command	1928.97	4.87	3.08	1.79
5	Kuzhalmannam	Non-Command	1928.97	4.62	2.92	1.7
6	Malampuzha	Non-Command	1928.97	4.75	2.96	1.79
7	Mannarkkad	Non-Command	1928.97	7.3	5.65	1.65
8	Nenmara	Non-Command	1928.97	5.07	2.45	2.62
9	Ottappalam	Non-Command	1928.97	7.41	5.45	1.96
10	Palakkad	Non-Command	1928.97	6.01	4.2	1.81
11	Pattambi	Non-Command	1928.97	7.51	7.26	0.25
12	Sreekrishnapuram	Non-Command	1928.97	7.99	7.26	0.73
13	Thrithala	Non-Command	1928.97	9.23	7.07	2.16
	Total	**Non-Command**	**1928.97**	**6.11**	**4.56**	**1.55**

State		**KERALA**				
District		**PATHANAMTHITTA**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/ Non-command/ Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Elanthoor	Non-Command	2162.8	3.46	3.08	0.38
2	Koipuram	Non-Command	2162.8	5.7	4.82	0.88
3	Konni	Non-Command	2162.8	5.59	4.63	0.96
4	Mallappally	Non-Command	2162.8	5.5	3.38	2.12
5	Pandalam	Non-Command	2162.8	5.43	3.88	1.55
6	Parakode	Non-Command	2162.8	5.53	3.88	1.65
7	Pulikeezh	Non-Command	2162.8	3.18	2.38	0.8
8	Ranni	Non-Command	2162.8	5.04	3.67	1.37
Total		**Non-Command**	**2162.8**	**4.92**	**3.71**	**1.21**

State		**KERALA**				
District		**THIRUVANANTHAPURAM**				
Assessment Year		**2023**				
Sl. No	**Assessment Unit**	**Command /Non-command /Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Athiyannur	Non-Command	1717.3	12.49	11.83	0.66
2	Chirayinkil	Non-Command	1717.3	6.45	4.35	2.1
3	Kilimanoor	Non-Command	1717.3	8.86	6.58	2.28
4	Nedumangad	Non-Command	1717.3	5.11	3.4	1.71
5	Nemom	Non-Command	1717.3	7.07	6.85	0.22
6	Parassala	Non-Command	1717.3	9.61	8.02	1.59
7	Perumkadavila	Non-Command	1717.3	6.88	4.67	2.21
8	Pothencode	Non-Command	1717.3	9.48	8.81	0.67
9	Vamanapuram	Non-Command	1717.3	6.32	5.25	1.07
10	Varkala	Non-Command	1717.3	15.82	13.1	2.72
11	Vellanad	Non-Command	1717.3	6.88	4.93	1.95
TOTAL		**Non-Command**	**1717.3**	**8.63**	**7.07**	**1.56**

State		**KERALA**				
District		**THRISSUR**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command/Non-command/Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Anthikkad	Non-Command	2636.84	9.47	7.52	1.95
2	Chalakkudy	Non-Command	2636.84	6.46	5.74	0.72
3	Chavakkad	Non-Command	2636.84	3.94	2.14	1.8
4	Cherpu	Non-Command	2636.84	11.07	8.84	2.23
5	Chowannur	Non-Command	2636.84	9.06	8.04	1.02
6	Irinjalakkuda	Non-Command	2636.84	8.02	7.05	0.97
7	Kodakara	Non-Command	2636.84	7.03	5.71	1.32
8	Mala	Non-Command	2636.84	8.5	6.32	2.18
9	Mathilakom	Non-Command	2636.84	2.64	2.77	0.13
10	Mullassery	Non-Command	2636.84	4.31	1.46	2.85
11	Ollukkara	Non-Command	2636.84	6.7	6.06	0.64
12	Pazhayannur	Non-Command	2636.84	6.01	4.88	1.13
13	Puzhakkal	Non-Command	2636.84	8.14	7.67	0.47
14	Thalikkulam	Non-Command	2636.84	3.52	2.3	1.22
15	Vadakkancherry	Non-Command	2636.84	7.87	6.33	1.54
16	Vellangallur	Non-Command	2636.84	6.58	4.34	2.24
TOTAL		**Non-Command**	**2636.84**	**6.83**	**5.44**	**1.38**

State		**KERALA**				
District		**WAYANAD**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Command /Non-command /Poor GW Quality**	**Rainfall (mm)**	**Average Pre-monsoon Water level (mbgl)**	**Average Post-monsoon Water Level (mbgl)**	**Average Fluctuation (m)**
1	Kalpetta	Non-Command	2603.24	7.57	5.89	1.68
2	Mananthavady	Non-Command	2603.24	6.93	5.72	1.21
3	Panamaram	Non-Command	2603.24	8.63	6.43	2.2
4	Sulthanbathery	Non-Command	2603.24	8.63	7.13	1.5
Total		**Non-Command**	**2603.24**	**7.94**	**6.29**	**1.64**

ANNEXURE III B (Contd.): DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

District		**ALAPPUZHA**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ Non-Command/ Poor Quality)**	**Type of Structure**	**No. of Structures**		
				Irrigation	**Domestic**	**Industrial**
1	Ambalappuzha	Non-Command	DW	15	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	220		
			STW	381		
			*Others	6212		
2	Aryad	Non-Command	DW	12		
			DW with pump	325		
			STW	281		
			*Others	6070		
3	Bharanikkavu	Non-Command	DW	360		
			DW with pump	610		
			STW	76		
			*Others	8671		
4	Champakkulam	Non-Command	DW	102		
			DW with pump	21		
			STW/BW	26		
			*Others	5800		
5	Chengannur	Non-Command	DW	256		
			DW with pump	1392		
			STW	38		
			*Others	9005		
6	Harippad	Non-Command	DW	295		
			DW with pump	825		
			STW	355		
			*Others	8420		
7	Kanjikkuzhy	Non-Command	DW	12		
			DW with pump	130		
			STW	154		
			*Others	7894		
8	Mavelikkara	Non-Command	DW	362		
			DW with pump	185		
			STW	118		
			*Others	8096		
9	Muthukulam	Non-Command	DW	72		
			DW with pump	358		
			STW	292		
			*Others	8267		
10	Pattanakkad	Non-Command	DW	15		
			DW with pump	68		
			STW	125		
			*Others	9753		
11	Thycattussery	Non-Command	DW	29		
			DW with pump	159		
			STW	80		
			*Others	4784		
12	Veliyanad	Non-Command	DW	21		
			DW with pump	235		
			STW	10		
			*Others	2092		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		ERNAKULAM				
Assessment Year		2023				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No. of Structures		
				Irrigation	Domestic	Industrial
1	Alangad	Non - Command	DW	2	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	906		
			STW	55		
			*Others	5345		
2	Angamaly	Non - Command	DW	4		
			DW with pump	1662		
			STW	95		
			*Others	6570		
3	Edappally	Non - Command	DW	63		
			DW with pump	182		
			STW	6		
			*Others	4281		
4	Koovappady	Non - Command	DW	3		
			DW with pump	1881		
			STW	70		
			*Others	6708		
5	Kothamangalam	Non - Command	DW	58		
			DW with pump	1561		
			STW	88		
			*Others	8122		
6	Moovattupuzha	Non - Command	DW	0		
			DW with pump	2280		
			STW	91		
			*Others	6656		
7	Mulamthuruthy	Non - Command	DW	7		
			DW with pump	1148		
			STW	250		
			*Others	6371		
8	Palluruthy	Non - Command	DW	3		
			DW with pump	240		
			STW	4		
			*Others	2628		
9	Pampakkuda	Non - Command	DW	21		
			DW with pump	1577		
			STW	48		
			*Others	4991		
10	Parakkadavu	Non - Command	DW	0		
			DW with pump	1500		
			STW	109		
			*Others	7321		

District		**ERNAKULAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Type of Structure**	**No. of Structures**		
				Irrigation	**Domestic**	**Industrial**
11	Paravoor	Non - Command	DW	0	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	1155		
			STW	0		
			*Others	6584		
12	Vadavukodu	Non - Command	DW	12		
			DW with pump	1194		
			STW	48		
			*Others	0		
13	Vazhakkulam	Non - Command	DW	0		
			DW with pump	2048		
			STW	52		
			Others	8755		
14	Vypeen	Non - Command	DW	7		
			DW with pump	125		
			STW	0		
			Others	0		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**IDUKKI**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No. of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
1	Adimali	Non-command	DW	193	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	1052		
			STW	650		
			*Others (pl. specify)	6054		
2	Azhutha	Non-command	DW	120		
			DW with pump	331		
			STW	850		
			Others (pl. specify)	9000		
3	Devikulam	Non-command	DW	160		
			DW with pump	371		
			STW	610		
			Others (pl. specify)	7387		
4	Elam Desom	Non-command	DW	377		
			DW with pump	700		
			STW	770		
			Others (pl. specify)	6075		
5	Idukki	Non-command	DW	203		
			DW with pump	473		
			STW	720		
			Others (pl. specify)	6759		
6	Kattappana	Non-command	DW	184		
			DW with pump	1105		
			STW	1655		
			Others (pl. specify)	9500		
7	Nedumkandam	Non-command	DW	198		
			DW with pump	690		
			STW	1855		
			Others (pl. specify)	8400		
8	Thodupuzha	Non-command	DW	301		
			DW with pump	843		
			STW	800		
			Others (pl. specify)	3729		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KANNUR**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
1	Edakkad	Non-command	DW	42	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	967		
			STW	66		
			*Others (pl. specify)	5042		
2	Irikkur	Non-command	DW	62		
			DW with pump	985		
			STW	290		
			Others (pl. specify)	12065		
3	Iritty	Non-command	DW	112		
			DW with pump	1320		
			STW	9		
			Others (pl. specify)	14761		
4	Kallyasseri	Non-command	DW	25		
			DW with pump	1100		
			STW	118		
			Others (pl. specify)	10302		
4	Kannur	Non-command	DW	26		
			DW with pump	2836		
			STW	80		
			Others (pl. specify)	16759		
5	Kuthuparamba	Non-command	DW	48		
			DW with pump	955		
			STW	136		
			Others (pl. specify)	8327		
6	Panur	Non-command	DW	20		
			DW with pump	764		
			STW	98		
			Others (pl. specify)	6867		
6	Payyannur	Non-command	DW	48		
			DW with pump	698		
			STW	262		
			Others (pl. specify)	7095		
7	Peravoor	Non-command	DW	96		
			DW with pump	1200		
			STW	119		
			Others (pl. specify)	8506		
8	Taliparamba	Non-command	DW	28		
			DW with pump	658		
			STW	201		
			Others (pl. specify)	16909		
9	Thalassery	Non-command	DW	18		
			DW with pump	674		
			STW	31		
			Others (pl. specify)	6313		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KASARGOD**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
1	Kanhangad	Non-command	DW	130	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	2700		
			STW	451		
			*Others (pl. specify)	7650		
2	Karadka	Non-command	DW	725		
			DW with pump	7750		
			STW	397		
			*Others (pl. specify)	6539		
3	Kasaragod	Non-command	DW	552		
			DW with pump	4802		
			STW	541		
			Others (pl. specify)	8348		
4	Manjeswar	Non-command	DW	1145		
			DW with pump	6325		
			STW	309		
			Others (pl. specify)	7511		
5	Nileswaram	Non-command	DW	79		
			DW with pump	1895		
			STW	321		
			Others (pl. specify)	7576		
6	Parappa	Non-command	DW	345		
			DW with pump	6485		
			STW	361		
			Others (pl. specify)	8653		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KOLLAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No. of Structures**		
			Structure	**Irrigation**	**Domestic**	**Industrial**
1	Anchal	Non-command	DW	344	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	742		
			STW	36		
			*Others (pl. specify)	14415		
2	Chadayamangalam	Non-command	DW	365		
			DW with pump	740		
			STW	47		
			Others (pl. specify)	13049		
3	Chavara	Non-command	DW	0		
			DW with pump	279		
			STW	102		
			Others (pl. specify)	8952		
4	Chittumala	Non-command	DW	433		
			DW with pump	882		
			STW	119		
			Others (pl. specify)	9523		
5	Ithikkara	Non-command	DW	205		
			DW with pump	510		
			STW	55		
			Others (pl. specify)	8530		
6	Kottarakkara	Non-command	DW	195		
			DW with pump	566		
			STW	107		
			Others (pl. specify)	9916		
7	Mukhathala	Non-command	DW	161		
			DW with pump	417		
			STW	126		
			Others (pl. specify)	11403		
8	Oachira	Non-command	DW	89		
			DW with pump	577		
			STW	92		
			Others (pl. specify)	13414		
9	Pathanapuram	Non-command	DW	289		
			DW with pump	859		
			STW	88		
			Others (pl. specify)	9929		
10	Sasthamkotta	Non-command	DW	271		
			DW with pump	580		
			STW	73		
			Others (pl. specify)	10111		
11	Vettikkavala	Non-command	DW	97		
			DW with pump	660		
			STW	89		
			Others (pl. specify)	11344		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KOTTAYAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No.of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
1	Erattupetta	Non-command	DW	32	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	691		
			STW	54		
			*Others (pl. specify)	5768		
2	Ettumanoor	Non-command	DW	89		
			DW with pump	275		
			STW	46		
			Others (pl. specify)	10049		
3	Kaduthuruthy	Non-command	DW	12		
			DW with pump	1198		
			STW	59		
			Others (pl. specify)	7722		
4	Kanjirappally	Non-command	DW	15		
			DW with pump	689		
			STW	107		
			Others (pl. specify)	9916		
5	Lalam	Non-command	DW	21		
			DW with pump	348		
			STW	84		
			Others (pl. specify)	4838		
6	Madappally	Non-command	DW	162		
			DW with pump	670		
			STW	50		
			Others (pl. specify)	10049		
7	Pallom	Non-command	DW	24		
			DW with pump	346		
			STW	123		
			Others (pl. specify)	12906		
8	Pampady	Non-command	DW	112		
			DW with pump	45		
			STW	232		
			Others (pl. specify)	6262		
9	Uzhavoor	Non-command	DW	210		
			DW with pump	456		
			STW	67		
			Others (pl. specify)	6953		
10	Vaikom	Non-command	DW	10		
			DW with pump	482		
			STW	30		
			Others (pl. specify)	4779		
11	Vazhoor	Non-command	DW	159		
			DW with pump	475		
			STW	68		
			Others (pl. specify)	5805		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**KOZHIKODE**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No. of Structures**		
			Structure	**Irrigation**	**Domestic**	**Industrial**
1	Balussery	Non-command	DW	0	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	1607		
			STW	182		
			*Others (pl. specify)	10682		
2	Chelannur	Non-command	DW	0		
			DW with pump	692		
			STW	76		
			Others (pl. specify)	9000		
3	Koduvally	Non-command	DW	0		
			DW with pump	1031		
			STW	112		
			Others (pl. specify)	11208		
4	Kozhikode	Non-command	DW	0		
			DW with pump	873		
			STW	15		
			Others (pl. specify)	11118		
5	Kunnamangalam	Non-command	DW	0		
			DW with pump	1604		
			STW	94		
			Others (pl. specify)	14353		
6	Kunnummal	Non-command	DW	0		
			DW with pump	637		
			STW	67		
			Others (pl. specify)	8160		
7	Melady	Non-command	DW	0		
			DW with pump	570		
			STW	15		
			Others (pl. specify)	5233		
8	Panthalayani	Non-command	DW	0		
			DW with pump	470		
			STW	36		
			Others (pl. specify)	4410		
9	Perambra	Non-command	DW	0		
			DW with pump	816		
			STW	98		
			Others (pl. specify)	7212		
10	Thodannur	Non-command	DW	0		
			DW with pump	227		
			STW	44		
			Others (pl. specify)	5404		
11	Tuneri	Non-command	DW	0		
			DW with pump	520		
			STW	37		
			Others (pl. specify)	5666		
12	Vadakara	Non-command	DW	0		
			DW with pump	297		
			STW	41		
			Others (pl. specify)	4754		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		MALAPPURAM				
Assessment Year		2023				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No .of Structures		
				Irrigation	Domestic	Industrial
1	Areacode	Non-command	DW	10	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	1125		
			STW	106		
			*Others (pl. specify)	9880		
2	Kalikavu	Non-command	DW	15		
			DW with pump	812		
			STW	58		
			Others (pl. specify)	7396		
3	Kondotty	Non-command	DW	125		
			DW with pump	1098		
			STW	468		
			Others (pl. specify)	8917		
4	Kuttippuram	Non-command	DW	1325		
			DW with pump	1265		
			STW	86		
			Others (pl. specify)	8369		
5	Malappuram	Non-command	DW	16		
			DW with pump	901		
			STW	418		
			Others (pl. specify)	8478		
6	Mankada	Non-command	DW	0		
			DW with pump	895		
			STW	619		
			Others (pl. specify)	6044		
7	Nilamboor	Non-command	DW	0		
			DW with pump	565		
			STW	15		
			Others (pl. specify)	8609		
8	Perinthalmanna	Non-command	DW	715		
			DW with pump	812		
			STW	1086		
			Others (pl. specify)	8650		
9	Perumpadappu	Non-command	DW	0		
			DW with pump	990		
			STW	1521		
			Others (pl. specify)	36877		
10	Ponnani	Non-command	DW	10		
			DW with pump	524		
			STW	15		
			Others (pl. specify)	4296		
11	Tanur	Non-command	DW	0		
			DW with pump	1225		
			STW	146		
			Others (pl. specify)	8349		
12	Tirurangadi	Non-command	DW	0		
			DW with pump	1550		
			STW	43		
			Others (pl. specify)	9794		
13	Tirur	Non-command	DW	0		
			DW with pump	855		
			STW	27		
			Others (pl. specify)	6867		
14	Vengara	Non-command	DW	0		
			DW with pump	765		

District		**MALAPPURAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Type of Structure**	**No .of Structures**		
				Irrigation	**Domestic**	**Industrial**
15	Wandoor	Non-command	STW	0		
			Others (pl. specify)	7397		
			DW	12		
			DW with pump	476		
			STW	81		
			Others (pl. specify)	8124		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**PALAKKAD**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No .of Structures**		
			Type of Structure	**Irrigation**	**Domestic**	**Industrial**
1	Alathur	Non-command	DW	17	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	4910		
			STW	22		
			*Others (pl. specify)	12697		
2	Attappadi	Non-command	DW	2		
			DW with pump	1837		
			STW	78		
			Others (pl. specify)	996		
3	Chittur	Non-command	DW	85		
			DW with pump	1144		
			STW	4523		
			Others (pl. specify)	10732		
4	Kollengode	Non-command	DW	0		
			DW with pump	2810		
			STW	307		
			Others (pl. specify)	7522		
5	Kuzhalmannam	Non-command	DW	40		
			DW with pump	1597		
			STW	144		
			Others (pl. specify)	8424		
6	Malampuzha	Non-command	DW	60		
			DW with pump	378		
			STW	1144		
			Others (pl. specify)	8710		
7	Mannarkkad	Non-command	DW	5		
			DW with pump	1002		
			STW	88		
			Others (pl. specify)	12264		
8	Nenmara	Non-command	DW	20		
			DW with pump	2701		
			STW	139		
			Others (pl. specify)	8075		
9	Ottappalam	Non-command	DW	198		
			DW with pump	1788		
			STW	51		
			Others (pl. specify)	9024		
10	Palakkad	Non-command	DW	0		
			DW with pump	1541		
			STW	96		
			Others (pl. specify)	9010		
11	Pattambi	Non-command	DW	0		
			DW with pump	4322		
			STW	126		
			Others (pl. specify)	10738		
12	Sreekrishnapuram	Non-command	DW	0		
			DW with pump	1692		
			STW	53		
			Others (pl. specify)	8457		
13	Thrithala	Non-command	DW	0		
			DW with pump	1138		
			STW	107		
			Others (pl. specify)	9135		
			STW: Shallow tube wells and bore wells, * Others: Irrigation through domestic wells			

District		**PATHANAMTHITTA**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Type of Structure**	**No.of Structures**		
				Irrigation	**Domestic**	**Industrial**
1	Elanthoor	Non-command	DW	50	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	603		
			STW	44		
			Others (pl. specify)	6873		
2	Koipuram	Non-command	DW	296		
			DW with pump	574		
			STW	38		
			Others (pl. specify)	7747		
3	Konni	Non-command	DW	145		
			DW with pump	459		
			STW	91		
			Others (pl. specify)	9978		
4	Mallappally	Non-command	DW	626		
			DW with pump	344		
			STW	66		
			Others (pl. specify)	7470		
5	Pandalam	Non-command	DW	268		
			DW with pump	1278		
			STW	86		
			Others (pl. specify)	8420		
6	Parakode	Non-command	DW	608		
			DW with pump	1583		
			STW	101		
			Others (pl. specify)	10061		
7	Pulikeezh	Non-command	DW	10		
			DW with pump	474		
			STW	55		
			Others (pl. specify)	5450		
8	Ranni	Non-command	DW	620		
			DW with pump	351		
			STW	107		
			Others (pl. specify)	8226		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**THIRUVANANTHAPURAM**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Type of Structure**	**No.of Structures**		
				Irrigation	**Domestic**	**Industrial**
1	Athiyannur	Non-command	DW	245	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	785		
			STW	55		
			Others (pl. specify)	8955		
2	Chirayinkil	Non-command	DW	12		
			DW with pump	265		
			STW	53		
			Others (pl. specify)	7545		
3	Kilimanoor	Non-command	DW	76		
			DW with pump	182		
			STW	418		
			Others (pl. specify)	10410		
4	Nedumangad	Non-command	DW	0		
			DW with pump	201		
			STW	224		
			Others (pl. specify)	18697		
5	Nemom	Non-command	DW	0		
			DW with pump	718		
			STW	48		
			Others (pl. specify)	8316		
6	Parassala	Non-command	DW	25		
			DW with pump	978		
			STW	35		
			Others (pl. specify)	9690		
7	Perumkadavila	Non-command	DW	15		
			DW with pump	598		
			STW	95		
			Others (pl. specify)	10243		
8	Pothencode	Non-command	DW	15		
			DW with pump	695		
			STW	44		
			Others (pl. specify)	10595		
9	Vamanapuram	Non-command	DW	25		
			DW with pump	653		
			STW	56		
			Others (pl. specify)	11613		
10	Varkala	Non-command	DW	21		
			DW with pump	398		
			STW	13		
			Others (pl. specify)	7257		
11	Vellanad	Non-command	DW	612		
			DW with pump	741		
			STW	14		
			Others (pl. specify)	12489		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		THRISSUR				
Assessment Year		2023				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Structure	No.of Structures		
				Irrigation	Domestic	Industrial
1	Anthikkad	Non-command	DW	0	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	2895		
			STW	15		
			*Others (pl. specify)	6769		
2	Chalakkudy	Non-command	DW	15		
			DW with pump	3998		
			STW	38		
			Others (pl. specify)	7394		
3	Chavakkad	Non-command	DW	0		
			DW with pump	2365		
			STW	800		
			Others (pl. specify)	12010		
4	Cherpu	Non-command	DW	0		
			DW with pump	3568		
			STW	66		
			Others (pl. specify)	4585		
5	Chowannur	Non-command	DW	12		
			DW with pump	4125		
			STW	307		
			Others (pl. specify)	8902		
6	Irinjalakkuda	Non-command	DW	0		
			DW with pump	2452		
			STW	529		
			Others (pl. specify)	4719		
7	Kodakara	Non-command	DW	0		
			DW with pump	4823		
			STW	56		
			Others (pl. specify)	10352		
9	Mala	Non-command	DW	0		
			DW with pump	6425		
			STW	3		
			Others (pl. specify)	7371		
10	Mathilakom	Non-command	DW	0		
			DW with pump	2851		
			STW	900		
			Others (pl. specify)	19152		
11	Mullassery	Non-command	DW	15		
			DW with pump	2152		
			STW	550		
			Others (pl. specify)	9003		
12	Ollukkara	Non-command	DW	0		
			DW with pump	1452		
			STW	278		
			Others (pl. specify)	7028		
13	Pazhayannur	Non-command	DW	0		
			DW with pump	2896		
			STW	182		
			Others (pl. specify)	7992		
14	Puzhakkal	Non-command	DW	0		
			DW with pump	3758		
			STW	105		
			Others (pl. specify)	8111		

District		**THRISSUR**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Structure**	**No.of Structures**		
				Irrigation	**Domestic**	**Industrial**
15	Thalikkulam	Non-command	DW	0		
			DW with pump	1825		
			STW	1010		
			Others (pl. specify)	10051		
16	Vadakkancherry	Non-command	DW	15		
			DW with pump	3485		
			STW	241		
			Others (pl. specify)	5785		
17	Vellangallur	Non-command	DW	0		
			DW with pump	2152		
			STW	114		
			Others (pl. specify)	10384		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		**WAYANAD**				
Assessment Year		**2023**				
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**		**No .of Structures**		
			Structure	**Irrigation**	**Domestic**	**Industrial**
1	Kalpetta	Non-command	DW	0	Domestic Extraction Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial Extraction data provided by Dept. of Industries, Government of Kerala
			DW with pump	286		
			STW	69		
			Others (pl. specify)	9672		
2	Mananthavady	Non-command	DW	41		
			DW with pump	138		
			STW	25		
			Others (pl. specify)	8429		
3	Panamaram	Non-command	DW	15		
			DW with pump	166		
			STW	53		
			Others (pl. specify)	8464		
3	Sulthanbathery	Non-command	DW	25		
			DW with pump	286		
			STW	391		
			Others (pl. specify)	8502		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

ANNEXURE IIIC: PARAMETERS USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

State		**KERALA**												
District		**ALAPPUZHA**												
Assessment Year		**2023**												
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ Non-Command/ Poor Quality)**	**Specific Yield (in fraction)**		**Rainfall Infiltration Factor (in fraction)**		**Season-wise Unit Extraction (ha m)**							
							Structure	**Irrigation**		**Domestic**		**Industrial**	
			Formation	**Value**	**Formation**	**Value**		**Monsoon**	**Non-monsoon**	**Monsoon**	**Non-monsoon**	**Monsoon**	**Non-monsoon**
1	Ambalappuzha	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.0002 - 4.095	0.0002 - 4.095
							DW with pump	0.06	0.24				
							STW	0.02	0.08				
							*Others (pl. specify)		0.007				
2	Aryad	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.016	0.064			0.0029	0.0029
							DW with pump	0.06	0.24				
							STW	0.02	0.08				
							Others (pl. specify)		0.028				
3	Bharanikkavu	Non-Command	Alluvium	0.11	Alluvium	0.09	DW	0.016	0.064			0.135	0.135
							DW with pump	0.1	0.4				
							STW	0.02	0.08				
							Others (pl. specify)		0.01				
4	Champakkulam	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			0.01	0.01
							DW with pump	0.06	0.24				
							STW	0.04	0.16				
							Others (pl. specify)		0.01				

State		KERALA												
District		ALAPPUZHA												
Assessment Year		2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ Non-Command/ Poor Quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)							
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
5	Chengannur	Non-Command	Alluvium	0.15	Alluvium	0.1	DW	0.012	0.048			0.001 - 0.75	0.001 - 0.75
							DW with pump	0.1	0.4				
							STW	0.03	0.12				
							Others (pl. specify)		0.008				
6	Harippad	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.016	0.064			0.0004 - 41.18	0.0004 - 41.18
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.015				
7	Kanjikkuzhy	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			0.0002-0.65	0.0002-0.65
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
8	Mavelikkara	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.016	0.064			0.375	0.375
							DW with pump	0.08	0.32				
							STW	0.04	0.16				
							Others (pl. specify)		0.01				
9	Muthukulam	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			0.0005 -	0.0005 -

State		KERALA											
District		ALAPPUZHA											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ Non-Command/ Poor Quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
													49.235
							DW with pump	0.08	0.32			49.235	
							STW	0.2	0.6				
							Others (pl. specify)		0.01				
10	Pattanakkad	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			34.185	34.185
							DW with pump	0.06	0.24				
							STW	0.03	0.12				
							Others (pl. specify)		0.01				
11	Thycattussery	Non-Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			0.0004-0.45	0.0004-0.45
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
12	Veliyanad	Non-Command	Alluvium	0.16	Alluvium	0.09	DW	0.012	0.048			0	0
							DW with pump	0.06	0.24				
							STW	0.04	0.16				
							Others (pl. specify)		0.01				

State	KERALA
District	ERNAKULAM
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Alangad	Non - Command	Laterite	0.09	Laterite	0.083	DW	0.024	0.096	Computed on the basis of projected population, per capita requirement & fractional load on ground water		23.435	23.435
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.007				
2	Angamaly	Non - Command	Laterite	0.06	Laterite	0.08	DW	0.024	0.096			0.004 to 23.018	0.004 to 23.018
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.007				
3	Edappally	Non - Command	Alluvium	0.16	Alluvium	0.1	DW	0.024	0.096			0.0039 to 5.444	0.0039 to 5.444
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
4	Koovappady	Non - Command	Laterite	0.05	Laterite	0.06	DW	0.012	0.048			0.0391 to 6.315	0.0391 to 6.315
							DW with pump	0.06	0.24				
							STW	0.08	0.32				

State	KERALA											
District	ERNAKULAM											
Assessment Year	2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.03				
5	Kothamangalam	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.00769 to 1.2	0.00769 to 1.2
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
6	Moovattupuzha	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.0223 to 4.17	0.0223 to 4.17
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.007				
7	Mulamthuruthy	Non - Command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			6.41	6.41
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
8	Palluruthy	Non - Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			0.005 to	0.005 to

State	KERALA
District	ERNAKULAM
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							DW with pump	0.08	0.32			4.639	4.639
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
9	Pampakkuda	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.0063 to 2.574	0.0012 to 2.574
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
10	Parakkadavu	Non - Command	Laterite	0.05	Laterite	0.076	DW	0.024	0.096			0.0034 to 4.05	0.0034 to 4.05
							DW with pump	0.08	0.3				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
11	Paravoor	Non - Command	Alluvium	0.16	Alluvium	0.1	DW	0.024	0.096			7.2	7.2
							DW with pump	0.08	0.32				
							STW	0.2	0.8				

State	KERALA												
District	ERNAKULAM												
Assessment Year	2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.02				
12	Vadavukodu	Non - Command	Laterite	0.047	Laterite	0.075	DW	0.012	0.048			0.0041 to 1.905	0.0041 to 1.905
							DW with pump	0.08	32				
							STW	0.08	0.32				
							Others (pl. specify)		0.007				
13	Vazhakkulam	Non - Command	Laterite	0.05	Laterite	0.08	DW	0.024	0.096			0.002 to 3.255	0.002 to 3.255
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.012				
14	Vypeen	Non - Command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.04			0.0012	0.0012
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.007				
							* Others: Irrigation through domestic wells						

State		**KERALA**											
District		**ERNAKULAM**											
Assessment Year		**2023**											
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Specific Yield (in fraction)**		**Rainfall Infiltration Factor (in fraction)**		**Season-wise Unit Extraction (ha m)**						
							Structure	**Irrigation**		**Domestic**		**Industrial**	
			Formation	**Value**	**Formation**	**Value**		**Monsoon**	**Non-monsoon**	**Monsoon**	**Non-monsoon**	**Monsoon**	**Non-monsoon**
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		IDUKKI											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
								Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Adimali	Non-command	Crystalline	0.019	Crystalline	0.068	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.001 to 0.575	0.001 to 0.575
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)		0.025				
2	Azhutha	Non-command	Crystalline	0.019	Crystalline	0.09	DW	0.012	0.048			0.0006 to 3.1495	0.0006 to 3.1495
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.026				
3	Devikulam	Non-command	Crystalline	0.019	Crystalline	0.068	DW	0.016	0.064			0	0
							DW with pump	0.05	0.2				
							STW	0.02	0.08				
							Others (pl. specify)		0.01				
4	Elam Desom	Non-command	Crysttalline	0.019	Crysttalline	0.08	DW	0.012	0.048			0.0016 to 0.54	0.0016 to 0.54
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.025				
5	Idukki	Non-command	Crystalline	0.019	Crystalline	0.09	DW	0.012	0.048			0.002 to	0.002 to

State		KERALA											
District		IDUKKI											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
								Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							DW with pump	0.08	0.32			0.18	0.18
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
6	Kattappana	Non-command	Crystalline	0.019	Crystalline	0.08	DW	0.012	0.048			0.66	0.66
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.008				
7	Nedumkandam	Non-command	Crystalline	0.015	Crystalline	0.08	DW	0.012	0.048			0.59	0.59
							DW with pump	0.08	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.015				
8	Thodupuzha	Non-command	Crystalline	0.02	Crystalline	0.079	DW	0.012	0.048			0.0405 to 0.755	0.0405 to 0.755
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.025				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		KANNUR											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Edakkad	Non-command	Laterite	0.025	Laterite	0.072	DW	0.016	0.064	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0	0
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							*Others (pl. specify)		0.01				
2	Irikkur	Non-command	Laterite	0.02	Laterite	0.078	DW	0.016	0.064			0.255	0.255
							DW with pump	0.1	0.38				
							STW	0.1	0.38				
							Others (pl. specify)		0.03				
3	Iritty	Non-command	Laterite	0.025	Laterite	0.08	DW	0.016	0.08			0.113-0.4106	0.113-0.4106
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							Others (pl. specify)		0.032				
4	Kallyasseri	Non-command	Laterite	0.039	Laterite	0.084	DW	0.016	0.064			0	0
							DW with pump	0.08	0.32				
							STW	0.1	0.4				
							Others (pl. specify)		0.02				
5	Kannur	Non-command	Laterite	0.09	Laterite	0.08	DW	0.016	0.064			5.07	5.07

State		**KERALA**										
District		**KANNUR**										
Assessment Year		**2023**										
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Specific Yield (in fraction)**		**Rainfall Infiltration Factor (in fraction)**		**Season-wise Unit Extraction (ha m)**					
							Structure	**Irrigation**		**Domestic**		**Industrial**
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							DW with pump	0.08	0.32				
							STW	0.1	0.4				
							Others (pl. specify)		0.01				
6	Kuthuparamba	Non-command	Laterite	0.025	Laterite	0.06	DW	0.016	0.064			0	0
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							Others (pl. specify)		0.02				
7	Panur	Non-command	Laterite	0.025	Laterite	0.077	DW	0.016	0.064			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.017				
8	Payyannur	Non-command	Laterite	0.035	Laterite	0.0678	DW	0.016	0.08			0	0
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							Others (pl. specify)		0.028				
9	Peravoor	Non-command	Laterite	0.025	Laterite	0.077	DW	0.016	0.064			0.304	0.304

State		**KERALA**										
District		**KANNUR**										
Assessment Year		**2023**										
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Specific Yield (in fraction)**		**Rainfall Infiltration Factor (in fraction)**		**Season-wise Unit Extraction (ha m)**					
							Structure	**Irrigation**		**Domestic**		**Industrial**
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							Others (pl. specify)		0.03				
10	Taliparamba	Non-command	Laterite	0.039	Laterite	0.065	DW	0.016	0.08			1.198	1.198
							DW with pump	0.1	0.4				
							STW	0.1	0.37				
							Others (pl. specify)		0.028				
11	Thalassery	Non-command	Laterite	0.025	Laterite	0.075	DW	0.016	0.064			1.4	1.4
							DW with pump	0.08	0.3				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		KASARGOD											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Kanhangad	Non-command	Laterite	0.03	Laterite	0.074	DW	0.024	0.2	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.855	0.855
							DW with pump	0.08	0.42				
							STW	0.15	0.6				
							*Others (pl. specify)		0.02				
2	Karadka	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.54			1.74	1.74
							DW with pump	0.08	0.32				
							STW	0.15	0.55				
							Others (pl. specify)		0.018				
3	Kasaragod	Non-command	Laterite	0.03	Laterite	0.074	DW	0.016	0.05			0.743	0.743
							DW with pump	0.1	0.4				
							STW	0.15	0.5				
							Others (pl. specify)		0.02				
4	Manjeswar	Non-command	Laterite	0.03	Laterite	0.075	DW	0.016	0.064			1.0521	1.0521
							DW with pump	0.1	0.4				
							STW	0.15	0.6				

State		KERALA										
District		KASARGOD										
Assessment Year		2023										
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.02				
5	Nileswaram	Non-command	Laterite	0.03	Laterite	0.075	DW	0.016	0.064			1.9	1.9
							DW with pump	0.1	0.38				
							STW	0.15	0.55				
							Others (pl. specify)		0.02				
6	Parappa	Non-command	Laterite	0.03	Laterite	0.075	DW	0.012	0.048			0.855	0.855
							DW with pump	0.06	0.35				
							STW	0.1	0.5				
							Others (pl. specify)		0.01				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		**KERALA**											
District		**KOLLAM**											
Assessment Year		**2023**											
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Specific Yield (in fraction)**		**Rainfall Infiltration Factor (in fraction)**		**Season-wise Unit Extraction (ha m)**						
							Structure	**Irrigation**		**Domestic**		**Industrial**	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Anchal	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.045	0.045
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							*Others (pl. specify)		0.02				
2	Chadayamangalam	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048			0.0025-0.608	0.0025-0.608
							DW with pump	0.08	0.35				
							STW	0.06	0.26				
							Others (pl. specify)		0.018				
3	Chavara	Non-command	Alluvium	0.16	Alluvium	0.1	DW	0.024	0.096			0.001-0.435	0.001-0.435
							DW with pump	0.06	0.3				
							STW	0.1	0.38				
							Others (pl. specify)		0.015				
4	Chittumala	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.04			6.1	6.1
							DW with pump	0.06	0.24				
							STW	0.05	0.24				
							Others (pl.		0.02				

State		KERALA											
District		KOLLAM											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							specify)						
5	Ithikkara	Non-command	Alluvium	0.11	Alluvium	0.09	DW	0.012	0.048			0.0015 to 0.653	0.0015 to 0.653
							DW with pump	0.06	0.22				
							STW	0.06	0.24				
							Others (pl. specify)		0.018				
6	Kottarakkara	Non-command	Alluvium	0.025	Alluvium	0.06	DW	0.012	0.048			0.005 to 0.69	0.005 to 0.69
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
7	Mukhathala	Non-command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.04			0.002 to 0.39	0.002 to 0.39
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
8	Oachira	Non-command	Alluvium	0.16	Alluvium	0.1	DW	0.012	0.048			0.004 to 0.045	0.004 to 0.045
							DW with pump	0.05	0.24				
							STW	0.05	0.2				

State		KERALA											
District		KOLLAM											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.02				
9	Pathanapuram	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.04			0.0089 to 0.1	0.0089 to 0.1
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
10	Sasthamkotta	Non-command	Laterite	0.04	Laterite	0.06	DW	0.012	0.04			0.12	0.12
							DW with pump	0.06	0.3				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
11	Vettikkavala	Non-command	Laterite	0.03	Laterite	0.06	DW	0.012	0.04			0.0012 to 0.09	0.0015 to 0.09
							DW with pump	0.06	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		KOTTAYAM											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Erattupetta	Non-command	Lateriite	0.08	Lateriite	0.073	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.075	0.075
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							*Others (pl. specify)		0.028				
2	Ettumanoor	Non-command	Laterite	0.04	Laterite	0.067	DW	0.012	0.048			0.02	0.02
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.019				
3	Kaduthuruthy	Non-command	Laterite	0.04	Laterite	0.082	DW	0.012	0.048			0.0192	0.0192
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.0175				
4	Kanjirappally	Non-command	Laterite	0.04	Laterite	0.075	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.0275				
5	Lalam	Non-command	Laterite	0.029	Laterite	0.075	DW	0.012	0.048			0.025	0.025

State	KERALA
District	KOTTAYAM
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)							
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.027				
6	Madappally	Non-command	Alluvial	0.16	Alluvial	0.115	DW	0.012	0.048			0.0039-0.072	0.0039-0.072
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.026				
7	Pallom	Non-command	Laterite	0.079	Laterite	0.1	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.029				
8	Pampady	Non-command	Laterite	0.03	Laterite	0.072	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.028				
9	Uzhavoor	Non-command	Laterite	0.03	Laterite	0.074	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				

State	KERALA													
District	KOTTAYAM													
Assessment Year	2023													
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)							
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.06	0.24				
							Others (pl. specify)		0.0485				
10	Vaikom	Non-command	Alluvial	0.12	Alluvial	0.09	DW	0.012	0.048			0.0183	0.0183
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.048				
11	Vazhoor	Non-command	Laterite	0.03	Laterite	0.072	DW	0.012	0.048			0.001-0.2976	0.001-0.2976
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.027				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State	KERALA
District	KOZHIKODE
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)							
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Balussery	Non-command	Laterite	0.025	Laterite	0.081	DW	0.024	0.096	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)		0.018				
2	Chelannur	Non-command	Laterite	0.025	Laterite	0.081	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.019				
3	Koduvally	Non-command	Laterite	0.025	Laterite	0.081	DW	0.024	0.096			0.703	0.684
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.018				
4	Kozhikode	Non-command	Laterite	0.052	Laterite	0.063	DW	0.024	0.096			0.515	0.515
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.018				
5	Kunnamangalam	Non-command	Laterite	0.025	Laterite	0.081	DW	0.024	0.096			0.0925	0.0925

State	KERALA													
District	KOZHIKODE													
Assessment Year	2023													
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)							
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.01				
6	Kunnummal	Non-command	Laterite	0.025	Laterite	0.093	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.018				
7	Melady	Non-command	Alluvial	0.14	Alluvial	0.08	DW	0.024	0.096			0.0925	0.0925
							DW with pump	0.05	0.2				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
8	Panthalayani	Non-command	Alluvial	0.16	Alluvial	0.9	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.025				
9	Perambra	Non-command	Laterite	0.03	Laterite	0.073	DW	0.024	0.096			0.074	0.074
							DW with pump	0.06	0.24				

State	KERALA												
District	KOZHIKODE												
Assessment Year	2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.08	0.32				
							Others (pl. specify)		0.0182				
10	Thodannur	Non-command	Laterite	0.025	Laterite	0.081	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.0175				
11	Tuneri	Non-command	Laterite	0.025	Laterite	0.071	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.018				
12	Vadakara	Non-command	Laterite	0.063	Laterite	0.103	DW	0.024	0.096			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.015				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		MALAPPURAM											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Areacode	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)		0.023				
2	Kalikavu	Non-command	Laterite	0.025	Laterite	0.078	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.029				
3	Kondotty	Non-command	Laterite	0.025	Laterite	0.082	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.022				
4	Kuttippuram	Non-command	Laterite	0.052	Laterite	0.07	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.025				
5	Malappuram	Non-command	Laterite	0.03	Laterite	0.078	DW	0.012	0.048			0	0
							DW with pump	0.06	0.24				
							STW	0.06	0.24				

State	KERALA											
District	MALAPPURAM											
Assessment Year	2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.015				
6	Mankada	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.015				
7	Nilamboor	Non-command	Laterite	0.025	Laterite	0.082	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.025				
8	Perinthalmanna	Non-command	Laterite	0.015	Laterite	0.075	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.025				
9	Perumpadappu	Non-command	Alluvial	0.16	Alluvial	0.1	DW	0.012	0.048			0	0
							DW with pump	0.06	0.024				
							STW	0.055	0.2				
							Others (pl. specify)		0.005				
10	Ponnani	Non-command	Alluvial	0.106	Alluvial	0.08	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				

State	KERALA											
District	MALAPPURAM											
Assessment Year	2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
11	Tanur	Non-command	Laterite	0.025	Laterite	0.82	DW	0.024	0.096			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.025				
12	Thriurangadi	Non-command	Alluvial	0.03	Alluvial	0.08	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.017				
13	Tirur	Non-command	Laterite	0.03	Laterite	0.082	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
14	Vengara	Non-command	Laterite	0.04	Laterite	0.07	DW	0.024	0.096			0	0
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.028				
15	Wandoor	Non-	Laterite	0.025	Laterite	0.08	DW	0.024	0.096			0	0

State	KERALA												
District	MALAPPURAM												
Assessment Year	2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
		command					DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.017				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		PALAKKAD											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Alathur	Non-command	Weathered Crystallines	0.06	Weathered Crystallines	0.06	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.273	0.273
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)	0	0.02				
2	Attappadi	Non-command	Weathered Crystallines	0.03	Weathered Crystallines	0.11	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)	0	0.02				
3	Chittur	Non-command	Weathered Crystallines	0.015	Weathered Crystallines	0.05	DW	0.024	0.096			29.03	29.03
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.02				
4	Kollengode	Non-command	Weathered Crystallines	0.03	Weathered Crystallines	0.08	DW	0.024	0.096			0.004 to 0.85	0.004 to 0.85
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl.	0	0.015				

State		KERALA										
District		PALAKKAD										
Assessment Year		2023										
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							specify)						
5	Kuzhalmannam	Non-command	Weathered Crystallines	0.025	Weathered Crystallines	0.07	DW	0.024	0.096			36	36
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
6	Malampuzha	Non-command	Crystalline	0.015	Crystalline	0.05	DW	0.012	0.048			129.72	129.72
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
7	Mannarkkad	Non-command	Weathered Crystallines	0.025	Weathered Crystallines	0.06	DW	0.012	0.048			1.125-0.456	1.125-0.456
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.024				
8	Nenmara	Non-command	Weathered Crystallines	0.025	Weathered Crystallines	0.06	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.2	0.8				

State		KERALA										
District		PALAKKAD										
Assessment Year		2023										
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)	0	0.014				
9	Ottappalam	Non-command	Weathered Crystallines	0.025	Weathered Crystallines	0.07	DW	0.012	0.048			0.237	0.237
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.016				
10	Palakkad	Non-command	Laterite	0.025	Laterite	0.07	DW	0.024	0.096			7.3	7.3
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.02				
11	Pattambi	Non-command	Laterite	0.03	Laterite	0.09	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.016				
12	Sreekrishnapuram	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			36	36
							DW with pump	0.08	0.32				

State		KERALA										
District		PALAKKAD										
Assessment Year		2023										
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.2	0.8				
							Others (pl. specify)	0	0.02				
13	Thrithala	Non-command	Laterite	0.025	Laterite	0.08	DW	0.024	0.096			0.3604	0.3604
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.02				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State		KERALA											
District		PATHANAMTHITTA											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Elanthoor	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.0012	0.0012
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.015				
2	Koipuram	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048			0.002	0.002
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.035				
3	Konni	Non-command	Laterite	0.025	Laterite	0.079	DW	0.012	0.048			0.0008	0.0008
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.015				
4	Mallappally	Non-command	Alluvium	0.025	Alluvial	0.07	DW	0.012	0.048			0.0031	0.0031
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.018				

State		KERALA											
District		PATHANAMTHITTA											
Assessment Year		2023											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
5	Pandalam	Non-command	Laterite	0.075	Laterite	0.07	DW	0.012	0.048			0.00016	0.00016
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.015				
6	Parakode	Non-command	Laterite	0.051	Laterite	0.09	DW	0.012	0.048			0.0007	0.0007
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.018				
7	Pulikeezh	Non-command	Alluvium	0.16	Alluvial	0.102	DW	0.012	0.048			0.0006	0.0006
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.016				
8	Ranni	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048			0.0004	0.0004
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.019				

State		**KERALA**											
District		**PATHANAMTHITTA**											
Assessment Year		**2023**											
Sl. No.	**Assessment Unit**	**Sub-unit (Command/ non-Command/ poor quality)**	**Specific Yield (in fraction**		**Rainfall Infiltration Factor (in fraction)**		**Season-wise Unit Extraction (ha m)**						
			Formation	Value	Formation	Value	**Structure**	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State	KERALA
District	THIRUVANANTHAPURAM
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Athiyannur	Non-command	Laterite	0.07	Laterite	0.085	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.00015 to 0.01	0.00015 to 0.01
							DW with pump	0.06	0.24				
							STW	0.01	0.04				
							Others (pl. specify)		0.012				
2	Chirayinkil	Non-command	Laterite	0.05	Laterite	0.07	DW	0.012	0.048			0.0001 to 0.049	0.0001 to 0.049
							DW with pump	0.08	0.32				
							STW	0.01	0.04				
							Others (pl. specify)		0.03				
3	Kilimanoor	Non-command	Laterite	0.03	Laterite	0.072	DW	0.012	0.048			0	0
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.0215				
4	Nedumangad	Non-command	Laterite	0.025	Laterite	0.075	DW	0.012	0.048			0	0
							DW with pump	0.06	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				

State	KERALA												
District	THIRUVANANTHAPURAM												
Assessment Year	2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
5	Nemom	Non-command	Laterite	0.05	Laterite	0.076	DW	0.024	0.096			0.0001 to 0.415	0.0001 to 0.415
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.018				
6	Parassala	Non-command	Laterite	0.09	Laterite	0.09	DW	0.012	0.048			0.0015-0.102	0.0015-0.102
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.027				
7	Perumkadavila	Non-command	Laterite	0.025	Laterite	0.07	DW	0.012	0.048			0.08	0.08
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
8	Pothencode	Non-command	Alluvium	0.09	Alluvium	0.087	DW	0.012	0.048			1.085	1.085
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.028				

State	KERALA												
District	THIRUVANANTHAPURAM												
Assessment Year	2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
9	Vamanapuram	Non-command	Laterite	0.025	Laterite	0.064	DW	0.012	0.048			0.003-0.31	0.003-0.31
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
10	Varkala	Non-command	Laterite	0.066	Laterite	0.078	DW	0.012	0.048			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.018				
11	Vellanad	Non-command	Laterite	0.03	Laterite	0.079	DW	0.012	0.048			0.0006	0.0006
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
							Others (pl. specify)		0.018				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State	KERALA
District	THRISSUR
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Anthikkad	Non-command	Alluvial	0.1	Alluvial	0.082	DW	0.024	0.096	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.00025-0.0022	0.00025-0.0022
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							*Others (pl. specify)		0.022				
2	Chalakkudy	Non-command	Weathered Granite	0.03	Weathered Granite	0.08	DW	0.02	0.049			0.0062-5.4	0.0062-5.4
							DW with pump	0.06	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.019				
3	Chavakkad	Non-command	Alluvial	0.16	Alluvial	0.11	DW	0.024	0.096			0.0018	0.0018
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.014				
4	Cherpu	Non-command	Weathered Granite	0.05	Weathered Granite	0.068	DW	0.024	0.096			0.0045	0.0045
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.011				
5	Chowannur	Non-	Laterite	0.06	Laterite	0.092	DW	0.012	0.048			0.42	0.42

State	KERALA
District	THRISSUR
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)					
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
		command					DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.01				
6	Iringalakkuda	Non-command	Weathered Granite	0.05	Weathered Granite	0.098	DW	0.024	0.096			0.37	0.37
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.013				
7	Kodakara	Non-command	Weathered Granite	0.03	Weathered Granite	0.09	DW	0.024	0.096			0.0015 to 1.9	0.0015 to 1.9
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.015				
8	Mala	Non-command	Laterite	0.05	Laterite	0.105	DW	0.024	0.096			0.0035	0.0035
							DW with pump	0.05	0.2				
							STW	0.06	0.32				
							Others (pl. specify)		0.015				
9	Mathilakom	Non-command	Alluvial	0.14	Alluvial	0.1	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				

State	KERALA
District	THRISSUR
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
								Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.06	0.24				
							Others (pl. specify)		0.015				
10	Mullassery	Non-command	Alluvial	0.15	Alluvial	0.105	DW	0.024	0.096			0.00005	0.00005
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.012				
11	Ollukkara	Non-command	Weathered Granite	0.027	Weathered Granite	0.08	DW	0.024	0.096			1.8	1.8
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.015				
12	Pazhayannur	Non-command	Laterite	0.03	Laterite	0.092	DW	0.012	0.048			0.0022	0.0022
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.015				
13	Puzhakkal	Non-command	Laterite	0.07	Laterite	0.08	DW	0.024	0.096			0.00015-5.4	0.00015-5.4
							DW with pump	0.08	0.32				
							STW	0.08	0.32				

State	KERALA												
District	THRISSUR												
Assessment Year	2023												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.02				
14	Thalikkulam	Non-command	Alluvial	0.16	Alluvial	0.104	DW	0.024	0.096			0	0
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.018				
15	Vellangallur	Non-command	Laterite	0.066	Laterite	0.072	DW	0.024	0.096			0	0
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.014				
16	Vadakkancherry	Non-command	Laterite	0.025	Laterite	0.071	DW	0.024	0.096			3.205	3.205
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.019				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

State	KERALA
District	WAYANAD
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Kalpetta	Non-command	Weathered Granite	0.031	Weathered Granite	0.08	DW	0.016	0.064	Computed on the basis of projected population, per capita requirement & fractional load on ground water		36	36
							DW with pump	0.08	0.32				
							STW	0.1	0.4				
							Others (pl. specify)		0.015				
2	Mananthavady	Non-command	Weathered Granite	0.031	Weathered Granite	0.08	DW	0.016	0.064			36	36
							DW with pump	0.08	0.32				
							STW	0.1	0.4				
							Others (pl. specify)		0.03				
3	Panamaram	Non-command	Weathered Granite	0.031	Weathered Granite	0.08	DW	0.016	0.064			43.2	43.2
							DW with pump	0.08	0.32				
							STW	0.1	0.4				
							Others (pl. specify)		0.02				
4	Sulthan Bathery	Non-command	Weathered Granite	0.031	Weathered Granite	0.08	DW	0.016	0.064			0.1295 to 43.2	0.1295 to 43.2
							DW with pump	0.08	0.32				
							STW	0.1	0.4				

State	KERALA
District	WAYANAD
Assessment Year	2023

Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit Extraction (ha m)						
							Structure	Irrigation		Domestic		Industrial	
			Formation	Value	Formation	Value		Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.02				
							* Others: Irrigation through domestic wells						
							STW: Shallow Tube wells and Bore wells						

ANNEXURE III D: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2023)

State		**KERALA**							
District		**ALAPPUZHA**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Ambalappuzha	Non-command	1573.02	0.09	126.25	346.56	2045.92	204.59	1841.33
2	Aryad	Non-command	2035.67	31.28	389.42	144.87	2601.24	130.06	2471.18
3	Bharanikkavu	Non-command	1802.33	146.12	214.31	1094.75	3257.51	162.87	3094.64
4	Champakkulam	Non-command	2457.86	1.08	281.88	1124.68	3865.5	193.28	3672.22
5	Chengannur	Non-command	3423.66	13.54	274.79	577.17	4289.16	428.92	3860.24
6	Harippad	Non-command	2610.27	72.1	209.61	837.48	3729.46	186.47	3542.99
7	Kanjikkuzhy	Non-command	1996.39	0.14	201.8	180.97	2379.3	118.97	2260.33
8	Mavelikkara	Non-command	2607.31	108.95	445.89	448.69	3610.84	361.09	3249.75
9	Muthukulam	Non-command	2831.32	29.62	517.23	189.07	3567.24	178.36	3388.88
10	Pattanakkad	Non-command	2321.77	9.99	199.2	78.78	2609.74	130.49	2479.25
11	Thycattussery	Non-command	2650.38	11.95	259.45	73.88	2995.66	149.79	2845.87
12	Veliyanad	Non-command	1806.8	0.08	217.52	1683.55	3707.95	370.8	3337.15
	TOTAL (ha.m)	**Non-command**	**28116.78**	**424.94**	**3337.35**	**6780.45**	**38659.52**	**2615.69**	**36043.83**
	TOTAL (MCM)	**Non-command**	**281.17**	**4.25**	**33.37**	**67.80**	**386.60**	**26.16**	**360.44**

State		**KERALA**							
District		**ERNAKULAM**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5)+(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Alangad	Non-command	1454.83	114.78	241.89	395.47	2206.97	110.35	2096.62
2	Angamaly	Non-command	3554.9	116.54	674.13	852.36	5197.93	519.79	4678.14
3	Edappally	Non-command	3365.26	23.02	638.17	254.09	4280.54	428.06	3852.48
4	Koovappady	Non-command	4472.82	95.51	848.2	975.27	6391.8	639.18	5752.62
5	Kothamangalam	Non-command	3374.67	59.46	639.96	570.44	4644.53	464.45	4180.08
6	Moovattupuzha	Non-command	2931.95	120.77	556	310.12	3918.84	391.88	3526.96
7	Mulamthuruthy	Non-command	2395.89	58.26	454.34	281.75	3190.24	319.03	2871.21
8	Palluruthy	Non-command	1394.28	0	264.4	0	1658.68	165.87	1492.81
9	Pampakkuda	Non-command	2603.24	77.95	493.67	800.29	3975.15	397.52	3577.63
10	Parakkadavu	Non-command	1992.53	49.23	377.85	233.66	2653.27	265.33	2387.94
11	Paravoor	Non-command	1606.85	47.2	304.71	144.93	2103.69	210.37	1893.32
12	Vadavukodu	Non-command	2923.61	205	554.42	987.76	4670.79	467.08	4203.71
13	Vazhakkulam	Non-command	3241.45	292.46	614.69	1096.45	5245.05	524.5	4720.55
14	Vypeen	Non-command	1048.55	4.23	56.54	16.93	1126.25	112.63	1013.62
	TOTAL (ha.m)	**Non-command**	**36360.83**	**1264.41**	**6718.97**	**6919.52**	**51263.73**	**5016.04**	**46247.69**
	TOTAL (MCM)	**Non-command**	**363.61**	**12.64**	**67.19**	**69.195**	**512.64**	**50.16**	**462.48**

State		**KERALA**							
District		**IDUKKI**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Adimali	Non-command	3065.42	76.21	107.4	181.34	3430.37	343.03	3087.34
2	Azhutha	Non-command	2782.99	34.83	97.5	184.5	3099.82	309.98	2789.84
3	Devikulam	Non-command	2319.74	16.08	81.27	64.04	2481.13	248.11	2233.02
4	Elam Desom	Non-command	1653.83	46.73	57.94	291.7	2050.2	205.02	1845.18
5	Idukki	Non-command	2580.13	38.82	90.4	177.75	2887.1	288.7	2598.4
6	Kattappana	Non-command	1911.72	59.6	66.98	418.79	2457.09	245.71	2211.38
7	Nedumkandam	Non-command	2073.67	2.53	72.65	246.54	2395.39	239.54	2155.85
8	Thodupuzha	Non-command	1759.48	37.41	61.64	292.33	2150.86	215.09	1935.77
	TOTAL (ha.m)	**Non-command**	**18146.98**	**312.21**	**635.78**	**1856.99**	**20951.96**	**2095.18**	**18856.78**
	TOTAL (MCM)	**Non-command**	**181.47**	**3.12**	**6.36**	**18.57**	**209.52**	**20.95**	**188.57**

State		**KERALA**							
District		**KANNUR**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Edakkad	Non-command	1511.99	68.45	124.17	337.23	2041.84	204.18	1837.66
2	Irikkur	Non-command	5935.22	256.22	0	739.96	6931.4	693.14	6238.26
3	Iritty	Non-command	5285.43	39.02	0	341.96	5666.41	566.65	5099.76
4	Kallyasseri	Non-command	2525.54	27.38	0	202.54	2755.46	275.54	2479.92
5	Kannur	Non-command	2380.29	82.95	195.47	327.09	2985.8	298.58	2687.22
6	Kuthuparamba	Non-command	1821.41	48.64	149.58	180.05	2199.68	219.96	1979.72
7	Panur	Non-command	1242.43	16.86	0	96.18	1355.47	135.55	1219.92
8	Payyannur	Non-command	5620.38	32.92	461.56	222.34	6337.2	633.72	5703.48
9	Peravoor	Non-command	3445.73	33.73	0	239.23	3718.69	371.87	3346.82
10	Taliparamba	Non-command	6495.68	133.98	533.44	786.97	7950.07	795.01	7155.06
11	Thalassery	Non-command	1931.82	117.34	0	290.09	2339.25	233.93	2105.32
	TOTAL (ha.m)	**Non-command**	**38195.92**	**857.49**	**1464.22**	**3763.64**	**44281.27**	**4428.13**	**39853.14**
	TOTAL (MCM)	**Non-command**	**381.96**	**8.57**	**14.64**	**37.64**	**442.81**	**44.28**	**398.53**

State		**KERALA**							
District		**KASARGOD**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Kanhangad	Non-command	4352.62	94.8	302.89	523.75	5274.06	527.4	4746.66
2	Karadka	Non-command	4472.49	292.2	413.54	905.71	6083.94	608.4	5475.54
3	Kasaragod	Non-command	4124.15	240	0	637.71	5001.86	500.18	4501.68
4	Manjeswar	Non-command	5352.62	291.24	0	872.88	6516.74	651.68	5865.06
5	Nileswaram	Non-command	3545.1	104.45	246.69	369.83	4266.07	426.61	3839.46
6	Parappa	Non-command	6366.24	146.64	443.01	810.41	7766.3	776.63	6989.67
	TOTAL (ha.m)	**Non-command**	**28213.22**	**1169.33**	**1406.13**	**4120.29**	**34908.97**	**3490.9**	**31418.07**
	TOTAL (MCM)	**Non-command**	**282.13**	**11.69**	**14.06**	**41.20**	**349.09**	**34.91**	**314.18**

State		**KERALA**							
District		**KOLLAM**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Anchal	Non-command	5947.07	170.05	1269.68	335.78	7722.58	772.26	6950.32
2	Chadayamangalam	Non-command	2486.84	51.15	891.46	235.03	3664.48	366.45	3298.03
3	Chavara	Non-command	1495.24	9.82	383.03	77.92	1966.01	98.3	1867.71
4	Chittumala	Non-command	1945.95	21.3	465.05	126.86	2559.16	255.92	2303.24
5	Ithikkara	Non-command	2118.69	130.71	326.4	74.08	2649.88	264.99	2384.89
6	Kottarakkara	Non-command	1367.12	66.69	490.08	325.3	2249.19	224.92	2024.27
7	Mukhathala	Non-command	2588.92	135.09	374.06	340.84	3438.91	343.89	3095.02
8	Oachira	Non-command	2441.21	22.95	583.4	176.14	3223.7	322.37	2901.33
9	Pathanapuram	Non-command	2207.37	75.24	791.28	227.09	3300.98	330.1	2970.88
10	Sasthamkotta	Non-command	1350.31	151.97	484.05	332.66	2318.99	231.9	2087.09
11	Vettikkavala	Non-command	1668.17	101.91	597.99	356.37	2724.44	272.45	2451.99
	TOTAL (ha.m)	**Non-command**	**25616.89**	**936.88**	**6656.48**	**2608.07**	**35818.32**	**3483.55**	**32334.77**
	TOTAL (MCM)	**Non-command**	**256.17**	**9.37**	**66.56**	**26.08**	**358.18**	**34.84**	**323.35**

State		**KERALA**							
District		**KOTTAYAM**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Erattupetta	Non-command	2035.29	14.81	478.41	97.28	2625.79	262.58	2363.21
2	Ettumanoor	Non-command	2422.45	16.44	233.68	396.65	3069.22	306.92	2762.3
3	Kaduthuruthy	Non-command	2481.86	190.64	583.38	1408.97	4664.85	466.49	4198.36
4	Kanjirappally	Non-command	3344.82	18.57	786.23	158.2	4307.82	430.78	3877.04
5	Lalam	Non-command	2414.75	63.45	232.93	242.81	2953.94	295.39	2658.55
6	Madappally	Non-command	3947.29	20.94	618.56	578.07	5164.86	516.48	4648.38
7	Pallom	Non-command	3850.82	65.03	801.29	1280.83	5997.97	299.9	5698.07
8	Pampady	Non-command	2492.84	17.21	240.47	98.66	2849.18	284.92	2564.26
9	Uzhavoor	Non-command	2800.22	42.35	270.12	776.63	3889.32	388.94	3500.38
10	Vaikom	Non-command	2000.04	308.04	192.93	517.54	3018.55	301.86	2716.69
11	Vazhoor	Non-command	2051.29	11.12	197.87	11.11	2271.39	227.14	2044.25
	TOTAL (ha.m)	**Non-command**	**29841.67**	**768.6**	**4635.87**	**5566.75**	**40812.89**	**3781.4**	**37031.49**
	TOTAL (MCM)	**Non-command**	**298.42**	**7.69**	**46.36**	**55.67**	**408.13**	**37.81**	**370.35**

State		**KERALA**							
District		**KOZHIKODE**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Ballussery	Non-command	2403.57	62.98	0	244.05	2710.6	271.07	2439.53
2	Chelannur	Non-command	2448.77	46.47	42.14	101.33	2638.71	263.87	2374.84
3	Koduvally	Non-command	4562.66	38.15	0	160.09	4760.9	476.09	4284.81
4	Kozhikode	Non-command	2509.4	38.74	280.08	147.28	2975.5	297.55	2677.95
5	Kunnamangalam	Non-command	2926.87	62.08	0	177.04	3165.99	316.59	2849.4
6	Kunnummal	Non-command	2600.74	40.94	0	103.46	2745.14	274.52	2470.62
7	Melady	Non-command	2199.55	16.65	25.23	49.93	2291.36	229.14	2062.22
8	Panthalayani	Non-command	3141.25	40.24	233.74	89.2	3504.43	350.44	3153.99
9	Perambra	Non-command	3085.68	39.66	344.29	132.96	3602.59	360.26	3242.33
10	Thodannur	Non-command	1666.66	14.76	0	58.75	1740.17	174.02	1566.15
11	Tuneri	Non-command	1704.53	45.63	29.33	96.68	1876.17	187.62	1688.55
12	Vadakara	Non-command	1757.79	8.35	196.19	57.2	2019.53	201.95	1817.58
	TOTAL (ha.m)	**Non-command**	**31007.47**	**454.65**	**1151**	**1417.97**	**34031.09**	**3403.12**	**30627.97**
	TOTAL (MCM)	**Non-command**	**310.07**	**4.55**	**11.51**	**14.18**	**340.31**	**34.03**	**306.28**

State		**KERALA**							
District		**MALAPPURAM**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Areacode	Non-command	4044.77	126.2	602.05	544.44	5317.46	531.75	4785.71
2	Kalikavu	Non-command	3880.02	46.73	577.52	335.41	4839.68	483.97	4355.71
3	Kondotty	Non-command	2749.2	88.12	93.42	510.52	3441.26	344.12	3097.14
4	Kuttippuram	Non-command	2307.9	62.7	78.42	1118.11	3567.13	356.71	3210.42
5	Malappuram	Non-command	2865.99	50.14	426.59	546.59	3889.31	388.93	3500.38
6	Mankada	Non-command	2191.59	57.74	66.91	447.13	2763.37	138.17	2625.2
7	Nilamboor	Non-command	3301.51	36.47	112.19	515.82	3965.99	396.6	3569.39
8	Perinthalmanna	Non-command	4157.33	116.76	618.8	743.61	5636.5	563.65	5072.85
9	Perumpadappu	Non-command	1803.04	67.29	178.92	357.38	2406.63	240.66	2165.97
10	Ponnani	Non-command	2373.33	90.18	235.51	588.77	3287.79	328.78	2959.01
11	Thanur	Non-command	2131.4	55.59	317.25	365.1	2869.34	286.93	2582.41
12	Thriurangadi	Non-command	2384.18	32.5	50.44	552.2	3019.32	301.93	2717.39
13	Tirur	Non-command	1810.27	49.15	269.45	350.28	2479.15	247.91	2231.24
14	Vengara	Non-command	2117.46	53.16	315.17	364.96	2850.75	285.07	2565.68
15	Wandoor	Non-command	2495.42	79.09	371.43	382.46	3328.4	332.84	2995.56
	TOTAL (ha.m)	**Non-command**	**40613.41**	**1011.82**	**4314.07**	**7722.78**	**53662.08**	**5228.02**	**48434.06**
	TOTAL (MCM)	**Non-command**	**406.13**	**10.12**	**43.14**	**77.23**	**536.62**	**52.28**	**484.34**

State		**KERALA**							
District		**PALAKKAD**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5) +(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Alathur	Non-command	2701.4	535.58	47.28	4575.05	7859.31	785.93	7073.38
2	Attappadi	Non-command	3573.29	169.46	619.85	267.07	4629.67	462.97	4166.7
3	Chittur	Non-command	2272.7	496.5	160.22	3277.98	6207.4	310.37	5897.03
4	Kollengode	Non-command	2081.07	625.86	105.97	3345.01	6157.91	615.79	5542.12
5	Kuzhalmannam	Non-command	1957.01	440.06	339.48	5110.97	7847.52	784.75	7062.77
6	Malampuzha	Non-command	1498.38	235.52	60.71	1653.45	3448.06	172.41	3275.65
7	Mannarkkad	Non-command	2430.01	311.56	59.56	681.74	3482.87	174.14	3308.73
8	Nenmara	Non-command	2015.23	145.2	146.35	556.33	2863.11	143.15	2719.96
9	Ottappalam	Non-command	2781.5	432.22	482.5	650.08	4346.3	434.63	3911.67
10	Palakkad	Non-command	2109.2	313.05	365.88	3117.93	5906.06	590.61	5315.45
11	Pattambi	Non-command	2635.92	160.75	153.8	563.41	3513.88	351.39	3162.49
12	Sreekrishnapuram	Non-command	2242.33	259.57	388.97	717.84	3608.71	360.87	3247.84
13	Thrithala	Non-command	1816.85	101.52	113.46	284.16	2315.99	231.6	2084.39
	TOTAL (ha.m)	**Non-command**	**30114.89**	**4226.85**	**3044.03**	**24801.02**	**62186.79**	**5418.61**	**56768.18**
	TOTAL (MCM)	**Non-command**	**301.15**	**42.27**	**30.44**	**248.01**	**621.87**	**54.19**	**567.68**

State		**KERALA**							
District		**PATHANAMTHITTA**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5)+(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Elanthoor	Non-command	1214.72	51.27	271.41	168.23	1705.63	170.56	1535.07
2	Koipuram	Non-command	1414.27	57.23	315.99	184.57	1972.06	197.21	1774.85
3	Konni	Non-command	3352.64	65.91	749.09	225.78	4393.42	439.35	3954.07
4	Mallappally	Non-command	1763.18	28.31	393.95	169.13	2354.57	235.46	2119.11
5	Pandalam	Non-command	1391.02	116.33	284.84	353.31	2145.5	107.28	2038.22
6	Parakode	Non-command	3514.06	119.39	785.15	577.46	4996.06	499.61	4496.45
7	Pulikeezh	Non-command	1598.42	30.84	238.09	85.77	1953.12	195.32	1757.8
8	Ranni	Non-command	2759.7	20.84	616.61	152.63	3549.78	354.97	3194.81
	TOTAL (ha.m)	**Non-command**	**17008.01**	**490.12**	**3655.13**	**1916.88**	**23070.14**	**2199.76**	**20870.38**
	TOTAL (MCM)	**Non-command**	**170.08**	**4.90**	**36.55**	**19.17**	**230.70**	**22.00**	**208.70**

State		**KERALA**							
District		**THIRUVANANTHAPURAM**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4) +(5)+(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Athiyannur	Non-command	992.15	24.47	311.27	111.17	1439.06	143.9	1295.16
2	Chirayinkil	Non-command	1133.77	78.55	355.7	247.25	1815.27	181.53	1633.74
3	Kilimanoor	Non-command	1850.69	34.52	456.08	427.93	2769.22	276.92	2492.3
4	Nedumangad	Non-command	1332.73	32.8	390.64	143.73	1899.9	95	1804.9
5	Nemom	Non-command	4051.58	39.73	1230.39	137.52	5459.22	545.92	4913.3
6	Parassala	Non-command	1132.03	31.66	355.15	176.04	1694.88	169.49	1525.39
7	Perumkadavila	Non-command	1741.16	189.52	671.8	508.14	3110.62	311.06	2799.56
8	Pothencode	Non-command	987.01	12.68	309.66	249.67	1559.02	155.9	1403.12
9	Vamanapuram	Non-command	2350.67	90.14	579.3	280.73	3300.84	330.08	2970.76
10	Varkala	Non-command	1218.34	36.86	382.23	186.16	1823.59	182.36	1641.23
11	Vellanad	Non-command	2353.9	15.16	1107.74	192.29	3669.09	366.91	3302.18
	TOTAL (ha.m)	**Non-command**	**19144.03**	**586.09**	**6149.96**	**2660.63**	**28540.71**	**2759.07**	**25781.64**
	TOTAL (MCM)	**Non-command**	**191.44**	**5.86**	**61.50**	**26.61**	**285.41**	**27.59**	**257.82**

State		**KERALA**							
District		**THRISSUR**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Anthikkad	Non-command	2293.97	32.87	5.33	1716.92	4049.09	404.91	3644.18
2	Chalakkudy	Non-command	3046.45	141.17	0	1158.68	4346.3	434.63	3911.67
3	Chavakkad	Non-command	3059.14	55.38	0	298.61	3413.13	341.31	3071.82
4	Cherpu	Non-command	1489.31	116.59	3.77	1844.55	3454.22	172.72	3281.5
5	Chowannur	Non-command	3079.26	34.62	10.73	1056.25	4180.86	418.09	3762.77
6	Iringalakkuda	Non-command	2227.99	83.83	7.76	876.64	3196.22	319.62	2876.6
7	Kodakara	Non-command	3939.81	36.61	75.55	1018.89	5070.86	507.08	4563.78
8	Mala	Non-command	2786.89	203.62	27.78	1034.94	4053.23	405.32	3647.91
9	Mathilakom	Non-command	3377.52	8.94	433.05	307.57	4127.08	412.71	3714.37
10	Mullassery	Non-command	2167.44	1.31	16.17	1050.94	3235.86	323.59	2912.27
11	Ollukkara	Non-command	3099.13	37.73	10.8	258.91	3406.57	340.66	3065.91
12	Pazhayannur	Non-command	4105.04	29.59	14.3	458.65	4607.58	460.76	4146.82
13	Puzhakkal	Non-command	3448.63	136.82	12.02	1927.67	5525.14	552.52	4972.62
14	Thalikkulam	Non-command	2141.25	3.61	15.97	260.5	2421.33	242.14	2179.19
15	Vadakkancherry	Non-command	3057.4	61.94	392.01	602.27	4113.62	411.36	3702.26
16	Vellangallur	Non-command	1839.27	78.98	235.82	542.42	2696.49	269.65	2426.84
	TOTAL (ha.m)	**Non-command**	**45158.50**	**1063.61**	**1261.06**	**14414.41**	**61897.58**	**6017.07**	**55880.51**
	TOTAL (MCM)	**Non-command**	**451.59**	**10.64**	**12.61**	**144.14**	**618.98**	**60.17**	**558.81**

State		**KERALA**							
District		**WAYANAD**							
Assessment Year		**2023**							
Sl. No.	**Assessment Unit/ District**	**Command / Non-Command**	**Recharge from rainfall during monsoon season**	**Recharge from other sources during monsoon season**	**Recharge from rainfall during non-monsoon season**	**Recharge from other sources during non-monsoon season**	**Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]**	**Total Natural Discharges**	**Annual Extractable Ground Water Resources [(8)-(9)]**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	Kalpetta	Non-command	6321.11	115.79	0	174.39	6611.29	661.13	5950.16
2	Mananthavady	Non-command	5975.88	183.04	0	213.54	6372.46	637.24	5735.22
3	Panamaram	Non-command	3559.61	58.3	0	111.8	3729.71	372.97	3356.74
4	Sulthanbathery	Non-command	5667.3	84.22	0	177.75	5929.27	592.93	5336.34
	TOTAL (ha.m)	**Non-command**	**21523.90**	**441.35**	**0.00**	**677.48**	**22642.73**	**2264.27**	**20378.46**
	TOTAL (MCM)	**Non-command**	**215.24**	**4.41**	**0.00**	**6.77**	**226.43**	**22.64**	**203.78**

ANNEXURE III D (Contd.): ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2023).

State		**KERALA**								
District		**ALAPPUZHA**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Doestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Ambalappuzha	Non-command	1841.33	144.60	8.20	680.88	833.69	699.4	989.12	45.28
2	Aryad	Non-command	2471.18	260.55	0.53	1466.93	1728.01	1506.82	703.28	69.93
3	Bharanikkavu	Non-command	3094.64	417.02	0.27	808.46	1225.75	830.44	1846.91	39.61
4	Champakkulam	Non-command	3672.22	73.49	0.02	547.31	620.82	562.2	3036.51	16.91
5	Chengannur	Non-command	3860.24	769.22	1.50	895.76	1666.47	920.11	2169.42	43.17
6	Harippad	Non-command	3542.99	741.86	82.39	757.65	1581.91	778.26	1940.47	44.65
7	Kanjikkuzhy	Non-command	2260.33	278.02	0.11	790.20	1068.34	811.69	1170.5	47.26
8	Mavelikkara	Non-command	3249.75	202.09	0.75	870.92	1073.76	894.59	2152.32	33.04
9	Muthukulam	Non-command	3388.88	451.60	98.47	1131.43	1681.5	1162.2	1676.61	49.62
10	Pattanakkad	Non-command	2479.25	133.88	68.37	1020.00	1222.24	1047.74	1229.27	49.30
11	Thycattussery	Non-command	2845.87	172.82	0.90	753.94	927.66	774.44	1897.71	32.60
12	Veliyanad	Non-command	3337.15	92.09	0.00	454.64	546.73	467	2778.06	16.38
	TOTAL (ha.m)		**36043.83**	**3737.24**	**261.52**	**10178.12**	**14176.88**	**10454.89**	**21590.18**	**39.33**
	TOTAL (MCM)		**360.44**	**37.37**	**2.62**	**101.78**	**141.77**	**104.55**	**215.90**	

State		**KERALA**								
District		**ERNAKULAM**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Alangad	Non-command	2096.62	402.14	46.87	1013.65	1462.64	1305.94	341.69	69.76
2	Angamaly	Non-command	4678.14	720.80	46.11	1110.76	1877.65	1431.07	2480.18	40.14
3	Edappally	Non-command	3852.48	163.58	10.89	2325.34	2499.82	2995.87	682.13	64.89
4	Koovappady	Non-command	5752.62	743.93	13.02	950.96	1707.9	1225.18	3770.5	29.69
5	Kothamangalam	Non-command	4180.08	628.74	9.34	1274.67	1912.77	1642.24	1899.74	45.76
6	Moovattupuzha	Non-command	3526.96	969.82	8.54	1318.63	2296.99	1698.87	849.73	65.13
7	Mulamthuruthy	Non-command	2871.21	669.38	10.24	1325.68	2005.3	1707.96	483.63	69.84
8	Palluruthy	Non-command	1492.81	145.42	11.10	221.43	377.95	285.28	1051.01	25.32
9	Pampakkuda	Non-command	3577.63	731.72	7.48	740.78	1479.99	954.39	1884.03	41.37
10	Parakkadavu	Non-command	2387.94	738.36	8.11	886.61	1633.09	1142.28	499.18	68.39
11	Paravoor	Non-command	1893.32	578.78	14.40	340.07	933.26	438.14	861.99	49.29
12	Vadavukodu	Non-command	4203.71	484.66	20.67	921.78	1427.12	1187.58	2510.79	33.95
13	Vazhakkulam	Non-command	4720.55	920.83	6.62	1703.71	2631.15	2194.99	1598.12	55.74
14	Vypeen	Non-command	1013.62	48.31	0.38	656.69	705.38	846.05	118.88	69.59
	TOTAL (ha.m)		**46247.69**	**7946.47**	**213.80**	**14790.76**	**22951.01**	**19055.84**	**19031.60**	**49.63**
	TOTAL (MCM)		**462.48**	**79.46**	**2.14**	**147.91**	**229.51**	**190.56**	**190.32**	

State		**KERALA**								
District		**IDUKKI**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Adimali	Non-command	3087.34	843.73	1.18	461.38	1306.29	461.38	1781.05	42.31
2	Azhutha	Non-command	2789.84	711.00	6.30	527.06	1244.36	527.06	1545.48	44.60
3	Devikulam	Non-command	2233.02	240.42	0.00	444.26	684.68	444.26	1548.34	30.66
4	Elam Desom	Non-command	1845.18	758.12	1.08	470.35	1229.54	470.35	615.64	66.64
5	Idukki	Non-command	2598.4	658.13	0.36	422.88	1081.37	422.88	1517.03	41.62
6	Kattappana	Non-command	2211.38	1050.38	1.32	690.65	1742.36	690.65	469.02	78.79
7	Nedumkandam	Non-command	2155.85	1100.68	1.18	596.70	1698.56	596.7	457.29	78.79
8	Thodupuzha	Non-command	1935.77	703.76	1.83	528.63	1234.23	528.63	701.54	63.76
	TOTAL (ha.m)		**18856.78**	**6066.22**	**13.26**	**4141.90**	**10221.39**	**4141.91**	**8635.39**	**54.21**
	TOTAL (MCM)		**188.57**	**60.66**	**0.13**	**41.42**	**102.21**	**41.42**	**86.35**	

State		**KERALA**								
District		**KANNUR**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Edakkad	Non-command	1837.66	367.75	0.00	556.87	924.62	685.85	784.06	50.32
2	Irikkur	Non-command	6238.26	949.17	6.35	1348.33	2303.85	1660.64	3622.1	36.93
3	Iritty	Non-command	5099.76	1112.54	3.82	1167.96	2284.32	1438.49	2544.91	44.79
4	Kallyasseri	Non-command	2479.92	675.60	0.00	850.66	1526.26	1047.7	756.62	61.54
5	Kannur	Non-command	2687.22	1141.10	10.14	939.96	2091.2	1157.68	378.3	77.82
6	Kuthuparamba	Non-command	1979.72	672.54	0.00	703.90	1376.44	866.94	440.24	69.53
7	Panur	Non-command	1219.92	445.14	0.00	647.69	1092.83	797.71	127.09	89.58
8	Payyannur	Non-command	5703.48	659.17	0.00	1421.59	2080.77	1750.88	3293.42	36.48
9	Peravoor	Non-command	3346.82	891.50	5.48	790.45	1687.42	973.54	1476.31	50.42
10	Taliparamba	Non-command	7155.06	872.00	11.98	1846.73	2730.71	2274.49	3996.59	38.16
11	Thalassery	Non-command	2105.32	366.50	5.60	1354.43	1726.53	1668.16	65.06	82.01
	TOTAL (ha.m)		**39853.14**	**8153.02**	**43.37**	**11628.57**	**19824.95**	**14322.08**	**17484.70**	**49.75**
	TOTAL (MCM)		**398.53**	**81.53**	**0.43**	**116.29**	**198.25**	**143.22**	**174.85**	

State		**KERALA**								
District		**KASARGOD**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable GroundWater Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use**	**Stage of Ground Water Extraction (%) (8/4) *100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Kanhangad	Non-command	4746.66	1901.41	1.71	1336.94	3240.05	2065.96	777.59	68.26
2	Karadka	Non-command	5475.54	3048.92	3.48	764.91	3817.32	1165.82	1257.31	69.72
3	Kasaragod	Non-command	4501.68	2453.14	1.49	1731.32	4185.94	2638.74	315.74	92.99
4	Manjeswar	Non-command	5865.06	3397.04	2.97	1348.48	4748.48	2055.26	409.8	80.96
5	Nileswaram	Non-command	3839.46	1396.83	11.40	1130.25	2538.49	1722.65	708.57	66.12
6	Parappa	Non-command	6989.67	3174.30	1.71	1150.34	4326.36	1753.26	2060.39	61.90
	TOTAL (ha.m)		**31418.07**	**15371.64**	**22.76**	**7462.24**	**22856.64**	**11401.69**	**5529.40**	**72.75**
	TOTAL (MCM)		**314.18**	**153.72**	**0.23**	**74.62**	**228.57**	**114.02**	**55.29**	

State		**KERALA**								
District		**KOLLAM**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Anchal	Non-command	6950.32	585.24	0.09	522.46	1107.79	552.37	5812.62	15.94
2	Chadayamangalam	Non-command	3298.03	560.26	1.22	1062.83	1624.32	1123.68	1612.86	49.25
3	Chavara	Non-command	1867.71	262.83	0.87	1042.19	1305.91	1101.86	502.13	69.92
4	Chittumala	Non-command	2303.24	453.69	12.20	1116.96	1582.85	1180.91	656.44	68.72
5	Ithikkara	Non-command	2384.89	324.82	1.31	1198.26	1524.38	1266.85	791.92	63.92
6	Kottarakkara	Non-command	2024.27	450.66	1.38	910.48	1362.52	962.61	609.62	67.31
7	Mukhathala	Non-command	3095.02	379.04	3.52	1890.70	2273.26	1998.94	713.52	73.45
8	Oachira	Non-command	2901.33	439.90	0.11	1107.81	1547.83	1171.23	1290.08	53.35
9	Pathanapuram	Non-command	2970.88	472.59	0.42	996.77	1469.78	1053.83	1444.04	49.47
10	Sasthamkotta	Non-command	2087.09	422.70	0.97	1060.52	1484.19	1121.23	542.19	71.11
11	Vettikkavala	Non-command	2451.99	492.16	0.19	1017.83	1510.17	1076.09	883.56	61.59
	TOTAL (ha.m)		**32334.77**	**4843.89**	**22.28**	**11926.81**	**16793.00**	**12609.60**	**14858.98**	**51.93**
	TOTAL (MCM)		**323.35**	**48.44**	**0.22**	**119.27**	**167.93**	**126.10**	**148.59**	

State		**KERALA**								
District		**KOTTAYAM**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Erattupetta	Non-command	2363.21	444.10	1.10	616.34	1061.54	642.2	1275.81	44.92
2	Ettumanoor	Non-command	2762.3	311.70	0.47	961.77	1273.94	1002.13	1448	46.12
3	Kaduthuruthy	Non-command	4198.36	616.70	0.00	748.99	1365.7	780.43	2801.22	32.53
4	Kanjirappally	Non-command	3877.04	566.31	0.00	976.04	1542.36	1017	2293.72	39.78
5	Lalam	Non-command	2658.55	288.46	0.37	591.25	880.06	616.06	1753.68	33.10
6	Madappally	Non-command	4648.38	573.34	7.15	1264.78	1845.28	1317.85	2750.03	39.70
7	Pallom	Non-command	5698.07	536.79	0.00	1451.04	1987.83	1511.93	3649.35	34.89
8	Pampady	Non-command	2564.26	262.48	0.00	639.79	902.27	666.64	1635.14	35.19
9	Uzhavoor	Non-command	3500.38	538.12	0.00	772.69	1310.81	805.11	2157.15	37.45
10	Vaikom	Non-command	2716.69	423.37	1.10	207.22	631.68	235.25	2056.98	23.25
11	Vazhoor	Non-command	2044.25	367.09	0.00	575.50	942.59	599.65	1077.51	46.11
	TOTAL (ha.m)		**37031.49**	**4928.47**	**10.18**	**8805.41**	**13744.06**	**9194.25**	**22898.59**	**37.11**
	TOTAL (MCM)		**370.31**	**49.28**	**0.10**	**88.05**	**137.44**	**91.94**	**228.99**	

State		**KERALA**								
District		**KOZHIKODE**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Balussery	Non-command	2439.53	816.63	0.00	1306.12	2122.75	1876.78	316.78	87.01
2	Chelannur	Non-command	2374.84	327.40	0.00	1324.72	1652.13	1903.51	143.92	69.57
3	Koduvally	Non-command	4284.81	499.67	5.55	1774.18	2279.4	2549.35	1230.24	53.20
4	Kozhikode	Non-command	2677.95	401.30	1.03	1497.69	1900.04	2152.06	123.54	70.95
5	Kunnamangalam	Non-command	2849.4	571.48	0.18	1929.35	2501.01	2772.31	348.39	87.77
6	Kunnummal	Non-command	2470.62	322.09	0.00	1217.33	1539.43	1749.2	399.32	62.31
7	Melady	Non-command	2062.22	188.34	0.18	728.52	917.04	1046.81	826.89	44.47
8	Panthalayani	Non-command	3153.99	238.93	0.00	1080.41	1319.33	1552.45	1362.62	41.83
9	Perambra	Non-command	3242.33	373.52	0.15	1010.99	1384.65	1452.71	1415.96	42.71
10	Thodannur	Non-command	1566.15	161.90	0.00	826.83	988.73	1188.08	216.17	63.13
11	Tuneri	Non-command	1688.55	242.08	0.00	887.55	1129.62	1275.33	171.15	66.90
12	Vadakara	Non-command	1817.58	185.37	0.00	978.03	1163.4	1405.35	226.86	64.01
	TOTAL (ha.m)		**30627.97**	**4328.71**	**7.09**	**14561.73**	**18897.53**	**20923.94**	**6781.84**	**61.70**
	TOTAL (MCM)		**306.28**	**43.29**	**0.07**	**145.62**	**188.98**	**209.24**	**67.82**	

State		**KERALA**								
District		**MALAPPURAM**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Areacode	Non-command	4785.71	710.49	1.76	2547.24	3259.49	5511.06	1526.22	68.11
2	Kalikavu	Non-command	4355.71	554.42	0.22	1992.61	2547.26	4311.09	1808.45	58.48
3	Kondotty	Non-command	3097.14	777.77	0.00	1941.16	2718.93	4199.78	378.21	87.79
4	Kuttippuram	Non-command	3210.42	818.89	0.18	1810.78	2629.84	3917.7	580.58	81.92
5	Malappuram	Non-command	3500.38	516.84	0.29	2163.95	2681.08	4681.79	819.3	76.59
6	Mankada	Non-command	2625.2	686.82	0.00	1256.07	1942.89	2717.55	682.31	74.01
7	Nilamboor	Non-command	3569.39	450.45	0.73	1494.02	1945.2	3232.37	1624.19	54.50
8	Perinthalmanna	Non-command	5072.85	1006.47	0.00	2198.07	3204.54	4755.61	1868.31	63.17
9	Perumpadappu	Non-command	2165.97	855.98	0.29	638.58	1494.84	1381.59	671.13	69.01
10	Ponnani	Non-command	2959.01	338.08	0.29	1483.84	1822.21	3210.35	1136.8	61.58
11	Thanur	Non-command	2582.41	724.23	1.06	1548.05	2273.34	3349.27	309.07	88.03
12	Thriurangadi	Non-command	2717.39	640.25	0.00	1657.17	2297.42	3585.35	419.97	84.55
13	Tirur	Non-command	2231.24	398.84	0.15	1523.15	1922.13	3295.4	309.11	86.15
14	Vengara	Non-command	2565.68	378.96	0.37	1774.64	2153.97	3839.51	411.71	83.95
15	Wandoor	Non-command	2995.56	356.36	0.50	1402.97	1759.82	3035.38	1235.74	58.75
	TOTAL (ha.m)		**48434.06**	**9214.83**	**5.85**	**25432.31**	**34652.96**	**55023.80**	**13781.10**	**71.55**
	TOTAL (MCM)		**484.34**	**92.15**	**0.06**	**254.32**	**346.53**	**550.24**	**137.81**	

State		**KERALA**								
District		**PALAKKAD**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Alathur	Non-command	7073.38	2167.80	1.09	1620.16	3789.07	2340.49	2563.98	53.57
2	Attappadi	Non-command	4166.7	742.08	0.00	345.50	1087.58	499.1	2925.52	26.10
3	Chittur	Non-command	5897.03	4290.68	174.18	1330.88	5795.73	1922.58	101.3	98.28
4	Kollengode	Non-command	5542.12	1504.27	2.77	787.19	2294.24	1137.17	2897.9	41.40
5	Kuzhalmannam	Non-command	7062.77	1161.35	72.02	1046.19	2279.56	1511.32	4318.08	32.28
6	Malampuzha	Non-command	3275.65	1555.84	259.44	1292.73	3108.01	1867.47	167.64	94.88
7	Mannarkkad	Non-command	3308.73	662.73	3.24	1554.66	2220.63	2245.85	396.91	67.11
8	Nenmara	Non-command	2719.96	993.11	0.00	762.78	1755.89	1101.91	624.94	64.56
9	Ottappalam	Non-command	3911.67	898.16	1.90	1441.18	2341.25	2081.93	929.67	59.85
10	Palakkad	Non-command	5315.45	869.28	14.60	1744.12	2628.01	2519.56	1912	49.44
11	Pattambi	Non-command	3162.49	1483.54	0.00	1280.75	2764.29	1850.16	398.2	87.41
12	Sreekrishnapuram	Non-command	3247.84	874.36	72.00	1105.22	2051.58	1596.6	704.88	63.17
13	Thrithala	Non-command	2084.39	652.60	11.53	1141.05	1805.19	1648.35	279.2	86.61
	TOTAL (ha.m)		**56768.18**	**17855.80**	**612.77**	**15452.41**	**33921.03**	**22322.49**	**18220.22**	**59.75**
	TOTAL (MCM)		**567.68**	**178.56**	**6.13**	**154.52**	**339.21**	**223.22**	**182.20**	

State		**KERALA**								
District		**PATHANAMTHITTA**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Elanthoor	Non-command	1535.07	350.80	0.66	322.15	673.6	331.91	851.71	43.88
2	Koipuram	Non-command	1774.85	408.24	0.55	409.39	818.18	421.79	944.27	46.10
3	Konni	Non-command	3954.07	421.18	0.29	607.70	1029.17	626.1	2906.5	26.03
4	Mallappally	Non-command	2119.11	327.29	0.99	468.80	797.08	483	1307.83	37.61
5	Pandalam	Non-command	2038.22	720.20	0.75	437.00	1157.95	450.24	867.03	56.81
6	Parakode	Non-command	4496.45	868.48	0.26	798.69	1667.43	822.89	2804.82	37.08
7	Pulikeezh	Non-command	1757.8	323.35	0.22	474.02	797.59	488.38	945.85	45.37
8	Ranni	Non-command	3194.81	356.62	0.15	554.86	911.62	571.67	2266.38	28.53
	TOTAL (ha.m)		**20870.38**	**3776.15**	**3.85**	**4072.62**	**7852.62**	**4195.98**	**12894.39**	**37.63**
	TOTAL (MCM)		**208.70**	**37.76**	**0.04**	**40.73**	**78.53**	**41.96**	**128.94**	

State		**KERALA**								
District		**THIRUVANANTHA PURAM**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Athiyannur	Non-command	1295.16	331.08	0.06	817.80	1148.94	883.3	80.72	88.71
2	Chirayinkil	Non-command	1633.74	324.54	0.10	1033.09	1357.73	1115.83	193.27	83.11
3	Kilimanoor	Non-command	2492.3	435.41	0.73	1141.91	1578.05	1233.36	822.8	63.32
4	Nedumangad	Non-command	1804.9	432.40	0.00	1127.11	1559.5	1217.38	155.13	86.40
5	Nemom	Non-command	4913.3	450.90	1.66	2947.47	3400.03	3183.54	1277.2	69.20
6	Parassala	Non-command	1525.39	576.41	0.41	694.18	1271.02	749.78	198.77	83.32
7	Perumkadavila	Non-command	2799.56	501.04	0.32	1077.22	1578.58	1163.49	1134.71	56.39
8	Pothencode	Non-command	1403.12	564.84	2.17	688.88	1255.9	744.05	92.05	89.51
9	Vamanapuram	Non-command	2970.76	473.86	1.64	1029.86	1505.36	1112.35	1382.91	50.67
10	Varkala	Non-command	1641.23	254.50	0.00	903.44	1157.94	975.8	410.93	70.55
11	Vellanad	Non-command	3302.18	547.48	0.00	1101.26	1648.74	1189.47	1565.23	49.93
	TOTAL (ha.m)		**25781.64**	**4892.46**	**7.09**	**12562.22**	**17461.79**	**13568.35**	**7313.72**	**67.73**
	TOTAL (MCM)		**257.82**	**48.92**	**0.07**	**125.62**	**174.62**	**135.68**	**73.14**	

State		**KERALA**								
District		**THRISSUR**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Anthikkad	Non-command	3644.18	1016.67	2.04	738.14	1756.85	895.73	1729.74	48.21
2	Chalakkudy	Non-command	3911.67	1637.82	10.85	1010.78	2659.44	1226.58	1036.43	67.99
3	Chavakkad	Non-command	3071.82	1105.19	0.01	1000.18	2105.37	1213.72	752.91	68.54
4	Cherpu	Non-command	3281.5	1133.48	0.01	537.52	1671	652.29	1495.73	50.92
5	Chowannur	Non-command	3762.77	1348.80	0.84	1623.39	2973.04	1969.99	443.13	79.01
6	Iringalakkuda	Non-command	2876.6	1000.04	0.74	800.52	1801.29	971.44	904.39	62.62
7	Kodakara	Non-command	4563.78	1617.25	3.80	986.71	2607.76	1197.37	1745.36	57.14
8	Mala	Non-command	3647.91	1708.27	0.01	811.09	2519.36	984.26	955.38	69.06
9	Mathilakom	Non-command	3714.37	1394.67	0.00	1474.06	2868.74	1788.77	530.92	77.23
10	Mullassery	Non-command	2912.27	915.28	0.00	494.00	1409.29	599.48	1397.5	48.39
11	Ollukkara	Non-command	3065.91	636.94	3.60	867.61	1508.15	1052.85	1372.52	49.19
12	Pazhayannur	Non-command	4146.82	1031.58	0.00	930.58	1962.17	1129.26	1985.97	47.32
13	Puzhakkal	Non-command	4972.62	1698.20	10.81	595.61	2304.62	722.78	2540.83	46.35
14	Thalikkulam	Non-command	2179.19	1024.52	0.00	681.70	1706.22	827.24	327.43	78.30
15	Vadakkancherry	Non-command	3702.26	1591.04	6.41	930.09	2527.57	1128.67	976.11	68.27
16	Vellangallur	Non-command	2426.84	1042.23	0.00	632.01	1674.24	766.95	617.66	68.99
	TOTAL (ha.m)		**55880.51**	**19901.98**	**39.11**	**14114.02**	**34055.11**	**17127.38**	**18812.01**	**60.94**
	TOTAL (MCM)		**558.81**	**199.02**	**0.39**	**141.14**	**340.55**	**171.27**	**188.12**	

State		**KERALA**								
District		**WAYANAD**								
Assessment Year		**2023**								
Sl. No.	**Assessment Unit/ Block**	**Command / Non-Command**	**Annual Extractable Ground Water Resources (Ham)**	**Current Annual Ground Water Extraction (Ham)**				**Annual Groundwater Allocation for Domestic use as on 2025**	**Net Ground Water Availability for future use (4-5-6-9)**	**Stage of Ground Water Extraction (%) (8/4)*100**
				Irrigation Use	**Industrial Use**	**Domestic Use**	**Total Extraction (5+6+7)**			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	Kalpetta	Non-command	5950.16	285.70	72.00	1183.13	1540.83	1437.35	4155.11	25.90
2	Mananthavady	Non-command	5735.22	315.26	0.00	1082.99	1398.25	1315.69	4104.27	24.38
3	Panamaram	Non-command	3356.74	254.02	0.00	925.77	1179.79	1124.69	1978.03	35.15
4	Sulthanbathery	Non-command	5336.34	469.40	86.66	962.85	1518.91	1169.74	3610.54	28.46
	TOTAL (ha.m)		**20378.46**	**1324.38**	**158.66**	**4154.74**	**5637.78**	**5047.47**	**13847.95**	**27.67**
	TOTAL (MCM)		**203.78**	**13.24**	**1.59**	**41.55**	**56.38**	**50.47**	**138.48**	

ANNEXURE III E: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA - ASSESSMENT UNIT WISE CATEGORIZATION (2023)

State		**KERALA**			
District		**ALAPPUZHA**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe / Semi-critical / Critical / Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Ambalappuzha	6890	6890	45.28	Safe
2	Aryad	8772	8772	69.93	Safe
3	Bharanikkavu	12995	12995	39.61	Safe
4	Champakkulam	15383	15383	16.91	Safe
5	Chengannur	14996	14996	43.17	Safe
6	Harippad	11439	11439	44.65	Safe
7	Kanjikkuzhy	11013	11013	47.26	Safe
8	Mavelikkara	10044	10044	33.04	Safe
9	Muthukulam	11651	11651	49.62	Safe
10	Pattanakkad	10871	10871	49.30	Safe
11	Thycattussery	14159	14159	32.60	Safe
12	Veliyanad	13190	13190	16.38	Safe
	District	**141403**	**141403**	**39.33**	**Safe**

State		**KERALA**			
District		**ERNAKULAM**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Alangad	7331	7331	69.76	Safe
2	Angamaly	23197	21197	40.14	Safe
3	Edappally	16053	16053	64.89	Safe
4	Koovappady	38560	35560.5	29.69	Safe
5	Kothamangalam	82997	22997	45.76	Safe
6	Moovattupuzha	21480	19980	65.13	Safe
7	Mulamthuruthy	16327	16327	69.84	Safe
8	Palluruthy	6651	6651	25.32	Safe
9	Pampakkuda	18740	17740	41.37	Safe
10	Parakkadavu	11881	11881	68.39	Safe
11	Paravoor	7665	7665	49.29	Safe
12	Vadavukodu	18595	18595	33.95	Safe
13	Vazhakkulam	19328	19328	55.74	Safe
14	Vypeen	5642	5642	69.59	Safe
	District	**294447**	**226947.5**	**49.63**	**Safe**

State		**KERALA**			
District		**IDUKKI**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Adimali	51914	21200	42.31	safe
2	Azhutha	107442	14542	44.60	safe
3	Devikulam	96343	16043	30.66	safe
4	Elam Desom	18722	9722	66.64	safe
5	Idukki	73482	13482	41.62	safe
6	**Kattappana**	37238	11238	**78.79**	**semi_critical**
7	**Nedumkandam**	34190	12190	**78.79**	**semi_critical**
8	Thodupuzha	16474	10474	63.76	safe
9	**District**	**435805**	**108891**	**54.21**	**Safe**

State		**KERALA**			
District		**KANNUR**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Edakkad	8948	8948	50.32	safe
2	Irikkur	41290	36290	36.93	safe
3	Iritty	42709	31509	44.79	safe
4	Kallyasseri	14339	14339	61.54	safe
5	**Kannur**	12678	12678	**77.82**	**semi_critical**
6	Kuthuparamba	18235	12935	69.53	safe
7	**Panur**	7383	7383	**89.58**	**semi_critical**
8	Payyannur	39212	34212	36.48	safe
9	Peravoor	42542	21342	50.42	safe
10	Taliparamba	57403	40703	38.16	safe
11	**Thalassery**	12057	12057	**82.01**	**semi_critical**
	District	**296796**	**232396**	**49.75**	**Safe**

State		**KERALA**			
District		**KASARGOD**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Kanhangad	24508	24508	68.26	safe
2	Karadka	37247	26247	69.72	safe
3	**Kasaragod**	25876	25876	**92.99**	**critical**
4	**Manjeswar**	34136	33136	**80.96**	**semi_critical**
5	Nileswaram	19695	19695	66.12	safe
6	Parappa	54668	35368	61.90	safe
	District	**196130**	**164830**	**72.75**	**Semi-critical**

State		**KERALA**			
District		**KOLLAM**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Anchal	94622	64622	15.94	safe
2	Chadayamangalam	24903	24903	49.25	safe
3	Chavara	7490	7490	69.92	safe
4	Chittumala	12125	12125	68.72	safe
5	Ithikkara	12573	12573	63.92	safe
6	Kottarakkara	13310	13310	67.31	safe
7	**Mukhathala**	14703	14703	**73.45**	**semi_critical**
8	Oachira	11641	11641	53.35	safe
9	Pathanapuram	27995	20095	49.47	safe
10	**Sasthamkotta**	12791	12791	**71.11**	**semi_critical**
11	Vettikkavala	16947	16947	61.59	safe
	District	**249100**	**211200**	**51.93**	**Safe**

State		**KERALA**			
District		**KOTTAYAM**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Erattupetta	27560	14560	44.92	safe
2	Ettumanoor	21460	21460	46.12	safe
3	Kaduthuruthy	15806	15806	32.53	safe
4	Kanjirappally	35290	23290	39.78	safe
5	Lalam	19110	19110	33.10	safe
6	Madappally	11950	11950	39.70	safe
7	Pallom	17802	17802	34.89	safe
8	Pampady	20550	20550	35.19	safe
9	Uzhavoor	22460	22460	37.45	safe
10	Vaikom	13190	13190	23.25	safe
11	Vazhoor	16910	16910	46.11	safe
	District	**222088**	**197088**	**37.11**	**Safe**

State		**KERALA**			
District		**KOZHIKODE**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	**Balussery**	27853	13953	**87.01**	**semi_critical**
2	Chelannur	13866	13866	69.57	safe
3	Koduvally	39048	27298	53.20	safe
4	**Kozhikode**	16351	16351	**70.95**	**semi_critical**
5	**Kunnamangalam**	33794	16994	**87.77**	**semi_critical**
6	Kunnummal	26252	13152	62.31	safe
7	Melady	8407	8407	44.47	safe
8	Panthalayani	9855	9855	41.83	safe
9	Perambra	27502	17902	42.71	safe
10	Thodannur	9677	9677	63.13	safe
11	Tuneri	14397	11497	66.90	safe
12	Vadakara	7228	7228	64.01	safe
	District	**234230**	**166180**	**61.70**	**Safe**

State		**KERALA**			
District		**MALAPPURAM**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Areacode	33357	28357	68.11	safe
2	Kalikavu	68912	24412	58.48	safe
3	**Kondotty**	18624	18624	**87.79**	**semi_critical**
4	**Kuttippuram**	17868	17868	**81.92**	**semi_critical**
5	**Malappuram**	18032	18032	**76.59**	**semi_critical**
6	**Mankada**	15245	15245	**74.01**	**semi_critical**
7	Nilamboor	62120	21820	54.50	safe
8	Perinthalmanna	28203	27203	63.17	safe
9	Perumpadappu	5899	5899	69.01	safe
10	Ponnani	9706	9706	61.58	safe
11	**Thanur**	12756	12756	**88.03**	**semi_critical**
12	**Thriurangadi**	13001	13001	**84.55**	**semi_critical**
13	**Tirur**	11105	11105	**86.15**	**semi_critical**
14	**Vengara**	14845	14845	**83.95**	**semi_critical**
15	Wandoor	25308	15308	58.75	safe
	District	**354981**	**254181**	**71.55**	**Semi-critical**

State		**KERALA**			
District		**PALAKKAD**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Alathur	31447	23447	53.57	safe
2	Attappadi	70323	22323	26.10	safe
3	**Chittur**	31468	31468	**98.28**	**critical**
4	Kollengode	21411	19911	41.40	safe
5	Kuzhalmannam	19212	19212	32.28	safe
6	**Malampuzha**	40394	20394	**94.88**	**critical**
7	Mannarkkad	45535	29535	67.11	safe
8	Nenmara	79847	23953	64.56	safe
9	Ottappalam	27306	27306	59.85	safe
10	Palakkad	20706	20706	49.44	safe
11	**Pattambi**	20744	20744	**87.41**	**semi_critical**
12	Sreekrishnapuram	22013	22013	63.17	safe
13	**Thrithala**	17216	17216	**86.61**	**semi_critical**
	District	**447622**	**298228**	**59.75**	**Safe**

State		**KERALA**			
District		**PATHANAMTHITTA**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Elanthoor	10622	10622	43.88	safe
2	Koipuram	12367	12367	46.10	safe
3	Konni	86477	25977	26.03	safe
4	Mallappally	15418	15418	37.61	safe
5	Pandalam	11641	11641	56.81	safe
6	Parakode	27152	22642	37.08	safe
7	Pulikeezh	6866	6866	45.37	safe
8	Ranni	92132	24132	28.53	safe
	District	**262675**	**133010**	**37.63**	**Safe**

State		**KERALA**			
District		**THIRUVANANTHAPURAM**			
Assessment Year		**2023**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	**Athiyannur**	7629	7629	**88.71**	**semi_critical**
2	**Chirayinkil**	10151	10151	**83.11**	**semi_critical**
3	Kilimanoor	17977	17977	63.32	safe
4	**Nedumangad**	15603	15603	**86.40**	**semi_critical**
5	Nemom	33727	33727	69.20	safe
6	**Parassala**	8221	8221	**83.32**	**semi_critical**
7	Perumkadavila	28538	27038	56.39	safe
8	**Pothencode**	7415	7415	**89.51**	**semi_critical**
9	Vamanapuram	42115	27115	50.67	safe
10	**Varkala**	10209	10209	**70.55**	**semi_critical**
11	Vellanad	37212	29212	49.93	safe
	District	**218797**	**194297**	**67.73**	**Safe**

State		**KERALA**			
District		**THRISSUR**			
Assessment Year		**2022**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Anthikkad	9904	9904	48.21	safe
2	Chalakkudy	61069	20369	67.99	safe
3	Chavakkad	9917	9917	68.54	safe
4	Cherpu	8448	8448	50.92	safe
5	**Chowannur**	17774	17774	**79.01**	**semi_critical**
6	Iringalakkuda	12073	12073	62.62	safe
7	Kodakara	29812	20812	57.14	safe
8	Mala	12713	12713	69.06	safe
9	**Mathilakom**	14635	14635	**77.23**	**semi_critical**
10	Mullassery	6585	6585	48.39	safe
11	Ollukkara	31572	20572	49.19	safe
12	Pazhayannur	23695	23695	47.32	safe
13	Puzhakkal	22892	22892	46.35	safe
14	**Thalikkulam**	6568	6568	**78.30**	**semi_critical**
15	Vadakkancherry	23659	18659	68.27	safe
16	Vellangallur	11069	11069	68.99	safe
	District	**302385**	**236685**	**60.94**	**Safe**

State		**KERALA**			
District		**WAYANAD**			
Assessment Year		**2022**			
Sl. No.	**Assessment Unit**	**Total Geographical Area of Block (Ha)**	**Ground water recharge Worthy area (Ha)**	**Stage of Ground Water Extraction (%)**	**Category (Safe/ Semi-critical/ Critical/ Over-exploited)**
1	**2**	**3**	**4**	**5**	**6**
1	Kalpetta	58351	41351	25.90	safe
2	Mananthavady	66651	41051	24.38	safe
3	Panamaram	35086	23286	35.15	safe
4	Sulthanbathery	52974	37074	28.46	safe
	District	**213062**	**142762**	**27.67**	**Safe**

ANNEXURE III F: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA-ADMINISTRATIVE UNIT WISE CATEGORIZATION (2023)

Sl. No	District	Total No. of Assess-ment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	Total No of OE blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block)	Total No of semi-critical blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block)	Total No of Safe blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block) CGWB & SGWD
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Alappuzha	12	0			0			0			12/2	Chengannur	Iron
													Muthukulam	Iron
2	Ernakulam	14	0			0			0			14/3	Palluruthy	Nitrate, Iron
													Vypeen	Iron
													Pampakkuda	Nitrate
3	Idukki	8	0			0			2/1	Kattappana	Nitrate	6/3	Azhutha	Nitrate
													Kattappana	Nitrate
													Elamdesom	Iron
4	Kannur	11	0			0			3/1	Thalassery	Nitrate	8/1	Koothuparamba	Nitrate
5	Kasargod	6	0			1/0			1/1	Manjeshwar	Iron	4/1	Karadka	Iron
6	Kollam	11	0	-		0			1/1	Mukhathala	Nitrate	10/1	Chadayamangalam	Nitrate
7	Kottayam	11	0			0						11/3	Lalam	Iron
													Madappally	Iron
													Pallom	Iron
8	Kozhikode	12	0			0			2/0			10/3	Kozhikode	Nitrate, Iron
													Kunnummal	Nitrate
													Vadakara	Nitrate

Sl. No	District	Total No. of Assess-ment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	Total No of OE blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block)	Total No of semi-critical blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block)	Total No of Safe blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block) CGWB & SGWD
9	Malappuram	15	0			0			8/2	Thanur	Nitrate	7/3	Areacode	Nitrate, Iron
													Nilamboor	Nitrate
										Tirur	Nitrate			
													Ponnani	Nitrate
10	Palakkad	13	0			2/2	Chittur	Iron, Fluoride	2/0			9/4	Kollengode	Nitrate, Fluoride
							Malampuzha	Nitrate					Kuzhalmannam	Fluoride
													Nenmara	Fluoride
													Palakkad	Fluoride
11	Pathanamthitta	8	0			0			0			8/2	Konni	Nitrate
													Parakode	Nitrate
12	Thiruvananthapuram	11	0			0			5/3	Athiyannur	Nitrate	6/3	Nemom	Iron
										Chirayinkeezhu	Nitrate			
										Nedumangad	Nitrate		Vamanapuram	Nitrate
													Varkala	Nitrate
13	Thrissur	16	0			0			3/1	Thalikkulam	Salinity	13/4	Chavakkad	Iron
													Cherpu	Iron

Sl. No	District	Total No. of Assess-ment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	Total No of OE blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block)	Total No of semi-critical blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block)	Total No of Safe blocks/ No of blocks with quality problem	Name of blocks with quality problems	Quality Problems encountered (in parts of the block) CGWB & SGWD
													Mala	Nitrate
													Puzhakkal	Iron, Nitrate
14	Wayanad	4	0			0			0	-		4/2	Sulthan Bathery	Iron
													Panamaram	Nitrate
	KERALA STATE	**152**	**0**			**3/2**			**27/10**			**122/35**		

ANNEXURE III G: ADDITIONAL POTENTIAL RECHARGE UNDER SPECIFIC CONDITIONS IN KERALA

Additional Potential Recharge under Specific Conditions in Kerala. (2023)				
Sl.No	**Assessment Unit/District**	**Potential Recharge in Water logged and Shallow Water table area (Ha.m)**	**Potential Recharge in flood prone area (Ha.m)**	**Total Annual Additional Potential Ground Water Recharge (Ha.m)**
1	**2**	**3**	**4**	**5**
District: Alappuzha				
1	Ambalapuzha	1653.6	0.00	1653.6
2	Aryad	2245.6	0.00	2245.6
3	Bharanikkavu	275.0	0.00	275.0
4	Champakulam	1440.0	0.00	1440.0
5	Chengannur	1550.0	0.00	1550.0
6	Haripad	2925.8	0.00	2925.8
7	Kanjikuzhy	2592.0	0.00	2592.0
8	Mavelikara	560.0	0.00	560.0
9	Muthukulam	960.0	0.00	960.0
10	Pattanakkad	4000.5	0.00	4000.5
11	Thaikattussery	4077.8	0.00	4077.8
12	Veliyanad	3840.0	0.00	3840.0
	District Total	**26120.3**	**0.00**	**26120.3**
District: Ernakulam				
1	Alangad	488.6	0.00	488.6
2	Edapally	2688.0	0.00	2688.0
3	Palluruthy	1702.7	0.00	1702.7
4	Paravur	746.4	0.00	746.4
5	Vypin	792.0	0.00	792.0
	District Total	**6417.7**	**0.00**	**6417.7**
District: Kasaragod				
1	Kanhangad	105.0	0.00	105.0
2	Neeleswaram	197.4	0.00	197.4
	District Total	**302.4**	**0.00**	**302.4**
District: Kollam				
1	Chavara	784.0	0.00	784.0
2	Oachira	864.0	0.00	864.0
3	Ithikkara	145.2	0.00	145.2
	District Total	**1793.2**	**0.00**	**1793.2**
District: Kottayam				
1	Vaikaom	504.0	0.00	504.0
	District Total:	**504.0**	**0.00**	**504.0**
District: Kozhikode				
1	Melady	720.0	0.0	720.0
2	Panthalayani	240.0	0.00	240.0
3	Vadakara	60.0	0.00	60.0
	District Total	**1020.0**	**0.00**	**1020.0**

Additional Potential Recharge under Specific Conditions in Kerala. (2023)				
Sl.No	**Assessment Unit/District**	**Potential Recharge in Water logged and Shallow Water table area (Ha.m)**	**Potential Recharge in flood prone area (Ha.m)**	**Total Annual Additional Potential Ground Water Recharge (Ha.m)**
District: Malappuram				
1	Ponnani	165.0	0.00	165.0
2	Tanur	75.0	0.00	75.0
3	Tirur	90.0	0.00	90.0
District Total		**330.0**	**0.00**	**330.0**
District: Pathanamthitta				
1	Pulikeezhu	800.0	0.00	800.0
District Total		**800.0**	**0.00**	**800.0**
District: Thrissur				
1	Chavakkad	300.0	0.00	300.0
2	Mathilakam	450.0	0.00	450.0
3	Mullassery	150.0	0.00	150.0
4	Thalikkulam	416.0	0.00	416.0
District Total		**2116.0**	**0.00**	**2116.0**
		38603.6	**0.00**	**38603.6**
State Total		**386.04 MCM**	**0.00**	**386.4MCM**

*ha: hectares
*ham: hectare metre
*mcm: million cubic metre
*bcm: billion cubic metre